

SO

AUTUMN | WINTER 2019

SMART SOLUTIONS
Behind the rise of
Critical Software

2020 VISIONS
What to expect
in the year ahead

DIGITAL
TRANSFORMATION
Revealing the five
steps to success

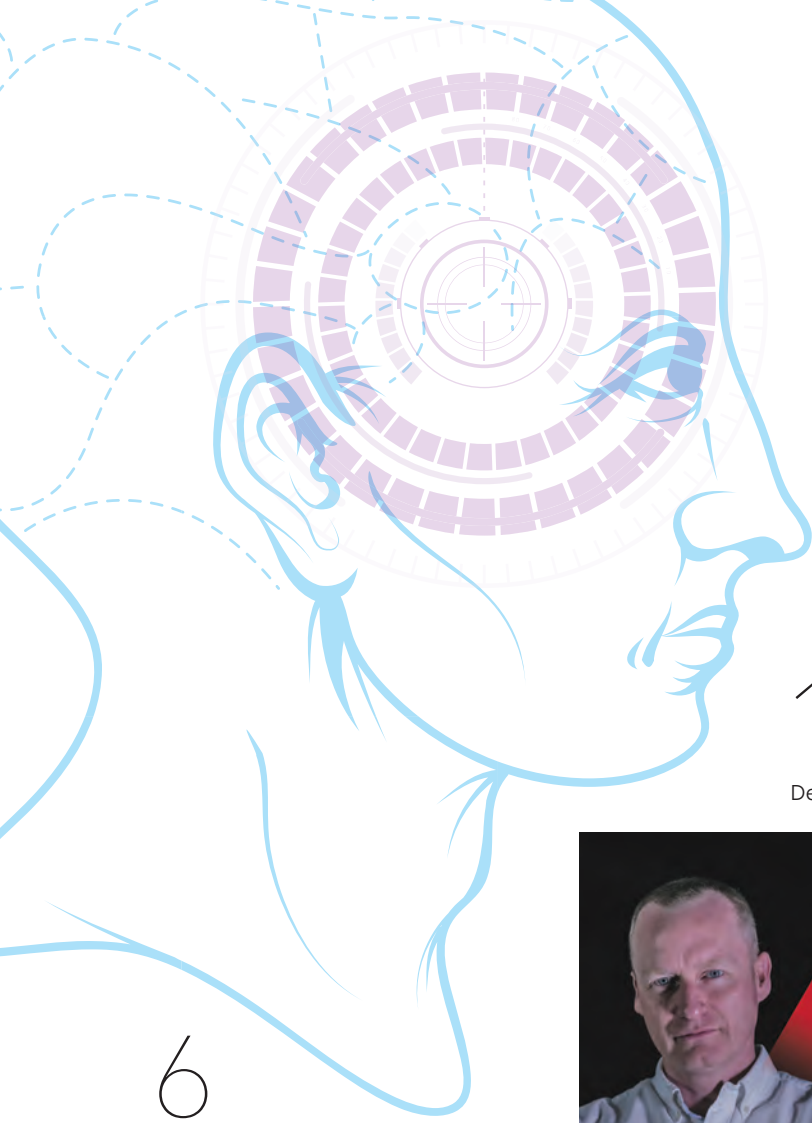
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WHAT IS IT ABOUT
VINYL THAT MEANS IT
NEVER GETS ECLIPSED
BY NEW TECH?



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SCIENCE PARK

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AI in Action

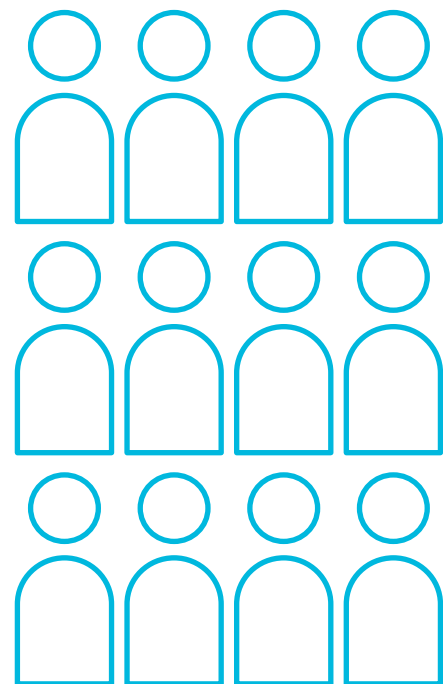
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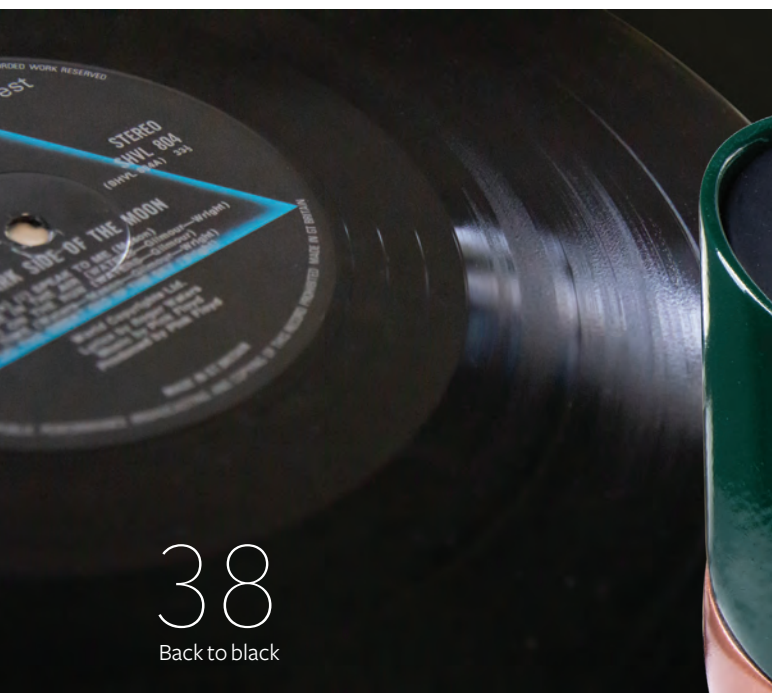
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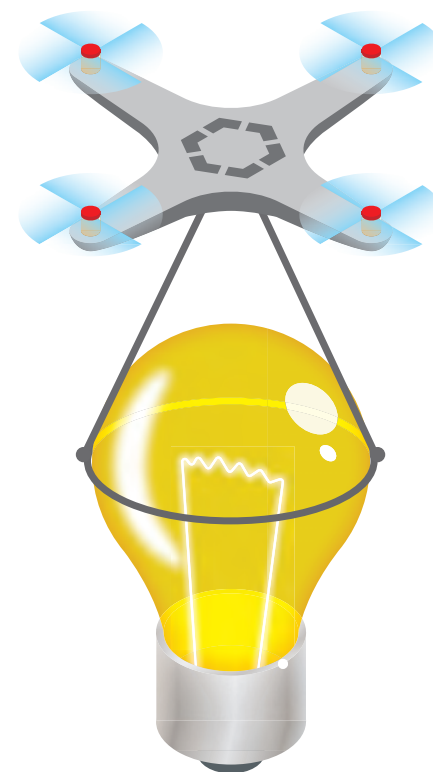


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If you'd like to contribute to the next issue of SO, contact: parknews@science-park.co.uk

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Our community of gamechangers



Welcome to SO

I was delighted to be asked to introduce this issue; an important one in many ways for it is a time of change. Politically, economically and socially, there are few certainties. Except, that is, the certainty that science and technology businesses will have to be more creative, more agile and more tenacious than ever before if they are to thrive in the new decade and beyond.

I'm very proud of the work that our incredible Science Park does to support both large and small technology businesses in fulfilling their potential. Over the past twelve years, much of this support has been down to the determination of Peter Birkett, our recently retired Chief Executive, and I would like to use this opportunity to pay tribute to his work.

Peter was absolutely focused on making Southampton Science Park stand out as a beacon of best practice in the region. In doing so, he achieved a great deal in terms of its physical development, the amenities provided and community building during his tenure. Let me give some examples.

Peter led the creation of the Park's Benham Campus and the repurposing of various outdated buildings into new business facilities such as the Science Centre laboratories and the Axis conference centre.

Introducing initiatives like CEO Breakfasts and the Catalyst incubator have enabled experienced and new business leaders to share challenges, learnings and opportunities, while creating important connections and seeding opportunities for growth.

With the creation of Lattes coffee shops, an on-site nursery for pre-school children and the opening of the Chilworth conservation area for the enjoyment of all,

he recognised the importance of providing high quality amenities for staff that work here and the local community.

Most recently, Peter oversaw the creation of a new brand identity and further marketing efforts which will help to ensure that Southampton Science Park is recognised as the South's most desirable destination for science and technology businesses well into the future.

Peter retired leaving the Science Park with the prospect of a very positive future and I'm delighted to announce that former Operations Director, Dr Robin Chave, has accepted the role of Chief Executive. Robin's wide-ranging career in technology coupled with his decade of operational experience at the Science Park means that he has a very deep understanding of both commerce and innovation. I am extremely confident that he will build on the firm foundations laid by Peter and continue to shape a science park that is a beacon of success for its business community and the South of England as a whole.

Ian Dunn

Chairman, Southampton Science Park
Chief Operating Officer, University of Southampton

what?

SO sees the future differently

SO connects

SO asks questions

SO engages, informs, inspires

SO celebrates success

SO shows how Southampton Science Park shapes society

SO makes science and technology social

SO shines on South Coast excellence

SO where could it take you?

Introducing Dr Robin Chave

Dr Robin Chave took over the reigns as Chief Executive of Southampton Science Park in October. We sat down with him to find out about his plans for the South's foremost innovation hub.

Robin, congratulations on your appointment. As former Operations Director you've already played a major role in shaping the Science Park to date, haven't you? Yes, I've been at the Science Park for nearly a decade so it's fair to say that I have a pretty good knowledge of how we operate. I also have a lifelong passion for science and technology and a personal insight into how to commercialise research effectively.

Tell us more. I completed my doctorate in advanced materials and began my career as a research scientist in the automotive industry. I then joined the defence firm QinetiQ as a forensic engineer, examining broken bits of aircraft and military hardware, ultimately moving into project management and leading multi-million-pound projects and bids within air and land divisions. Since then, I'm very proud to say that Southampton Science Park has been my work home.

How do you think the Science Park currently compares to alternative business accommodation, both regionally and within the technology community? Well, I've been speaking to a number of CEOs across the Park over the last few weeks and the overwhelming impression I get is that people think this is a truly lovely place to work; a desirable business destination in the region. So, the attractiveness of our surroundings and the added value that the Science Park brings are important considerations for the businesses that choose to locate themselves here.

There's a definite sense that – even though we could be moving towards turbulent economic times – our community approach, which encourages collaborative working, can help companies of all sizes here to continue to thrive. For early-stage businesses particularly, the support provided through initiatives like our Catalyst programme is incredibly powerful,

with outstanding mentors and coaches helping to get them off to the best possible start.

However, whilst our out-of-town location is seen as a major draw for many businesses, a non-city-centre location does give rise to some challenges that I'd like to begin to address. I think we could do more when it comes to embracing alternative transport and flexible working and this would help us to realise our overarching sustainability goals too. Mobility and sustainability are both key policy focuses for the UK industrial strategy and I think the Science Park should be well positioned to support this agenda.

What other aspirations do you have for the Science Park, five to ten years from now? I've got lots of ideas but there are a few in particular that I would really like to see come to fruition in the near future.

One of these is to work with the University to redevelop the old radiator factory in the middle of the Science Park and turn the site into an engineering innovation hub. We already offer a good range of offices, laboratories and custom-build opportunities but we do not currently have ready-made facilities for the type of light industrial research and development activity that requires workshop space with easy access, to accommodate vehicles or bulky test equipment for example. I hope to have more detailed news on this very shortly.

I also want to enhance our visitors' sense of arrival at the Science Park by reimagining the Innovation Centre entrance to create a positive, exciting buzz the moment that you walk in; this work would also encompass the transformation of our catering facilities in this area. Our coffee shop has always been an important facility for people that work here but it could be even more than that – a real community hub.

Finally, I recognise a need to deliver better flexible working environments to support early stage businesses in that first crucial phase of growth.

At the Park itself, this will involve further development of our incubation centre, but I'd also like to explore the potential for a smaller outreach Science Park facility, perhaps in a city-centre location for those younger entrepreneurs and future business-leaders who may prefer to be city-based. This is undoubtedly a longer-term vision, but I hope that in this way we can start to bridge the gap between our leafy environment in Chilworth and the city-based entrepreneurial community.

And in the year ahead? Relationship building – it's critical to all businesses, no matter what stage they are at. We have a thriving business community now, but it could be even more so, and I believe the key to achieving this is enabling better communication with and between Science Park businesses.

Our conference centre Axis is a great enabler in terms of bringing business people together on a more structured level to discuss issues and solutions, but we can all benefit from talking and networking a little bit more in our day-to-day lives, to share our knowledge and ideas with one another.

While I am working through my planned meetings with business leaders at the Park, I would say to our whole business community – please don't wait for an invite! My door is always open and I'm keen to hear from you – as, I'm sure, are your neighbouring businesses. Let's get communicating and building even better, stronger relationships.

AI IN ACTION

The global race to embrace artificial intelligence and machine learning is on. Potentially worth £billions to the economy, AI has been identified by government as one of the four Grand Challenges that the UK must rise to, to secure its future success on the world stage.

That's why Southampton Science Park organised AI in Action, the region's first major conference focusing on the practical application of artificial intelligence. The event drew a large audience from across the commercial and public sector spheres.

In an illuminating keynote, author, IBM inventor and innovation leader Lindsay Herbert, delivered a very clear message. "Huge amounts of money are being wasted by companies trying to create the ultimate 'digital experience' but the focus needs to be on the 'human experience' if we are to solve some of the biggest issues that we face around the globe," she said. "Those that own the data, own the future and this cannot be a select few people in positions of power that are motivated by profit rather than problem solving. Technology must evolve with the human experience with big, worthy problems at its core." You can read more from Lindsay in her interview elsewhere in this issue.

Speakers from the fields of medicine, transportation, finance and retail revealed the challenges of deploying artificial intelligence in their respective areas while opening the audience's eyes to its potential.

Common themes around enhancing and personalising customer experiences, the ability for machines to enhance human decision making and the responsible use of data were universal. However,



in acknowledging these challenges, what became evident is that they won't be solved by computer scientists: multi-disciplinary teams which put humans at the heart of the problem that AI is trying to solve are going to be critical to success.

Closing the event, Dr Robin Chave, the Science Park's Chief Executive, commented: "We are delighted to see so many representatives from so many commercial sectors here. It demonstrates the curiosity, indeed the mystery, which surrounds the use of artificial intelligence and machine learning – technology that, without a shadow of a doubt, is going to have significant impacts across the whole of society."

AI in Healthcare

Matt Inada-Kim is a front-line clinician at Hampshire Hospitals and the National Clinical Lead for Deterioration and Advisor for Sepsis at NHS England. He has developed a long-term national plan and supporting structures to improve processes in the recognition, escalation, communication and response to the deteriorating patient in all care settings.

Ask yourself whether you'd rather be diagnosed by man or machine and most would pick the former. Why? Because human beings are the most variable thing in the world - we don't fit into boxes - so, how can a machine offer a better solution than a highly trained human doctor?

Surprisingly, it might be able to. Medical conditions are binary - we either know the answer or we don't. However, while doctors diagnose and base decisions on the hundred or so similar cases that they've seen before, human bias creeps in and sometimes they get it wrong. Artificial intelligence-based systems, on the other hand, could reference millions of prior cases to potentially more accurately pinpoint the patient's problem. And if you know the problem, you can perform appropriate tests and pinpoint the solution.

Research has shown that, when all data is available to reference, AI outperforms a human. Just. However, when data is incomplete, humans outperform machines. The trouble is that data is rarely complete and immediately available, especially in emergency room situations, and so human judgement continues to be vital. An under-pressure clinician needs to make fast decisions about whether you treat the most likely diagnosis - or the most potentially life threatening.

There's a careful balance that must be struck between the medical principle of 'first, do no harm' and the need for urgent disruption in a resource-poor healthcare system.



For Matt therefore, the use of any technology should be about augmenting the human experience, not diminishing it. AI has enormous potential in healthcare, but it cannot replace the empathy and ability of humans to think on their feet and make judgements in what will always be unique situations.

His view is that, while it is unlikely that AI will ever be the complete answer, it mustn't be stifled. Its successful deployment will be dependent on ensuring that it interferes 'just the right amount'.

There's a careful balance that must be struck between the medical principle of 'first, do no harm' and the need for urgent disruption in a resource-poor healthcare system. The way to resolve this? Collaboration at scale: everyone needs to get involved to shape the technology and create unified systems that link effectively. And this, currently, is a colossal challenge.

AI in Transportation

Andy Dollin is Chief Operating Officer at Tonic Analytics. He is also director of the Galileo Programme, working alongside Highways England and the National Police Chief's Council.

Project Galileo is working to solve the fundamental question: how do you make our roads safer, more secure and more efficient? Some context is important here: across the UK, 25% of congestion is due to an incident. Five people die on a road here every day and this costs the economy £16.3bn each year. At the same time, road traffic is predicted to grow by 53% by 2050.

Not only are these important challenges to solve, but the project gives rise to some exciting possibilities too. What if you could use AI to predict, and therefore prevent, accidents? Or mitigate the probability of vehicle failure? Or identify the people most likely to commit road offences?

Artificial intelligence could do all of this. But, to succeed, a multi-faceted approach to the project would be required - one that might start with data insight but would have to encompass full stakeholder collaboration and public engagement throughout.

The project would also need to address issues around digital protection and data ethics due to the enormous amount of personal information that would be processed along the way. Consider for a moment, the data sets required: the road network itself, its usage patterns and physical condition; the drivers, riders and pedestrians using these roads along with their road safety history; vehicle ownership, condition and maintenance schedules; and of course, external factors like weather conditions. Combined, these create literally billions of data points, giving rise to considerable challenges for the Tonic Analytics team. ▶



Until a policy framework is in place, it will be down to us as innovators and technicians to stay on the right side of wrong.

Andy realised early on that he would need to pause technical development to understand and resolve the non-technical challenges that surrounded the project before moving forward. Failing to address the ethics, legalities and security issues arising from the amount of data processing that this project would entail would mean that it would have a very slim chance of achieving the desired outcome. He commented: "If data is your fuel and AI is your engine, please don't forget the body, chassis, wheels and steering! Be prepared to apply the brakes to stay on track."

Working closely with the Information Commissioners Office (now an important stakeholder and on the Galileo delivery board), the project remains on track and on a robust ethical footing.

Andy was also quick to point out that 'data legality' does not equal 'data ethics' and this is likely to be a critical factor in many AI applications. Just because something isn't illegal, doesn't mean that it's appropriate, especially when outcomes form the basis of decision making around public safety. However, data ethics is in its infancy and there's currently no single point of reference for companies working in the AI arena in this regard. Until a policy framework is in place, it will be down to us as innovators and technicians to stay on the right side of wrong.

AI in Finance

Harriet Rees is Head of Data Science at Starling Bank. In her role, she directs projects to provide insight, drive better customer experiences and improve operational efficiency using machine learning while reinforcing a data-driven mindset throughout the organisation.

Starling Bank regards itself as 'a tech company with a banking licence'; a challenger that wants to change banking from the inside out. At its core, this means putting customers back in control. It might sound like a traditional 'customer experience' approach, but Starling has gone further.

According to Harriet's insight, customers find finance confusing, many not knowing how best to manage their affairs. Starling's solution has been to empower customers by showing them their data in real time. "People love data," she comments. "They love to see information about themselves. Visualising this creates a new customer relationship with banking – one where the customer is in control and the bank delivers against their increased expectations of the financial services sector."

Accordingly, Starling customers are promised that they can open an account in six minutes or less. This is driven by AI-assisted onboarding, considered critical in making that all-important fresh and positive first impression. Account holders have immediate access to features that enable them to lock and unlock their cards and set personalised spending limits (including a gambling lock) for instance. One step further, Starling gives them the opportunity, subject to permissions, to access a personalised online financial eco-system by integrating with other financial organisations such as pension providers.

This 'open banking' approach gives customers ultimate visibility of their affairs but there's further benefit too. The financial institutions themselves benefit by having a deep understanding of an individuals' entire financial footprint. Access to a wider data source enables them to more effectively manage risk through enhanced credit decision-making capabilities and this new level of sector collaboration could be key in the fight against fraud too. Real-time fraud-detection engines are already using AI to spot out of character transactions to proactively protect customers. "Competition isn't everything," stated Harriet.

How has this been achieved by a banking start-up as opposed to one of the big guns? Quite simply, the company turned the conventional organisational structure on its head. In-house engineers sit with data scientists to build effective solutions for the cloud from the outset.

Harriet does acknowledge though, that customers aren't quite ready to be given financial advice by a machine. Human decisions enhanced by AI on the other hand, are here to stay.

Customers aren't quite ready to be given financial advice by a machine. Human decisions enhanced by AI on the other hand are here to stay

AI in Retail

Ben Park is Director of Artificial Intelligence at Sopra Steria. A self-proclaimed technology evangelist, he is a strong advocate of Design Thinking to enable a customer first approach to the digital transformation of retailing.

There's no getting away from it: customer experience is critical to success online and on the high street. Only 4% of customers complain after a bad experience; 96% just go to the competition. Hence it now costs six times more to attract a new customer than to keep an old one. And that's why 80% of businesses expect to compete on customer experience moving forward.



However, customers change. We're broader in range, from baby boomers to Gen Z. We're 'always on' and expect things 'our way', instantly. We feel good when we think that a service has been designed for us personally.

Netflix is exemplary in this, using smart algorithms to analyse viewing habits and present the right content options. Amazon too, offers very advanced personalisation based on our data, achieving a whopping 63% conversion rate. McDonalds has acquired a personalisation company recently to enhance its drive-through offering.

There can be no doubt then, that personalisation is critical to the customer experience. Younger consumers especially, expect it. What's more it's being taken to whole new levels. Hyper-personalisation is an even deeper level of

Issues around digital exclusion still exist so there'll always be a role for a human customer assistant.

'understanding me'. Using 'internet-of-things' sensors combined with algorithms, the ability to provide a rich, differentiated customer experience is right here, right now. Want to see a relevant special offer pop up on your phone as you're walking past that retailer on the high street? You got it!

And the next big thing? Sentiment analysis: using AI to capture qualitative rather than quantitative information to determine how the customer is feeling at any given time will further support purchase decisions.

Gartner predicts that, by the end of 2020, 85% of all customer interactions will be managed without human involvement. While we may prefer to deal with another human being, humans can't provide instant responses, we're fallible and we go home when our shift is over. And that's not what we want as customers.

This perhaps reinforces the reasons behind the rise of automated chatbots, voicebots and voice interfaces like Siri and Alexa that are now mainstream. Technology is getting to the point where it can offer an experience not quite the same as, but extraordinarily close to, the human experience. Google Duplex can even understand nuances in conversations.



And where does this leave the humble human? Ben suggests that the emergent technology won't replace humans, but it will instead release them from keying information into screens to talk and advise; freeing them up to provide higher value customer interactions for service providers. Online, AI can determine if people are struggling to find the product or help they're after and support them by facilitating a human to step in for enhanced customer service. Of course, issues around digital exclusion still exist so there'll always be a role for a human customer assistant.

DELIVERING WITH INTEGRITY

Matt Brake is a Divisional Director and a member of the International Management Board at Critical Software: a fast-developing company at Southampton Science Park. Here, he tells us how the company has achieved growth without compromising quality and integrity through a period of unprecedented success.

Matt, tell us about your role and your career leading up to this point. Certainly. I started out as an apprentice software engineer working for Plessey, which became Siemens, and subsequently British Aerospace, so much of my early career was spent working on defence, civil defence, homeland security and command and control systems.

Broadening into project management and business development roles enabled me to join Caggemini in 2005, working with government departments on national security programmes and creating accounts in a new market area. I learnt a lot over my decade there but, by 2015, I realised that all my experience had been with huge companies and I wanted an opportunity to prove myself and help shape a smaller company – one that I could have a hand in running.

That's when I joined Critical Software here at the Science Park: initially as a business development manager, then heading a small team of just 30 globally working in the energy sector. This part of the business was worth just £3m three years ago but we're now up to 190 people and turning over £18m.

So, what does your Smart Technology Solutions division do and how has it achieved such colossal impact in such a short space of time? Most people are aware of the drive towards smart metering but perhaps few realise just how fantastically complex the infrastructure behind it all is. In fact, the UK's smart meter network is the envy of Europe because we've attempted something here that no-one else has: we've committed to a cohesive, nationwide system – a single central hub through which all data flows and this will work very well long term. In most other countries, it's a very fragmented, regionalised approach where it will be difficult to maximise benefits from the technology.

The Capita-owned company DCC is responsible for providing the infrastructure here. However, there was a missing piece of the jigsaw: DCC realised that they needed a system that would help with the passing and correlation of the messages to and from meters and make the infrastructure work with second generation smart meters. It was a relatively small piece of work, but we won the tender and delivered against it. That led to us being instrumental in a larger DCC programme to enrol the first-generation meters onto the DCC infrastructure too. Lots of people said it couldn't be done. We proved that it could, and our solutions are performing very well for the programme and for all organisations working on it. The energy industry has much better information to inform production and consumers are getting more accurate bills and the opportunity to be more efficient, which is ultimately better for the environment.

It was what happened around that piece of work that really mattered though. We approached the project with the attitude of 'what else could we do?', 'how can we provide additional value?' DCC soon recognised our ability to deliver the obvious milestones but also the peripheral work that has proved incredibly valuable, and, as a result, our portfolio of responsibility has grown and grown.

Can you give us an example? Yes. Eventually there will be 52 million meters producing data, running through the UK's smart meter system. An individual's or a business's energy consumption cannot be altered, it's there for all to see. This is a very rich source of information for all sorts of organisations, not just the energy suppliers.

If smart metering can give us more insight and control over the energy we use than ever before, why not make that information accessible to all, provided that the right security and regulatory

protocols to access that information are in place? Why not make that information available to wholesalers to enable them to better balance energy production, for example? Why not make that information available to insurance companies to help with claim validation or to support court action against fraud? Why not open that information up to start-ups with an idea to disrupt and improve a market?

And that's what we've done with the creation of nrgry: a cloud-based service providing large and small companies with access to current and historic energy data and tariff information for every home and business with a smart meter. Opening up opportunities like this at the outset paves the way for other businesses to innovate.

What's more, consumers are in control. With integrated consent on the portal, consumers and organisations can see who they've given data access to through their individual energy contracts and manage this accordingly.

Given Critical's heritage in space systems, how did the transition to the energy market come about, and how difficult has it been to convince potential customers of your capabilities in a new marketplace?

Actually, it's been a very natural transition. Our work with NASA presented a very small market opportunity and it's hugely competitive. It was an obvious journey from there into transport: aviation, automotive and railways. We are proud to be BMW's no1 software partner and to work with extremely influential companies like Airbus, Leonardo, BAE Systems, Vodafone, Alstom, EDP and Siemens.

However, what we're exceptionally good at is solving problems that need to be addressed by software. ➤



The Mayor of Test Valley, Martin Hatley, visits the Critical Software team



If you've got a requirement for a critical piece of software and there isn't a product out there that provides that functionality, not only can we build it for you, but we guarantee a level of quality that means it will deliver high value from day one. This is our USP. It's not a sector-specific proposition.

From a commercial perspective, this unrestricted approach is beneficial because markets ebb and flow. Working across several market segments, we can better absorb these fluctuations – important for a small business. It's good for us and it's good for our clients too as it means we have a very high utilisation of resources and that brings cost-efficiencies that we can pass on.

What was it about the Critical Software proposition that won the tenders? We've proved ourselves as a very capable tech company. We create super high-quality software that doesn't go wrong and deliver it with unsurpassed integrity and customer care. We don't have hundreds of customers, so they are all special to us and are treated accordingly.

And how do you achieve this level of quality and integrity? I get asked this all the time! In fact, one customer recently put it like this: 'how is it that, as a small company, you never miss a milestone and always deliver on time and on budget, when globally recognised companies are failing?'

My answer is that there's nothing easy about it. We're small, we're agile and we work really, really hard.

We also have a flat hierarchy and clear responsibilities. We recruit the best we can get and for us that means hiring people who care about delivering high quality. We take on a lot of graduates that we can see promise in and we keep training them so they are improving all the time. At the same time, we have many mature and experienced people here so there's a lot of mentoring going on. It's the only way to do it. So people stay. Or, if they leave, they tend to come back!

We're a fast-growing business because our owners genuinely care about how we do business. A positive culture of client care is prevalent, a sense that you want to give a great service

underpins everything. Many companies say that, but the reason I've stayed, and intend to, is that Critical's owners mean it – they really do care about quality service. It's uplifting.

As a global business, presumably you've been touched by Brexit: how have the effects been mitigated?

I'm personally responsible for our risk log associated with Brexit. We analysed all the potential issues, then worked out what mitigation we need to put in place to protect our people and our clients, and then drilled down to the specific actions associated with this. I'm extremely relaxed about it because we're well prepared. It's what we do. We know how to manage challenges.

What advice would you offer those starting out in a tech business? First, clearly define your USP, otherwise you won't get anywhere. I find it interesting to look at who drives the strategy in organisations as it differs considerably. I've worked for companies that are strategically driven by marketing, by finance or by engineering. We let the quality of our software do the talking but with a huge amount of positive support from delivery and operations teams.

Second, don't cut corners to save money. Being in business is about learning lessons and not making the same mistakes. A lot of our success is down to the fact that we look very hard at risk management. We report accurately, even when there is a problem, without any blame culture. Making employees feel that they can report failure quickly without being under negative pressure and knowing they can get help is very important.

What benefits does Southampton Science Park bring to the business? We're a truly global business with operations all over the world but the UK is a huge part of the company's success, so the owners are wildly enthusiastic about our business here, investing more and more. We've got about 50 people here on the park and it's a great venue, easy for people to get to and sufficiently flexible to accommodate growth. We've already moved once on the park and we're in conversations now about our next move to facilitate our next phase of expansion.



WISDOM

The social and technology milestones and trend predictions for the year ahead

2020. For some, it's just another year. For others it's hugely exciting; a year that has featured in many a science fiction tale as a wondrous point in the future when everything you ever dreamt of would be technically possible. For many working in the innovation sector, it's a deadline!

Here's a snapshot of some of the things to look out for in the year ahead around the globe.

Commerce

Continued investment by the likes of FedEx, IBM, Walmart and Mastercard could propel blockchain forward as it starts to show real-world results. Facebook's own blockchain-based cryptocurrency, Libra, is expected to launch in 2020.

Connectivity

In India, work should complete on the National Optical Fibre Network, a multi-billion-dollar broadband network that will get 600 million rural citizens online. The largest of its kind in the world, the Network will not only bridge the urban/rural divide in the sub-continent but could also signal a new era in its economic capability on the world stage.

5G is set to become more widespread offering super-fast data networks beyond major cities. It could mean that mobile networks will be more usable than wired ones currently running our homes and businesses. The increased bandwidth will enable machines, robots, and autonomous vehicles to collect and transfer more data than ever, leading to further innovation in the IoT and AI spaces.

Globally, there will be:

- > 6 billion smartphone users (that's more people owning a phone than having electricity).
- > 50 billion internet connected devices
- > 188 exabytes of internet traffic (24 exabytes of which will be mobile)

50 billion
internet
connected
devices

6 billion
smartphone users



21



cities in India will run out of groundwater

Environment

The Paris climate change deal comes into effect with the goal of keeping global temperature rise below 2 degrees Celsius compared with pre-industrial times. On the one hand, 21 cities in India will run out of groundwater according to a government report. On the other, solar is expected to become more economical than regular electricity for more than half of US citizens.

Health

Technology is transforming healthcare provision at an unprecedented rate. The next phase is likely to be the ability to predict and treat health issues in people even before they experience any symptoms as a result of data capture from wearable devices. This will lead to greater personalisation or 'precision medicine'.

Innovation

The 2020 World Expo takes place in Dubai

- 190 participant countries
- 173 days
- 169 years since the first World Expo at Crystal Palace showcasing the inventions of the Industrial Revolution
- 3 themes focused on using our heads and our hearts to build a better world
 - opportunity (unlocking the potential within us)
 - mobility (creating smarter and better connections)
 - sustainability (living in balance with the world around us)

The UK pavilion will highlight artificial intelligence and the space sector "offering an awe-inspiring glimpse into the future, exploring everything from the commercialisation of space to creating exoskeletons for the disabled".

A continuously changing poem on the exterior, generated by artificial intelligence and visitors' contributions, the pavilion was inspired by a Stephen Hawking project, in which he pondered how humanity could express itself to an extra-terrestrial civilisation.

since the first World Expo

169 years



Machines

Although many companies have been exploring how to embrace machine learning and artificial intelligence, it's often an expensive outsourced piece of development work. In 2020, we're likely to see a boom in AI-as-a-service, enabling businesses to input data and pay for the data crunching and outputs on a pay-as-you-go basis. Amazon, Google and Microsoft already offer such platforms, but the trend is likely to be for more tailored, specialised applications.

Retail

The retail transformation from bricks and mortar to clicks and mortar will continue apace as the world's biggest vendors focus on being e-commerce businesses first and physical retailers second. The role of a shop will change from revenue generator to brand builder, used primarily for marketing and customer engagement purposes.

Society

Earth's population is forecasted to reach 7,758,156,000. Wealth inequality will continue to be extreme, leading to global economic destabilisation as politicians increasingly respond to people rather than economic influence.

earth's population forecast to reach 7,758,156,000



XXXII

Olympiad of the modern era



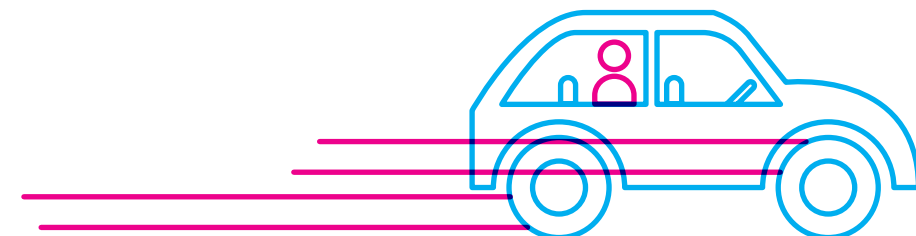
Sport

The Summer Olympics takes place in Tokyo

- XXXII Olympiad of the modern era
- 11,090 athletes
- 339 events
- 206 countries
- 37 venues
- 33 sports
- 3 principles to transform the world:
 - striving for your personal best (achieving your personal best)
 - accepting one another (unity in diversity)
 - passing on a legacy for the future (connecting to tomorrow)

Transport

Elon Musk expects Tesla to reveal a truly 'complete' autonomous vehicle in 2020. In the meantime, vehicles with lesser degrees of autonomy (automatic braking, lane changing, security systems and entertainment functions) will become more mainstream. Automated trucking and shipping systems are in development.



FRIEND OR FOE?

Exploring facial recognition

Facial recognition is on the rise – and fast. But could it become one of the most divisive technologies ever to breakthrough?

The process of identifying, or verifying the identity of, a person using their unique physical characteristics is not new. Fingerprint recognition techniques began to be used formally as early as 1858, although it would not be until the 1990s that the next big development, in the form of iris recognition, would be used publicly.

Relatively speaking then, the development and deployment of facial recognition, has followed swiftly on. The explosion in the use of this technology is partly technological and partly cultural.

From a technical perspective, significant advances in biometrics and machine learning techniques and the speed of data processing mean that facial recognition technology is now very easy to deploy, simple to operate and quick to deliver, with no physical interaction with, or consent from, subjects required. The result is the enablement of quick decision making in potentially critical, time-sensitive situations.

Culturally, societal instability has created natural applications for the use of facial recognition. In 2011, the technology was instrumental in the verification of Osama bin Laden's identity during a US raid. In 2016, the 'man in the hat' responsible for terror attacks in Brussels was similarly identified by FBI facial recognition software. A natural, and largely socially acceptable, link has therefore been formed between facial recognition and the notion of public safety.

Widening Applications

Law enforcement continues to be the widest use of facial recognition. Many of us will be used to biometric passport control systems used at border checks but we may not be so aware of other applications – to help with policing and crowd control at major sporting events and music festivals for example. Indeed, Ticketmaster has invested in facial recognition with the aim of getting fans into events faster without having to show or scan tickets. Apparently, this will be a customer opt-in option.

Health monitoring is another growth area, with facial analysis able to detect some genetic diseases, support pain management techniques and the administration of medicines – all areas that could relieve a stressed health service through the provision of virtual rather than in-person support.

With consumer purchasing power prevalent, it is perhaps no surprise that retailing is quick to see the potential of embracing the face too. The 'Know Your Customer' trend combined with facial recognition is enabling retailers to rapidly reach new heights in personalised customer engagement. By placing cameras in or close to retail outlets, it is possible to analyse shopper behaviour and 'improve the customer purchase process' in real time. In the US, KFC, Amazon GO stores, Walgreens and department store Saks are early adopters. Grocery giant Tesco plans to roll out its OptimEyes screens at UK petrol stations to deliver targeted advertising to customers. Of course, they can also spot a shoplifter in seconds too.

HALF OF ALL AMERICANS ARE ALREADY IN POLICE FACIAL RECOGNITION DATABASES

Security or Surveillance?

Despite being rigorously controlled in Europe – and the rollout of GDPR has helped with this from a legal perspective – facial recognition is giving rise to some serious concerns around its use from an ethical standpoint. This has been mirrored across the world with digital rights advocacy group Fight for the Future launching a Ban Facial Recognition campaign in the US.

In Britain, there is no law or government policy around the use of facial recognition but there appears to be an increasing trend towards public unease. David Davis MP, writing for the Guardian recently, stated: "There is a point at which crime-fighting measures cease to challenge the guilty and become a threat to the innocent." The Information Commissioner's Office (ICO) meanwhile has commented: "Scanning peoples' faces as they lawfully go about their daily lives, in order to identify them, is a potential threat to privacy that should concern us all."

Earlier this year, the Financial Times revealed that facial recognition software was in use in London's King's Cross, covering the railway station, shops, offices, and educational establishments. Public concern surrounding this led to an ICO investigation and, ultimately, the system being switching off.

This public uneasiness has not been the case around the World however, as some countries more readily embrace its use. China has millions of cameras connected to facial recognition software and Russia has declared hopes to expand its own surveillance networks. In the US, the police typically use facial recognition to search CCTV footage for suspects rather than scanning live crowds, but it is becoming more pervasive – half of all Americans are already in police facial recognition databases.

So, what are the concerns? They are many and varied, ranging from protecting fundamental human rights to the potential for databases to be hacked. There's also the very real issue of accuracy. Amazon's facial recognition technology has previously falsely identified 28 members of US Congress as people arrested for crimes.

THE FACIAL RECOGNITION MARKET IS CURRENTLY WORTH AROUND \$3BILLION

What's Next?

There's almost certainly no turning back. Estimates suggest that the facial recognition market is currently worth around \$3billion but it is predicted to grow to \$7billion over the next five years.

It's no wonder then that the software goliaths are all well and truly immersed and systems are being fine-tuned to work faster and to capture more faces and in difficult situations, such as those taken in bad light or when people have their faces covered. Facial recognition overlaid with emotion detection and sentiment analysis is in development too: the ability to capture state of mind as well as physical attributes a potentially powerful tool in consumer-oriented tailored communications.

Where software goes, hardware follows. Facial recognition smart glasses are already in production. The glasses frames hold a tiny eight-megapixel camera which scans the faces of passers-by and alerts the wearer to any matches in a database of a million people within a second. Police bodycams do much the same thing, while a US patent goes further and describes a police bodycam that starts recording when the face of a suspect is spotted.

On the flipside, those opposed to the technology are developing anti-detection software. In Russia, for example, Grigory Bakunov has developed an algorithm that creates special makeup to confuse face detection devices. Apparently, he has chosen not to bring his solution to market, realising that it could be used by criminals all too easily.



How does facial recognition work?

Facial recognition technology uses captured images which are turned into digital data using algorithms. From here, computers can analyse and compare the captured image to those held on multiple databases. Unique facial features such as the spacing between eyes, the bridge of the nose, the contours of the lips, ears and chin can all be used to identify a person within a matter of seconds, even if they are in the middle of a crowd.

How to innovate



Lindsay Herbert,
IBM Inventor and
Innovation Leader

Her keynote speech, 'Death to Digital Experience: How to Actually Innovate' at Southampton Science Park's AI in Action event this Autumn may have ruffled some feathers for those working in the digital transformation space. Here, Lindsay Herbert explains why she believes 'digital transformation' does not equal 'innovation'.

Q. In a nutshell, what does 'digital transformation' mean?

A. Real digital transformation means to become more adaptive to change itself. The 'digital' part comes in because you can't adapt to major change without leveraging data, technology and the ways of working brought about by the digital age.

The phrase 'digital transformation' has been haunting us for about ten years now and I strongly urge everyone to stop using the term. It's fallen into the dubious category of buzzwords, and everyone thinks it means something different.

If you're the CEO, you probably think it means 'digitising' existing parts of the business. If you're a digital agency, you probably think it means going 'agile'. The phrase gets thrown around too freely, so you get lots of people all nodding along to decisions when they all have different interpretations – this can be very dangerous.

Q. Can you give us an example of good digital transformation in action?

A. The Rijksmuseum in Amsterdam is my favourite example because it perfectly demonstrates that digital transformation isn't just about putting new technology everywhere.

The mission of the Rijksmuseum is to preserve the art and history of The Netherlands and share it with the world. When it had to close for refurbishments, the Managing Director decided he didn't just want to update the physical building; he wanted to digitally transform the museum too. So, he went on a pilgrimage around the world looking at famous galleries and museums – but what he saw in 'digital experience' depressed him.

It depressed him to see technology in every location that, instead of elevating the experience, was just a really obvious clue as to the last time each organisation had received a big injection of funding. If he walked into a gallery and saw desktop computers, he thought: 'poor gallery, you've not had any funding since the nineties'.

If he walked in and saw tablets: 'oh, good for you, you've had some recent funding'. But the most depressing thing of all? People tapping on screens instead of looking at the priceless works of art.

When you walk into a gallery it should be the most beautiful, authentic space in the world – it's the home of the genuine article. Why mess around with screens when you have the real thing right there in front of you?

So, his first radical transformation decision was to ban all technology from the galleries of the Rijksmuseum.

But he knew technology had a place. He knew it could help the Rijksmuseum achieve a key part of its mission: to share the art and history of The Netherlands with the rest of the world. And so, he championed and won the decision to make all Rijksmuseum art and artefacts available online, in high resolution, completely copyright free.



Initially, people were shocked at the idea of 'giving away' their art, their intellectual property. But, standing firm, the Managing Director argued that some people will never be able to visit the Rijksmuseum in person, and to those people the museum has an obligation. An obligation to provide them access. Those who are lucky enough to be able to visit in person, he stressed, would be better informed.

It was a huge success. Visitor numbers were off the scale.

When I interviewed him for my book, I asked him how he convinced the museum board that this was the right move to make. He said, "Do you have Skype? Do you have Facebook? Yes. And yet, you still go to the trouble of seeing your friends and family in person. No way is a digital replication ever going to replace the real thing."

Q. How has your own experience shaped your view of digital transformation?

A. I've definitely got some deep wounds and battle scars from making innovations real!

One of my latest inventions is the IBM Instant Checkout. I came up with it because I started to dread those six words: unexpected item in the bagging area! I knew technology could do better, so I set out to invent something truly frictionless.

Let me tell you, the lessons of real innovation come hard and fast when you're standing in a North London petrol station watching your invention go from a pristine and controlled lab environment to handling its first interactions with the general public during evening rush hour!

These kinds of experiences throughout my career are where much of my insight, tips and advice come from. They've helped shape my own perspective on digital transformation, along with the countless innovation interviews I conducted with company leaders from all around the world for the book.

Q. Why is adapting to change so hard?

A. Because we're human. We're all a bit scared of doing things differently and uncertainty makes us nervous, especially if it relates to how we make a living.

And it's a vicious cycle because when we do finally face our fears and realise that a new piece of technology or process is much better than what we had before, we become attached and get comfortable again. And then we're wary of the next change, and the next, and the next...

This is why I believe that changing to keep up with technology isn't the real problem. The real challenge is changing attitudes towards change itself.

The secret to success is to learn to react to the small, early signs of change. If you can make that part of your business-as-usual, that's half the battle won.

Q. Is that why you wrote a book?

A. In the same way that a rising tide floats all boats, I'm a strong believer that the more innovation there is in the world, the better the world will be for us all.

Innovation is what I do for a living, and I've learned all its lessons the hard way. Writing the book enabled me to share my experiences, and those from other successful innovation leaders around the world, to help more companies truly innovate. A lot of other books on the market talk about 'the why' but very few discuss 'the how'

Q. In it, you talk about a staged approach to transformation which you call BUILD. Could you describe it?

A. Absolutely. BUILD is a set of actionable steps for how to innovate on a major scale. The acronym symbolises the scale, permanence and impact of digital transformation itself. Here it is in a nutshell:

The 5 Stages of Real Digital Transformation.

1. Bridge: No company is an island, but many act like one.

If a company feels it is in need of digital transformation, it's because it is no longer keeping pace with change. That change could be in the form of customer needs, the competitive landscape, or the ability to leverage helpful new technologies for example.

The first stage, therefore, is to establish meaningful connections and feedback loops with the people the company is meant to serve, as well as the experts and allies who can help it serve them better. This will not only reveal how the company needs to change, but also if its innovations in response to it are having a positive effect.

2. Uncover: Barriers to innovation are hiding in plain sight.

Outdated policies and processes are just some of the typical barriers that prevent a company from responding organically to external change. Unless you mitigate these issues, they will block innovation progress at every turn.

As such, the second stage is to find and mitigate the barriers that may stand in the way of the innovations you want to develop.

3. Iterate: Innovation is iterative and collaborative, not a new silo.

The worst way to tackle innovation is to create an isolated team with no access to real users or to the parts of the business that will be impacted if the innovation scales. It leads to projects developing solutions that fail to address real user needs, and/or require unnecessarily difficult changes to the rest of the business before they can be incorporated into existing infrastructure and processes.

The third stage then, is about prototyping and testing with real users incrementally to let the innovation team know if the solution is on the right track externally. It's also about making sure you have meaningful involvement from all relevant parts of the business throughout its iterative development to gain buy-in and ensure the prototype is suitable for scaling to real enterprise-level use.

4. Leverage: Measure what's treasured and use it to gain new ground.

All people are wary of change and hearing about the company's latest adoption of a new technology will only make people worry about the relevance of their own skills and their future job security.

Instead, the fourth stage is about sharing innovation results as business results (what people from the company already see as valued metrics), and only with those whose approval and buy-in you need to scale. This also gives them a role to play in taking the innovation forward, making them feel valued and part of the company's transformation journey.

5. Disseminate: Innovation isn't learned on a training course; it's learned by doing.

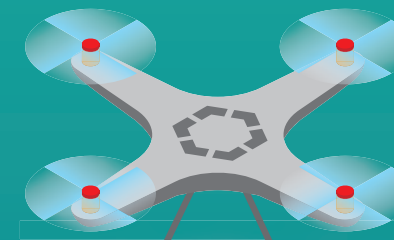
Technology and innovation skills are best learned working to solve a real goal, and with experienced people mentoring others on the job (and not in a training course).

As such, the final stage is to provide guidelines, incentives, and structures that enable and empower people to identify new opportunities for innovation, and to form multi-disciplinary groups to work out possible solutions. It's also to provide leaders with decision-making frameworks for how to evaluate new innovations, determine what to scale, and decide how much to invest in new ideas.

Q. Aside from reading your book, how can companies get your help with innovation?

A. There are two ways! First, you can invite me to give a talk. I love sharing innovation success stories and the 'how-to' of innovation at events and leadership summits. In addition to discussing the challenges faced by the group, it also gives me a great opportunity to learn about their innovation success stories.

Second, I can help if you have an innovation problem that you're trying to solve for your company. In addition to working directly with technology to help companies solve innovation challenges, I also have an extensive network of start-ups, scale-ups and tech companies that specialise in niche and cutting-edge solutions. By working with the right people and using the right methods, there are few innovation challenges that can't be solved.



Lindsay Herbert is an IBM Inventor and Innovation Leader. In addition to advising company leaders worldwide on how to further their innovation agendas, Lindsay also invents breakthrough technologies for IBM itself. Lindsay is also a Governor for the Museum of London, appointed by Mayor of London Sadiq Khan to help inform the Museum's own digital transformation journey.

Her best-selling book, Digital Transformation, has received international praise for its practical framework on how to drive major change through real innovation. It is available on Amazon, from all major booksellers, and via Bloomsbury at www.bloomsbury.com/uk/digital-transformation-9781472940377/

Prestige Parks

What's behind the UK's science park success story?

Science Parks have existed in the UK for over 40 years. However, their evolution into an established segment of both the property market and the wider economic sector has been particularly marked in the postmillennial era: over two thirds were established post-2000. What is it about these clusters of innovation that make them special places to do business? A recent survey carried out by the United Kingdom Science Park Association (UKSPA) reveals their appeal.

5,800 resident companies based at UKSPA member locations

Reputation

A prestige address appears to be the key driver for businesses choosing a science park base, along with the positive reputational association that they gain by being co-located with high profile tenants and in close proximity to world renowned universities and a skilled workforce. High speed connectivity is also an important factor.

Skills

The science, technology and engineering sector has been identified by Government as being central to the future growth of the UK economy. The sector delivers a relatively high value add in comparison to many other industries and this is reflected in the employment growth it delivers, encompassing a significantly high proportion of extremely skilled jobs.

Local

Analysing the geographic origin of companies, some 37% of tenant companies are based within a 5-mile radius of their start-up location with 75% based within 30-miles. This suggests that there's a real desire for convenience.

The high proportion (68%) of single site, independent companies that have chosen to base themselves at a UKSPA member location demonstrates the significant role that science parks play in fostering entrepreneurial activity and fuelling economic development within their local areas.

Value

Compared to other business premises, science parks provide a high degree of added value. Importantly, over 70% of survey respondents offer business incubation support, with three-quarters of these dedicating space for relevant small businesses.

Last year alone over 4000 events were hosted by UKSPA member locations, of which approximately 1,200 promoted collaboration between tenant companies. This confirms that the majority of UKSPA members offer high quality, dedicated conferencing and meeting room facilities like Axis at Southampton Science Park. Some offer specialist financial support, staff wellbeing and childcare facilities too.

Last year alone over **4000** events were hosted by UKSPA member locations

Jim Duvall, Executive Director at UKSPA, commented: "The full findings of our most recent survey reveal a growing sector, with a complex ecosystem of inter-dependent locations that are diverse in scale, underlying occupier base and real estate characteristics. What they share, however, is a focus in actively supporting the growth of small and emerging businesses within the fast growing and value adding science, technology and engineering sector. We are extremely grateful to our members who participated in the survey, which has enabled us to paint a comprehensive picture of UKSPA membership activity and impact."

UKSPA member locations employ **120,000** people

The 5,800 resident companies based at UKSPA member locations employ around 120,000 personnel. Beyond science park boundaries, virtual companies - usually micro-businesses - also form an important part of regional innovation eco-systems. The survey findings suggest that there are over 1,300 such companies associated with a science park and these have created a further 4,000 jobs.

There's a halo effect too though: 3,500 people are directly employed by the science parks themselves; these roles encompassing managerial, operational, facilities management, catering and business support teams.

UKSPA member survey

A collection of insights from the 2018-19 research on our members

120,000

people are employed on UKSPA member locations

Science Park Employees: 80,000 | Research & Technology Organisations 25,000 | Innovation Centre Employees: 11,000 | Other jobs, including operational management and support staff 4,000

68%

Tenant Companies

Over two thirds of tenant companies on UKSPA member locations are independent single site companies

77%

Contributors to success

Over three quarters of UKSPA members believe their provision of connectivity (Broadband/Fibre Networks) is an important contribution to the success of their location

- 82% Brand of location/prestige
- 80% Location
- 77% Connectivity (Broadband / Fibre Optic)
- 69% Availability of highly-skilled workforce
- 65% Presence of 'anchor' tenants
- 63% University/IHE presence/links

5,800

companies and organisations occupy space on UKSPA member locations

4,000

companies located on UKSPA Science Parks

1,300

companies located on UKSPA innovation centres

500

research and technology organisations

70%

of UKSPA locations opened after 2000

- 17.2% Pre 1990
- 12.6% 1990s
- 31% 2000s
- 39.1% 2010s

4,000+

networking events were hosted by UKSPA member locations, of which almost 1,200 promoted collaboration between tenant companies

42%

of UKSPA members see lack of affordable housing as a constraint on future success

25%

of UKSPA members offer access to child care facilities

93%

of locations provide meeting room facilities, with 79% offering conference space

71%

of locations offer incubation services or support. 75% of these locations provide specialist incubation space

53%

of members provide occupiers with access to specialist financial advice

READ MORE AT UKSPA.ORG.UK

Water scarcity is a lot closer than you might think.

The Environment Agency predicts that the UK will run out of usable water by 2045 with dramatic consequences unless action is taken. Now is the time for businesses in all sectors to wake up to water.

Water is not a big part of the conversation when it comes to sustainability. We talk a great deal about the impact of carbon. We talk a lot about the impact of plastics. We increasingly talk about the impact of diets and the food chain. Few people are talking about the impact of water inefficiency: a growing problem right across the UK and the world.

The Environment Agency has spoken of a '25-year water bomb', highlighting that, unless proactive action is taken, we will simply run out of water here by 2045. Roughly twenty years from now, they say, we will enter the 'jaws of death' when water demand



Elevating Water

So, what it will take to encourage further corporate water users to look more proactively at relieving water stress?

• **Claire Yeates**, Director at specialist water consultancy Waterscan, comments: "High profile leadership would help; something that's been demonstrated in the way that David Attenborough has almost single-handedly awoken the world to the issue of ocean plastics. So would legislation and financial penalties for corporate water mismanagement but, in the current political context, this is unlikely to be prioritised".

(which is going up due to population growth and business development) exceeds water availability (which is going down due to climate change and aging infrastructure).

At this tipping point, where water starts to become a scarce commodity, the laws of economics dictate that prices will rise and both businesses and consumers will sit up and take notice. And that's the point where it will be too late. Far too late.

Non-household water usage accounts for 21% of total water demand across the UK, so the actions of our businesses have significant impacts on the mid to long term continuity of our water supplies.

"Customer expectations of suppliers have never been higher, and this has proven to be an effective motivator for action in many areas"

"These aside, there are a number of fundamental drivers that will, sooner or later, raise water efficiency higher up corporate agendas. First, there's pure and simple operational resilience because water is critical to all businesses of all sizes. Manufacturing is a good example of where any shortage would be keenly felt. We're working with people like Kellogg's, Coca Cola European Partners and several major breweries right now to ensure that water continues to flow throughout their operations. If it's not already listed, water scarcity should be built into all corporate risk registers.

"Secondly, there's corporate reputation and associated consumer and supply chain power. Customer expectations of suppliers have never been higher, and this has proven to be an effective motivator for action in many areas – again, plastic usage is a good example of where prompt and effective action has been taken. Consumer and supply chain education, setting targets against baseline data and reporting against these in annual reports are incredibly important factors in change

creation. It won't be long before there is a national or global benchmark on corporate water use, but why would any organisation wait to be named and shamed?

"Thirdly, there's collaboration. We need positive, creative, strategic thinking coupled with innovative technologies and a 'can-do' collaborative attitude to permeate the water supply chain, from water wholesaler through to staff within company operations. We coordinate regular user forums for precisely this purpose: dedicated sessions where corporate water users have an opportunity to sit with Ofwat, the market operator MOSL and bodies like the Environment Agency and the Consumer Council for Water to understand the challenges and help shape the future of the UK's water landscape."

Companies could, of course, carry on with their operations as currently, hoping that the work that water suppliers, regulators and companies like Waterscan are doing will be enough to eliminate the probability of water shortages. However, at best that is likely to consequence in inefficient water usage, undetected leakage and unnecessarily high bills. At worst, if water restrictions had to be imposed, unprepared businesses would be risking serious disruption to their ability to function.

Is it overly alarmist to be talking about 'water time bombs' and 'the jaws of death'? Probably not: science suggests that these are not overstated prophecies but credible predictions that both policymakers and non-governmental organisations agree on. It's a shame that terms like this must enter the narrative, but if this is the only way to make water a part of the sustainability debate then so be it.

Proactive businesses can benefit from a focus on water in multiple ways.

They will be able to:

- Make their businesses more resilient to the effects of climate change and water scarcity, by future-proofing their operations against restrictions and making them less dependent on external factors.
- Achieve their sustainability targets and be able to report on their success to investors and customers.
- Lower their bills and increase competitiveness in their respective markets.
- Be an active part of the solution - something that their local communities and customers will greatly appreciate – in turn building long-term reputational gains.

Several businesses at Southampton Science Park are collaborating to be part of the water solution.

Founded in 2015 as a spin out from Imperial College London, Inflowmatix works closely with water industry specialists, engineering experts, and world-class academics to bring cutting edge research and technology to water utilities around the world that specifically address the challenges in water that we face today. Its solutions build on a high speed, low cost pressure sensing device designed and manufactured in the UK to bring insight into pipe failure mechanisms.

Critical Software has been working with Waterscan to further develop its Waterline platform which enables its clients to access water cost and consumption data in a visually compelling, user-friendly way, unrivalled in

the water sector. In addition to a wide-ranging reporting suite, Waterline can monitor the progress of major projects and installations such as automatic meter reading and leak repairs.

Kelda Technology has pioneered water-in-air shower products that halve water usage and water heating costs through unique, patented shower technology. The company hopes to make water usage better for everyone, everywhere - for businesses with high-volume water requirements, for consumers demanding an improved eco shower experience and for those around the world in water-scarce and water-stressed regions, where every drop counts.

WATER, WATER: EVERYWHERE?

LOCATION LOCATION LOCATION



PROMEGA, GLOBAL LEADER IN LIFE SCIENCES, HAS UNVEILED ITS STUNNING NEW CUSTOM-BUILT UK HEADQUARTERS AT SOUTHAMPTON SCIENCE PARK'S BENHAM CAMPUS.

Promega's striking bespoke build, which covers 16,000 sq. ft, has been designed to be environmentally friendly, functional and beautiful inside and out.

Sean Donnelly, Operations Director, Promega UK said: "Promega UK has been a fundamental part of Southampton Science Park for over 25 years. This is the beginning of a new chapter for the Branch in the UK.

"When we were planning this development, we were keen to stay on the Park; the plot on Benham Road was an ideal location. The new building, containing commercial offices, research and development labs and our cold storage facility, reflects the attention to detail and planning which we undertook with our parent company, Promega Corporation. The result is a construction which reflects our corporate style and ethos, whilst creating something which is truly unique.

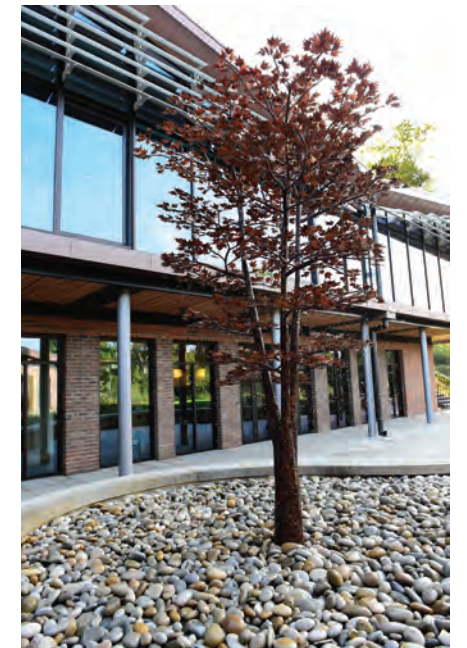
"Our central themes in the design of the building are:

- The creation of a building capable of operating with a carbon neutral footprint. New building technologies help achieve low energy consumption, low carbon emissions and water conservation.
- Establishing an environment that nurtures creativity, self-discovery and individual growth; one where employee health and well-being is an integral part of our daily activities.
- A facility enabling us to foster deeper relationships with our customers, suppliers and collaborators, sharing with them the culture, ethos and capabilities of Promega.
- Our desire to share our knowledge of life science with our local community and to educate and enthuse future generations of life scientists.

We hope to welcome visitors from the New Year and will be planning an 'Open Day' to showcase our new home."

Dr Robin Chave, CEO of the Science Park, added: "Supporting companies at all stages of growth is a central part of what we do here. Promega's rapid growth and expanded operations required a new approach to their accommodation and we are delighted to have enabled this. The result is not only an exemplary and superb addition to the Science Park but also a fitting testimony to Promega UK's success to date."

Further opportunities exist to follow in the formidable footsteps of world leaders Promega and Fibercore which have all chosen Southampton Science Park as the optimum place to design and construct their own prestigious UK bases. Call **023 8076 3808** to find out more.



THE CATALYST FOR SUCCESS



CATALYST

AUGMENTED SOLUTIONS is innovating ways to improve science, technology, engineering and mathematics skills through immersive content aimed at school age children. The hope is that it will fuel an interest in STEM-based careers amongst young people.

Founder **Michael Griffin** says: "Our main challenge now is to develop a logical, tested and exciting business model that transitions rapidly into a successful company. That's why we were very excited to have won entry to Catalyst as we feel this is exactly what we need to help us launch the business most rapidly with the least risk."

In September, Southampton Science Park welcomed new companies to its highly sought after Catalyst business accelerator programme. Here we reveal the small businesses that the Catalyst judges believe have big written all over them!

PROCUREHQ is creating a platform that will automate supplier liaison and simplify the procurement of materials for small businesses across the construction sector (approximately 20% of all the UK's SMEs).

Founder **Matthew Hutchings** says: "Starting up a business is one of the most exciting things you can do, but it is also one of the most challenging and daunting. Obstacles, hardships and disaster lie ahead testing stamina, agility, and the limits of courage! Presenting my business at the Catalyst introductory day gave me the confidence to believe in my vision and I look forward to what the future holds."

EMMERSE STUDIOS is developing digital gameplay that will help children to become more creative, curious and willing to explore new ideas while developing a conscious mind around social behaviour and mental health. It will target teens and young adults to contribute to the development of emotional intelligence.

Founder **Emma May** says: "As the creator of the family card game Quirk!, I know that there's a lot of learning involved in every aspect of running a business. I am very excited to have the opportunity to be on the Catalyst programme to better understand my business development and meet and work with other start-ups."

LIBERATI is supporting IT departments in enterprise organisations that need to transition from legacy Oracle database applications to Microsoft cloud versions. The solution liberates database apps from vendor lock-in and reduces re-platforming time from years to weeks.

Founders **Seyed Mohammad Ali Torabi** and **Dr Hamid Khoshbakht** say: "We have launched a beta version of the product and secured initial seed investment. The challenge now is to secure early adopters since our target customers are enterprise customers who are very risk averse. Joining Catalyst is a great boost to morale, giving us the energy to work even harder and not give up!"

VALA is a unified awards and events management software platform which promises to be the holy grail for event organisers, who typically manage this complex task by hacking together various 'un-fit-for-purpose' third party software. It will cater for everything from local youth football league awards to the Oscars.

Founder **David Frankel** comments: "Practically speaking our current goal is to have a go-to-market strategy well-defined after testing, budgets and subsequent funding for sales and marketing and an overall growth strategy in place ready to enable hiring an execution team."

GLOBAL MUSIC LEARNING has created online music school Gigajam; designed to help students and music teachers access high quality, affordable instrumental music lessons anytime, anywhere. Just 1.7% of school pupils receive 1-1 tuition yet, where lessons are free, the uptake is 22%, restricted only by supply of music teachers.

Founder **Brian Greene** comments: "My business already has support from early adopters in music education and I now need to focus on resourcing, marketing and continual improvement of the technology. This Catalyst period with access to vital support provides me with a very focused opportunity to concentrate my energies into the priorities that give my business the greatest chance of success."



Tis the season to hunker in. But that needn't mean resting on your laurels: winter time is the perfect time to learn lessons and new approaches. Here are ten top-rated books to fuel your thinking when it's cold outside.

Bad Blood: Secrets and Lies in a Silicon Valley Start-Up

John Carreyrou

The shocking inside story of the breathtaking rise and collapse of a multi-billion-dollar biotech start-up: the biggest corporate fraud since Enron. Written by the prize-winning journalist who first broke the story and pursued it to the end, this is a cautionary tale set amid the bold promises and gold-rush frenzy of Silicon Valley. So gripping, it's being made into a movie.

Indistractable: How to Control Your Attention and Choose Your Life

Nir Eyal

Revealing the hidden psychology driving you to distraction, this book explains how to make pacts with yourself to keep your brain on track. Empowering and optimistic, it will help you make decisions and see them through, realise your ambitions, and live the life you really want. And there's no digital detox in sight.

No One Is Too Small to Make a Difference

Greta Thunberg

'Everything needs to change. And it has to start today' says the young Nobel Peace Prize nominee. Here are the history-making, ground-breaking speeches of Greta Thunberg, the young activist who has become the voice of a generation, inspiring millions and forcing governments to listen.

Letters from an Astrophysicist

Neil deGrasse Tyson

An awe-inspiring read and an intimate portal into an incredible mind that's equally funny, wise and mind-blowing. 'Don't fear change. Don't fear failure. The only thing to fear is loss of ambition. But if you've got plenty of that, then you have nothing to fear at all' says the author, regarded by some as the most influential, acclaimed scientist on the planet.

Everything Is Figureoutable

Marie Forleo

Become unstoppable by instilling the fundamental belief that will change everything! This book promises to re-train your brain to think more creatively and positively in the face of setbacks to help you break down any dream into manageable, achievable steps and achieve your goals, whatever they may be.

Bitcoin Billionaires

Ben Mezrich

A story of redemption and revenge in the wake of an epic legal battle with Facebook - a wild and surprising ride while illuminating a tantalising economic future. Concluding that crypto was 'either the next big thing or total bull****', the Winklevoss brothers took a bet and became the first bitcoin billionaires. This is the story of how they did it.

The Globotics Upheaval: Globalisation, Robotics and the Future of Work

Richard Baldwin

Automation, artificial intelligence and robotics are changing our lives quickly. Here, a leading globalisation expert suggests that digital disruption goes much further than we realise and the inhuman speed of this transformation threatens to overwhelm our capacity to adapt. We can, he argues, outpace this by using skills that no machine can copy: creativity and independent thought.

The Power of Nunchi: The Korean Secret to Happiness and Success

Euny Hong

Nunchi (literally, 'eye measure') is the guiding principle of Korean life: the subtle art of reading a room, gauging other people's thoughts, and feelings in order to build trust, harmony and connection. Understand what other people are thinking and feeling - and use that to get ahead.

Factfulness: Ten Reasons We're Wrong About The World – And Why Things Are Better Than You Think

Hans Rosling, Ola Rosling, Anna Rosling Ronnlund

Endorsed by Bill Gates and Barack Obama, this book promises to change the way you see the world, and make you realise things are better than you thought. Oozing with facts, lively anecdotes and moving stories compiled by legendary statisticians, it creates a fact-focused, bias-free vision of our new world order that is uplifting, revelatory and inspiring.

Fresh Ideas



ON THE PARK

News from the Science Park Community



Genomic analysis in the field



Biotechnology company MicroGEM has achieved a technical breakthrough in the ability to conduct genomic analysis in the field.

Using its PDQeX Nucleic Acid Extractor and a collaborator's sequencing technologies, researchers conducted real-time identification of viral pathogens in a farmer's field setting for the Cassava Virus Action Project. Working with difficult plant samples and with no power, infrastructure, or internet, the researchers successfully conducted real-time DNA extraction and sequencing on samples collected from cassava plants in Tanzania, Uganda and Kenya. The entire process was completed in hours, a significant departure from the weeks previously required to receive test results. It means that farmers are quickly able to identify which plants were infected and had to be discarded.



800 million people rely on the cassava plant for food and income. However viral diseases play a significant role in wiping out entire crops, so the ability to detect these pathogens in the field is a significant step forward in crop management for subsistence farmers across the world.

MicroGEM is committed to bringing complex molecular techniques out of laboratories and into the field. Its temperature-driven, enzymatic single-tube process simplifies the number of steps for traditional nucleic acid extraction and uses no harsh chemicals, resulting in high-quality extracts with reduced contamination and high yields – all in minutes, not hours. The PDQeX is compact and can be run on a battery or plugged in, making it a simple, affordable solution for rapid extractions in the laboratory or at the point of need. MicroGEM's reagent kits are optimized to work with either the PDQeX or existing laboratory thermocyclers. www.microgembio.com

Semantic partners with Silverstone



semantic

Digital consultants Semantic has partnered with The Silverstone Experience – the UK's biggest attraction launch in 2019 – to create its online presence.

The Silverstone Experience was devised to give visitors a chance to get close to iconic racing cars and bikes that have graced the circuit, immerse themselves in a tech lab to bring the science behind the sport to life and other interactive experiences, as well as taking in the past, present and future of this world famous track.

Neil Lewin, Owner of Semantic, said: "Building websites for attractions is something of a speciality for us here at Semantic, and we were delighted to get work on another fantastic attraction in The Silverstone Experience. It takes time to build optimal online user journeys that deliver results. Our challenge here was that we had just six weeks to design, build and launch the website before the attraction officially opened. Often, websites of this scale can take several months to complete, so the team really had to go the extra mile to reach the finish line."

www.semantic.co.uk



Empowering mobile employees



Mobile solutions company Nine23 has launched FLEXContainer to empower mobile employees in enterprise settings.

For more than a decade, mobile employees have been working with 'one hand tied behind their backs' by overly restricted mobile security policies. FLEXContainer removes those limitations by enabling unrestricted, secure collaboration between employees and their organisations.

The containerised mobile application, over which the company has full control to ensure the security of sensitive company data, is deployed on the employees' personal device. At the same time, employees have peace of mind that the organisation will only have control inside the application, not the whole device, to maintain and respect their privacy. The solution is delivered from Nine23's accredited private cloud Platform FLEX.

Stuart McKean, CEO said: "We are excited to launch a product that will secure and enhance employees' mobile working, allowing them to work wherever they are on their personal devices. The amount of interest we received about it at CyberUK, an event hosted by the National Cyber Security Centre, was very positive." www.nine23.co.uk



2019 Test Valley Business Awards

The 2019 Test Valley Business Award Winners have been announced.

From over 200 entries, four Science Park businesses were recognised at this year's awards.

Critical Software was named the winner of the Innovation & Technology Award, with **Inflowmatix** and **Tonic Analytics** both achieving highly commended accolades in the same category. Recent Catalyst programme graduate **Signly** was highly commended in the very hotly contested Small Business of the Year Award too.

Dr Robin Chave, hosting on behalf of the Science Park, commented: "We have been a proud Gold

Sponsor of the Test Valley Business Awards for over a decade because we understand the important role that awards play in championing regionally-based businesses and supporting their growth strategies. It was extremely pleasing to see a number of companies based here at the Science Park achieving success in this year's awards: a significant achievement and one that is testimony to the incredible innovative work carried out here."

Previous Science Park companies that have achieved success in this awards scheme include Fresh Relevance, 1st Touch, Symetrica and Photonstar LED. All have gone on to accomplish significant commercial growth. www.tvbawards.org.uk

New appointments for Avonglen



Business finance company Avonglen has cemented its growth since arriving at the Science Park in 2004 with the appointment of two new Associate Directors.

Lynne Bulstrode has more than a decade of experience working as a portfolio Finance Director within an accountancy practice. Since joining Avonglen, Lynne has become the part-time Finance Director for three businesses, one of which is based on the Science Park. Sue Gray was promoted into the role after 20 years' experience of providing finance support and direction to the CEOs of both multi-national and developing businesses.

In 2018, Avonglen moved into larger premises on the park to accommodate further staff to support a wide variety of ambitious businesses. Director William Harris said: "The role of Finance Director is often pivotal in a business and we are pleased to offer the support of a first-class professional on a part-time basis, meaning a business of any size can afford to have the best advice possible." www.avonglen.com

Shaping government policy

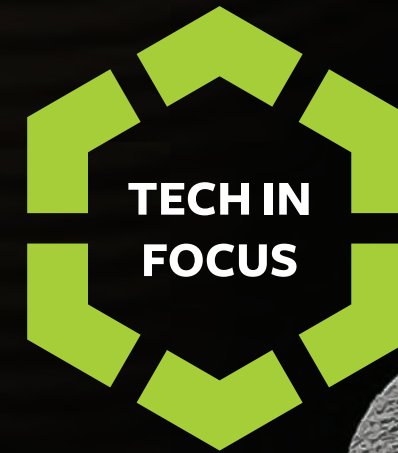


Southampton Science Park is the only UK science park asked to contribute to The Parliamentary Review 2018/19; an annual publication issued to thousands of leading policymakers with the strategic aim of raising standards through the sharing of best practice.

The Science Park article discusses the powerful role that science parks can play in reinvigorating and fast-tracking the UK's economic progress globally. Unlike business parks, it argues, they are differentiated by the value-adding business support services they provide and their commitment to facilitating growth.

The article goes on to highlight three significant challenges that technology businesses – and more broadly, the UK's innovation sector – face and suggests how policymakers might tackle these; in particular, the need for government to support innovative businesses through the provision of early stage capital that bridges the gap between founding capital and full investment.

The release of The Parliamentary Review is marked with a reception at the Palace of Westminster. Attending on behalf of the Science Park, Dr Robin Chave commented: "We were delighted to be asked to contribute to this prestigious publication because we're very proud of the work that we do here and the success stories that are created within our business community. Amid these successes though, there's much that government can do to support tech businesses looking to get a foothold on the world stage - and there's never been a better time to do it!"



International technology company Critical Software has launched Medical Devices Services.

The move builds on the company's heritage in critical systems to offer medical device manufacturers the kind of software development and testing services they need to ensure devices are safe, reliable and robust.

Ana Rita Silva, Head of Business Development for Medical Devices, said: "Every day, patients around the world put their lives in the hands of

qualified healthcare professionals and the medical devices that support their work. These devices are increasingly complex, with software often at the heart of them. Life support machines, defibrillators, implants and many other diagnostic equipment are just a few examples.

However, a staggering one in three medical devices with software in them suffer recalls because of failures currently and this is something we are aiming to change. With our expertise in software development, testing, security and our industry knowledge, we are well-placed to respond to the industry's demands for increasingly reliable and safe devices." www.criticalsoftware.com

Accessing the NHS marketplace



Health-tech organisation Wessex Academic Health Science Network (WAHSN) hosted a national event at the Science Park's Axis Conference Centre in October.

'Bridging the Gap 4: South Coast' was devised to help healthcare innovators to access the NHS marketplace by gaining a thorough understanding of who NHS decision makers are and what they are looking for in order to drive better patient outcomes. The event covered how to navigate the NHS, gather evidence in digital health, scale-up and build collaborations.

WAHSN is keen to work with SMEs and innovators in developing healthcare products and access routes to market. Having outgrown its previous office space, it relocated within the Science Park to facilitate more collaborative, flexible and efficient working. www.wessexahsn.org.uk

3D printed architectural concrete



Photo: Ricardo Gomez on Unsplash.com

BACK TO BLACK

THE WAY WE CONSUME IT IS EVER EVOLVING, BUT OUR LOVE OF BUYING MUSIC REMAINS STEADFAST.

57%

of Brits love or are 'fanatical' about music*

Rest of world average 54%

From the marvel of the crackly wireless and 78rpm bakelite through to 33rpm long plays, coveted scented picture disks and intriguing gatefold sleeves, tangled cassette mix tapes, shiny compact discs, digital downloads and streaming services, the music industry is nothing if not resilient to advances in technology.

What is it about vinyl that means it never gets eclipsed by new tech? Why is it that we're seemingly coming full circle and pulling a hundred-year-old technology, back from near extinction?

Annual sales of vinyl albums have grown for 13 consecutive years – and it's a global thing.

Sales of vinyl records are at their highest level since 1991 in the UK. Since 2015 there has been a remarkable 128% rise in sales, eclipsed only by the continuing shift towards streaming over the same period (+203%). Meanwhile, CD sales continue a long-term decline, down by >28% in 2018.

In the US, vinyl album sales saw an increase of >14% from 2017 to 2018 (12% of all albums sold in 2018), while digital album sales declined by >20% over the same period.

Vinyl album unit sales	UK	US
2007	200,000	1,900,000
2018	4,200,000 Worth >£57m	16,800,000 Worth \$39.5bn

(What's the Story) Morning Glory?

What are the reasons behind this surprising comeback in the digital age? Ask any vinyl evangelist and they'll enthusiastically reel off the answers.

- **Authenticity:** many artists view vinyl as the ultimate medium to express themselves: a creative output that is designed to be listened to and appreciated as a singular body of work, as opposed to single track selection or track-skipping.
- **Quality:** Pressing sound onto vinyl offers a higher quality output as no details are missed: it sounds just as the artist and producer want it to. Unfortunately, the same can't be said when you listen to the same music on the radio or a smart speaker – details are missed as the audio files are compressed to make them small enough to store and broadcast.

- **Tangibility:** vinyl lovers appreciate the experience of buying records and the physical presence of their purchase - something to sit and savour – and the ritual of placing the disk on the turntable and the lowering of the needle. At a time when we're constantly seeking out new ways to destress, vinyl presents a comforting and joyous one-hour window of focused attention.
- **Artistry:** the synergy of music, prose and art is a huge draw, giving the consumer an unparalleled insight into the artist, and the product a longevity that can't be matched. Is there anyone who wouldn't be able to recognise the iconic artwork associated with Abbey Road, Rumours, The Dark Side of the Moon, Thriller, Bat Out of Hell, Nevermind or Born in the USA?
- **Rarity:** collectability is an important element too. While record labels might balk at the cost of producing limited editions, fans are passionate about tracking these deluxe quality items down. The anticipation and announcement of the

format is as exciting for classic releases as it is new material, giving both the industry and the artist a PR gift to work with.

- **Community:** Super DJs and dance bands just would not bring people together in the way that they do if they were stood in front of a streaming device rather than decks. More than that, turntables facilitate another level of creativity through sampling and mixing for seamless crowd pleasing.
- **Compatibility:** Offering a new, ultimately personalised way to engage with music, smart speakers have been key to fuelling the music subscription market growth. While streaming revenues are more than double those generated by physical formats (£500m, or 60% of industry income), the industry believes that streaming and vinyl technologies are ultimately a match made in heaven. ▶

30%
of Brits buy music
on an at-least
monthly basis*
Rest of world average
26%

32%
Britons' music
listening takes
place on radio*
Rest of world average
29%

9%
of our music listening
takes place on our Hi-Fis and
record turntables, reflecting
our enduring love of
physical formats
Rest of world average
8%

6%
of our listening
takes place on
smart speakers*
Rest of world average
3%



Greatest Hits

And what are we buying? A real mix of reissues of classics and, encouragingly, new stuff!
The 2018 top 20 vinyl chart looked like this:

1	TRANQUILITY BASE HOTEL & CASINO	ARCTIC MONKEYS
2	THE GREATEST SHOWMAN	MOTION PICTURE CAST RECORDING
3	RUMOURS	FLEETWOOD MAC
4	GREATEST HITS	QUEEN
5	THE DARK SIDE OF THE MOON	PINK FLOYD
6	STAYING AT TAMARA'S	GEORGE EZRA
7	NEVERMIND	NIRVANA
8	WHAT'S THE STORY MORNING GLORY	OASIS
9	LEGACY	DAVID BOWIE
10	BACK TO BLACK	AMY WINEHOUSE
11	THE WAR OF THE WORLDS	JEFF WAYNE
12	GUARDIANS OF THE GALAXY - AWESOME MIX 1	ORIGINAL SOUNDTRACK
13	THE STONE ROSES	STONE ROSES
14	DIVIDE	ED SHEERAN
15	GUARDIANS OF THE GALAXY - AWESOME MIX 2	ORIGINAL SOUNDTRACK
16	LEGEND	BOB MARLEY & THE WAILERS
17	THE BEATLES	BEATLES
18	AM	ARCTIC MONKEYS
19	DEFINITELY MAYBE	OASIS
20	A BRIEF INQUIRY INTO ONLINE	1975

FANS LOVE TO BUY IT, ARTISTS LOVE TO RECORD ON IT, JOURNALISTS LOVE TO WRITE ABOUT IT – IT'S TAKEN ON THE MANTLE OF REPRESENTING THE HEART AND SOUL OF MUSIC.

CHRIS GREEN
BRITISH PHONOGRAPHIC INDUSTRY (BPI)
DIRECTOR OF RESEARCH ON VINYL

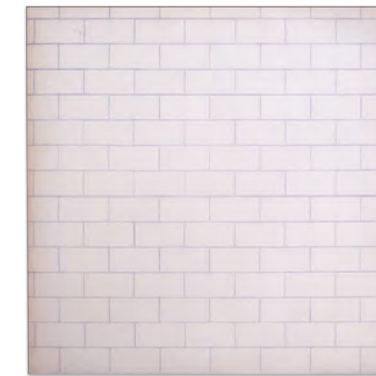
Awesome Mix

The 2019 chart is likely to demonstrate another eclectic mix with previously unreleased material from the likes of Miles Davis launching on vinyl alongside 90s bands reliving their heydays with the release of 25th anniversary special editions, like the Lightning Seeds' strawberry shaped and scented Jollification and Pulp's deluxe, gatefold His 'N' Hers with sports enhanced packaging.

While film soundtracks have always had a strong presence in any album chart, watch out too for game scores, opening the format up to a whole new market. Minecraft, Grand Theft Auto V and The Last of Us have all seen their soundtracks released on vinyl, and a limited edition Sonic the Hedgehog vinyl release is imminent.

It's no wonder that HMV Vault – the company's new flagship in Birmingham – is stocking 25,000 records alongside 80,000 CDs.

The question is: what next for the resurgence of this retro-tech? Can vinyl records, and the hardware required to play them, technically evolve to build on its revival? Do they even need to - or are they perfect just the way they are?



VINYL APPEARS TO HAVE A COMPLEMENTARY RELATIONSHIP WITH STREAMING – THE TWO FORMATS COEXIST AND SUPPORT EACH OTHER: WE INCREASINGLY STREAM FOR DISCOVERY AND EASE OF ACCESS AND FOR OUR DAILY MUSIC FIX, BUT WE'RE ALSO LIKELY TO WANT TO BUY, OWN, GIFT AND COLLECT THE MUSIC WE MOST LOVE ON VINYL, BOX SETS – AND STILL CD TOO FOR THAT MATTER. SO, VINYL HAS HELPED TO SHAPE A NEW AND EXCITING MUSIC ECO-SYSTEM, WHERE WE NOW HAVE MORE WAYS THAN EVER BEFORE TO DISCOVER AND ENJOY THE MUSIC, WE ALL LOVE.

CHRIS GREEN, BPI DIRECTOR OF RESEARCH

*Data from IFPI's 2019 Music Listening Report

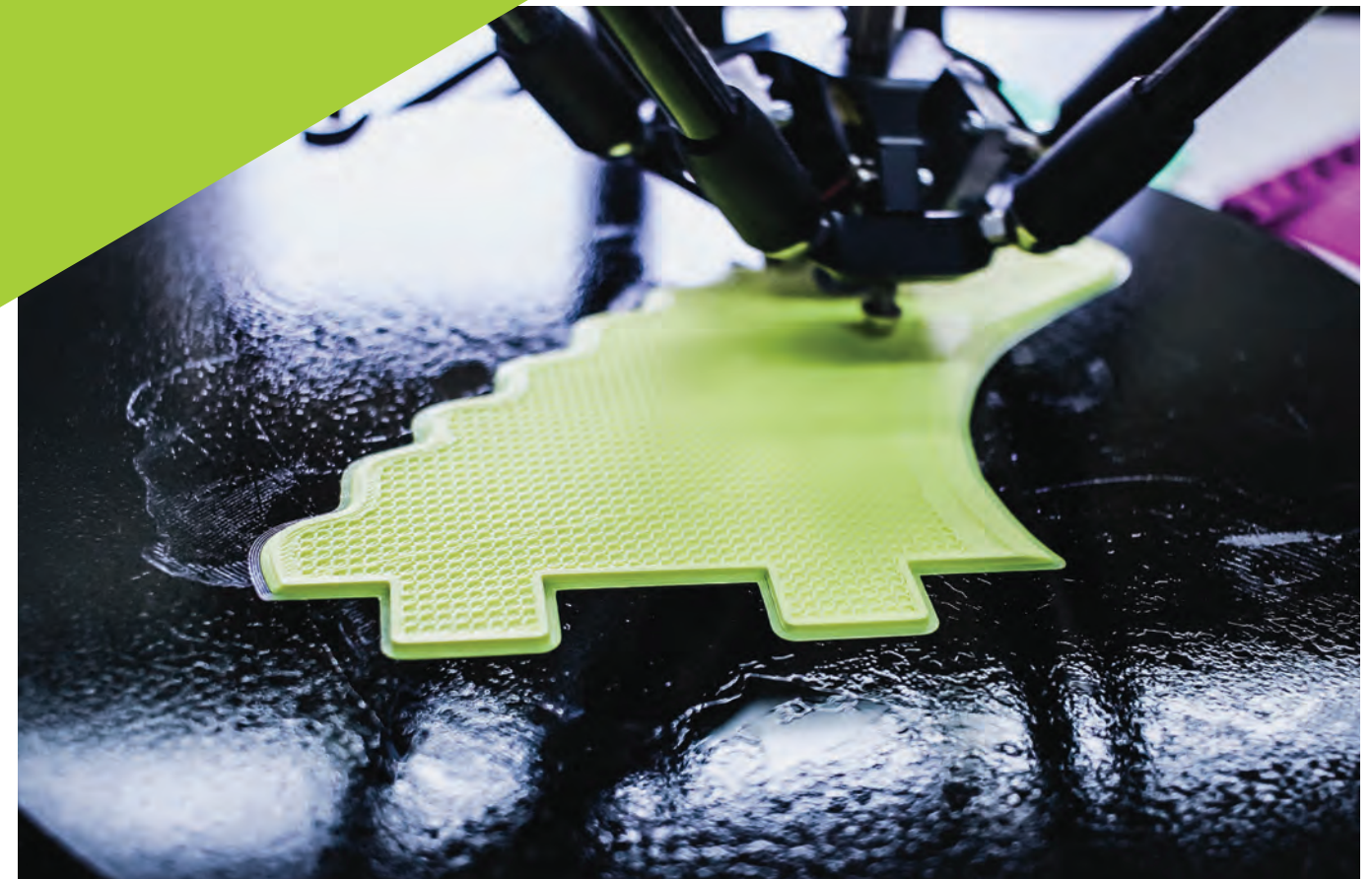
NEW DIMENSIONS

A quick guide to 3D printing



Wireless Bluetooth Speaker 3D printed on ZMorph VX Multitool 3D Printer.

Sci-fi author Arthur C. Clarke first envisaged the basic functions of a 3D printer in 1964 but it took another twenty years for Charles (Chuck) Hull to create the first machine capable of printing an actual part. Now, the enormous potential of 3D printing across a broad range of applications is becoming evident. Indeed, the industry is forecast to grow into a \$35.6bn industry by 2024 (from \$15.8bn in 2020). Here's your instant expert guide to 3D printing.



What is it?

Process and materials vary but the principle remains the same: you use computer-aided design (CAD) software to create a digital model; the blueprint of the object you want to create. Your design is then converted into an STL file format - this slices the design into ultra-thin 2D layers which can be turned into instructions for the printer to execute. The printing process adds material one layer at a time to build the design in 3D which is why the process is often called 'additive manufacturing'.

Why is it important?

3D printing is a true game-changer with the potential to accelerate, de-risk and customise technological innovation.

In contrast to traditional manufacturing methods, often requiring bespoke tools and moulds which can cost many thousands of pounds, 3D printing presents a fast and cost-effective solution. With no specialised tooling or set-up required, the manufacturing cost of a 3D printed part is dictated simply by the amount of material used and the amount of time spent. It also means that complex geometric structures can be created easily and there are no limitations to customisation: simply change your computer model to create something unique.

A wide range of materials can be 3D printed. The majority are plastics but metals and composites - materials filled with ceramic, wood or carbon particles - are increasingly common, enabling items to be created for highly specific purposes. 3D printed parts today can have high heat resistance, high strength or stiffness and even be biocompatible.

Accordingly, 3D printing is transforming prototyping. The product development process that, until recently, has taken months or even years can now be achieved in weeks or even days. Both the form and function of a design can be modelled, tested, tweaked, remodelled and retested at a fraction of the cost and time usually associated with these processes.

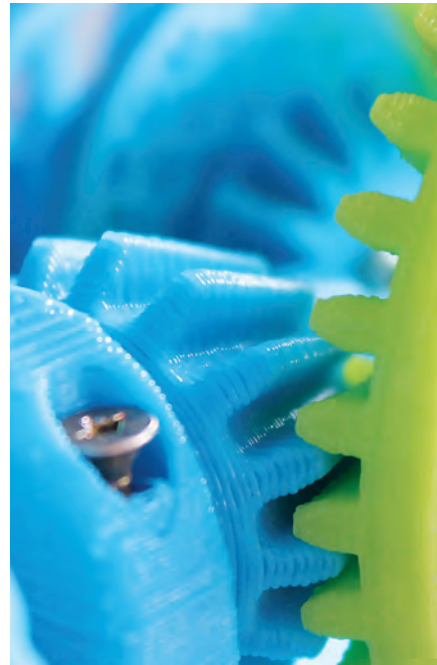
How can it be applied?

3D printing is most cost-effective for small-scale production, when a single (or very few) parts are required, when a quick turnaround time and a low-cost is necessary, when customisation is critical, or when a complex geometric design cannot be produced by any other manufacturing method.

But that is not as limiting as it might sound. Current and potential applications are hindered, it seems, only by imagination.



3D printing is a true game-changer with the potential to accelerate, de-risk and customise technological innovation.



Starting with aerospace (for high-performance parts with high strength-to-weight ratio), automotive (fast spare parts and customisation) and architecture (for structure verification, design review, reverse-structure engineering and expedited scaled modelling), 3D printing has also found its way into fashion and footwear (ultimate customisation and comfort) and films (incredible, cost-efficient props).

One key area to note though, is medical devices. Hearing aids, dental accessories, orthopaedic implants, anatomical replicas for training purposes, surgical guides and tools, smart drug design and delivery and even replica human tissue and blood vessels are proven applications based on 3D printing's speed and its ability to control complex, highly bespoke and small scale outputs.

In educational environments too, the process has unrivalled benefits in its ability to bring subjects to life through scaled replicas for both hands-on practical learning and new fields of research.

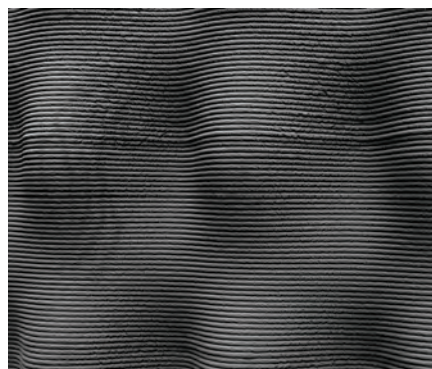
Where will it go from here?

It's worth pointing out that there are some limitations with current technology in terms of material strength and the need for post-processing to achieve desired surface finishes, but these challenges do not appear to be throttling the growth of the 3D industry in commercial settings.

Certainly, forward-thinking creatives like interior, clothing and jewellery designers will be able to produce items that were previously impossible. Meanwhile, some experts believe that the technology could be utilised to help alleviate homelessness by providing eminently affordable housing. Others see a future in food: one US laboratory has already created a low cost, low resolution machine, capable of printing models made from ordinary granulated sugar.

An area that is highly anticipated, but may take a little time to mature, is that of '2D scan to 3D print'. Turning a flat image into a model is already possible, but, currently, a high degree of manual intervention is required to get the desired result.

One thing is for certain though: watch out for a plethora of companies offering 3D print support services from outsourced design work to outsourced printing. Shapeways, for example, recently integrated with Etsy to enable anyone to submit DIY 3D models, pick a material and finish, and receive their object in far better quality than a consumer-grade printer could ever deliver. As usual Google is ahead of the curve: Google SketchUp Make is free, easy-to-learn software for those who don't have CAD training or who are new to the world of 3D modelling. Want to model a house, extension or garden? You totally can.



3D printed architectural concrete

Want to model a house, extension or garden? You totally can.

ZMorph VX Multitool 3D Printer.



NEWS FROM

UNIVERSITY OF Southampton



Infrastructure in focus

A National Infrastructure Laboratory (NIL) has been opened at the University's Boldrewood campus, providing state of the art equipment to design infrastructure that can meet the demands of the modern world.

Much of the UK's infrastructure needs updating. Current inadequacies cost the country an estimated £2m each day. Railways, roads and bridges need to adapt to increasing volumes of traffic moving at greater speeds, whilst in the energy sector, disused oil rigs need to be decommissioned safely and wind turbines need to be resilient to produce sustainable energy reliably. Future infrastructure designers will also need to factor in climate change challenges which will lead to longer periods of hot, dry weather as well as prolonged, heavier rainfall.

William Powrie, Professor of Geotechnical Engineering said: "Infrastructure and urban systems underpin modern life. Our new facilities, which will be open to researchers from around the world, will support research to ensure that our infrastructure is affordable, adaptable, resilient and transformational."

At the NIL's core is a cavernous Large Structures Testing Laboratory with a 4m deep reinforced concrete floor where the strength of heavy-duty infrastructure components such as railway tracks, bridge beams and wind turbine blades will be tested to their limits. It also features a 6m diameter geotechnical centrifuge which effectively compresses timescales by increasing gravity, enabling researchers to simulate the behaviour of an infrastructure component in service conditions over the course of its whole life in just hours or days.

Coral recovery

A team of scientists and engineers led by the National Oceanography Centre (NOC) and the University are revisiting the Darwin Mounds, a 1,000 metre deep cold-water coral reef in the north Atlantic, to look for evidence the coral is regenerating 16 years after it was named a Marine Protected Area.

The expedition aims to answer the question 'how long does cold water coral take to recover?', achieved by comparing surveys of the site from 2000 and 2011 with current findings. The surveys use some of the newest marine survey technology, including the NOC's robot-sub, Autosub6000, to map the area, and the HyBIS Robotic Underwater Vehicle to collect high-definition video footage.

These surveys will be conducted as part of the Climate Linked Atlantic Sector Science programme, which is working to assess how the ocean will evolve as a result of climate change and intensified human exploitation.

Connecting culture

The University is leading a two-year project to catalyse a new future in the arts.

'Connecting Culture' will serve as a new model of cross-sector working for Southampton, leading to a step-change in how the city engages with children and young people by directly drawing on their real-life experiences to shape future actions and activities.

Louise Coysh, Associate Director of Arts and Culture at the University, said: "Connecting Culture contributes perfectly to the delivery of our arts and culture strategy, creating a superb evidence base which will increase our knowledge and experience of Southampton's cultural sector and the impact that creativity can have on children and young people. The programme also demonstrates how the University of Southampton can support the cultural sector, locally and nationally, to be more resilient and sustainable, especially in the face of the many factors that tend to limit investment in the arts."

CBT and IBS

Research has shown that Cognitive Behavioural Therapy (CBT) tailored specifically for Irritable Bowel Syndrome (IBS) and delivered over the telephone or through an interactive website is more effective in relieving the symptoms of IBS than standard care two years after treatment. These results are important in allaying uncertainty about whether the initial benefits of CBT could be sustained in the long term.

IBS is a common gastrointestinal disorder affecting 10-20% of people. Abdominal pain, bloating and altered bowel habit significantly affect patients' quality of life and ability to work. There is limited availability of CBT for IBS in a resource-constrained NHS currently, but this research indicates that easily accessible treatment could be provided to many patients and provide them with effective, long-term relief.

Research lead, Professor Hazel Everitt commented: "The fact that both telephone and web-based CBT sessions were shown to be effective treatments is a really important and exciting discovery. Patients can undertake these treatments at a time convenient to them, without having to travel to clinics and we now know that the benefits can last long term."

The research team is working towards making the therapy widely available in the NHS.



Professor Mark Spearing, President and Vice-Chancellor (Interim), added: "The University, in partnership with the city's leading arts organisations, is keen to lead Southampton in considering culture as a way to transform the physical environment and social progression and we are dedicated to developing collaborative programmes like this long-term as an example of the vision for the University's partnerships in the city, and beyond."

The ambitious project will be the first 'place-based' case study of a city in the UK.

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