

A BLUEPRINT FOR DIGITALLY DRIVEN RECOVERY FROM COVID-19

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Foreword

This white paper is highly timely and especially welcome. Not just because the University has produced it at the height of the 2nd wave of the COVID-19 pandemic in the UK, but also as its findings will influence and be incorporated into the Liverpool City Region's first ever Digital Strategy and Action Plan, to be published in early 2021.

In turn, this reflects the close partnership between the Combined Authority and our universities, as well as with industry and other stakeholders, that is the hallmark of the LCR innovation ecosystem and our approach to maximising our competitive advantages to unlock growth.

The paper is all the more authoritative having been jointly commissioned by two of the University's most distinctive, high impact, and industry-engaged assets, namely the Institute of Digital Engineering & Autonomous Systems (IDEAS) that incorporates the Virtual Engineering Centre as well as the new Digital Innovation Facility, and the Materials Innovation Factory – a world leader in computer and robotics-aided materials discovery and design.

It is also impressive that the findings are based on the direct input of 200 Manager-level or above business respondents from all major sectors across the North West of England, meaning they have a wider resonance and application beyond the Liverpool City Region.

What the research highlights is the extent, pace and scale at which NW businesses have adopted new digital technologies and made more use of existing ones over the last year, and how significant this has been in terms of positively responding to the pandemic, creating new business models and opportunities, as well as retaining jobs.



The fact that the vast majority of businesses, large and small, intend to continue to adopt, adapt and innovate using digital technologies over the next 12 months clearly illustrates that accelerated digitalisation is here to stay, and how vital this can be to short and medium term economic recovery as well as longer term growth.

There are also important insights about barriers to adoption. Yes this is partly about actual and perceived cost, but also about the need to demystify the possible solutions and benefits for all sectors and industries, and it is incumbent upon all of us to work together and help reinforce this accordingly.

Councillor David Baines

Leader of St Helens Council and Portfolio Holder for Digital Connectivity and Inclusion at the Combined Authority

1. Introduction

COVID-19 has left few industries unchanged. It has proved a serious challenge for many while creating growth opportunities for others.

In a year of unprecedented uncertainty, there has been one constant: digital technology has been adopted at a dizzying rate.

Business models and entire sectors have been digitally transformed at a pace and scale few could have imagined pre-pandemic.

Shifts in attitude, culture and investment priorities which might otherwise have taken years have been catalysed over weeks. Coronavirus has created a burning platform for decision-makers, with the cost of inaction outweighing the cost of action for the first time since the inception of the Industry 4.0 era.

The pandemic has highlighted beyond question the merits of a robust strategy for digital innovation. Businesses further along the digitisation journey have been far better equipped to respond and adapt to the challenges posed by the pandemic and measures to control it.

Their less digitally-mature counterparts have had to catch up quickly. In doing so, they have rendered existing operations more resilient, unlocked new revenue streams and accelerated product development.

Robot technicians and high-throughput computing are not just keeping laboratory R&D on track – they're made it faster and more accurate. Digital twins, sensor technologies and data analytics are already providing an incredible return on investment mere months after being applied to keep manufacturing facilities open and global supply chains moving.

None of these changes will be rolled back.

Businesses wedded to analogue processes and business models will quickly find themselves disconnected from the opportunities in a future that is undoubtedly digital-first.

We engaged with hundreds of business leaders from multiple industries to canvas their experience of digital transformation during coronavirus: the drivers behind it, the barriers they still face, and the prizes for overcoming them.

“

The pandemic has highlighted beyond question the merits of a robust strategy for digital innovation”

This resulting blueprint discusses many of them. It also highlights the most important first steps businesses must take to deliver a successful digital transformation strategy while avoiding the pitfalls.

The recommendations are from the University's industry experts and academics with vast experience supporting businesses to digitally transform, both pre-pandemic and during it.

There has never been a stronger imperative for businesses of all sizes, from start-ups to blue chip corporates, to explore the benefits of emergent technologies. Those which do will not only secure a recovery from COVID-19 but a sustainable competitive advantage enabling them to thrive in the new normal.

Andy Levers

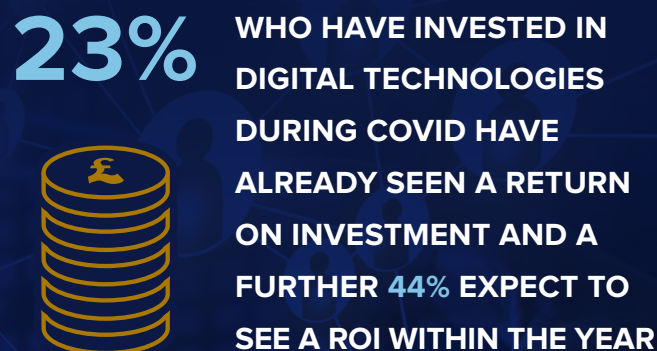
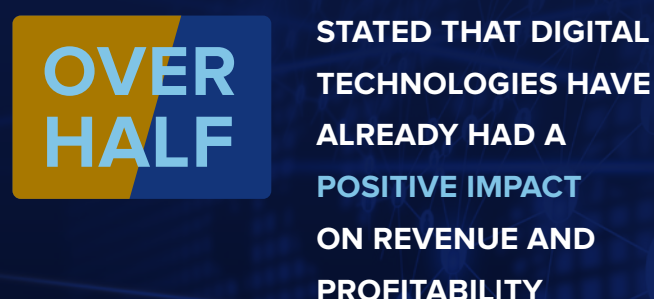
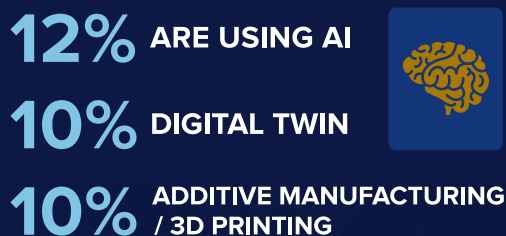
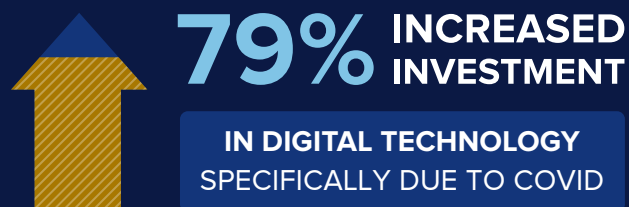
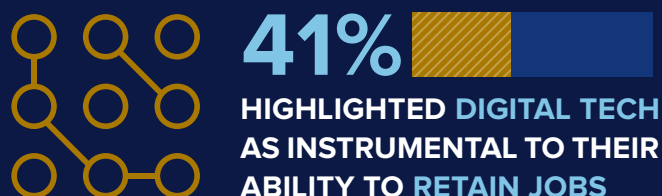
Institute of Digital Engineering and Autonomous Systems

Matt Reed

Materials Innovation Factory

2. Key findings

In response to the pandemic



Methodology and sample size:

The survey was conducted online among a general sample of businesses in the standard government office region of the North West. To be eligible for interview respondents had to be (at least) at management level within the company. A total of 200 interviews was conducted between 24 September and 30 September 2020. (Questions relating to how businesses use digital technologies and their impact were asked of the 181 businesses within the sample that used any digital technology.)

3. Building resilience into existing operations

COVID-19 HAS ACCELERATED DIGITAL ADOPTION

Our study probed businesses about their use of digital technologies before and during the COVID-19 crisis. It reveals the pandemic to have acted as a major catalyst for digital adoption.



More than three quarters of businesses have adopted a new digital technology during COVID-19



Eight out of ten say they are using technology more across their businesses since the onset of the pandemic

It is no coincidence that this increase in adoption has played out at a time when businesses across a broad range of sectors have faced major challenges to how they function.

And those challenges have been profoundly felt.

Many (**63%**) in our sample agreed that COVID-19 has changed how their business operates. For a significant minority, the pandemic has proved a severe challenge – with **39%** stating that their pre-COVID business model is no longer fit for purpose.

TECHNOLOGY HAS BEEN INSTRUMENTAL IN BUILDING RESILIENCE

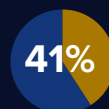
Against this backdrop of uncertainty and disruption, our questionnaire tells us that digital technologies have been instrumental in helping respondents to adapt, remain viable and ultimately to safeguard jobs.



say adopting digital technologies has made their business stronger



A third say it has enabled them to reduce costs



say digital technology has been instrumental in keeping staff in employment

At a time when many businesses have been running at a reduced capacity due to the enforcement of social distancing guidelines or employees being placed on furlough, efficiency has been a key factor in building resilience.

When asked about the impact on business efficiency during COVID-19, two thirds (67%) said that the use of digital technologies had made their business more efficient.

This grew to 72% for both medium (50 – 249 employees) and large businesses (250+ employees), suggesting technology had allowed these organisations to unlock greater economies of scale.

However, more than half (59%) of small businesses also said they had achieved efficiency gains through their use of technology.

IMPACT BEYOND COMMUNICATION

Social distancing has led to a well-documented increase in the use of digital communication channels, which is reflected in our findings. Despite these tools being well established before the pandemic, six out of ten businesses said they had started using video conferencing because of COVID-19 and 65% claimed to be using it more.

Yet, the scale of digital adoption brought on by the pandemic has been much more profound than this.

Even when removing these platforms from the responses – four fifths (81%) of our sample said they were using other digital technologies, with 51% increasing their use as a result of COVID-19.

In fact, our study finds a wide variety of digital technologies are increasing in their use:



43% Internet of Things sensors and devices



29% simulation, virtual reality or augmented reality



12% Artificial Intelligence



10% digital twins



10% 3D printing / additive manufacturing

LEADING FROM THE TOP

Our respondents were asked which departments of their business were using more digital technologies – excluding video conferencing – because of COVID-19 (Figure 1).

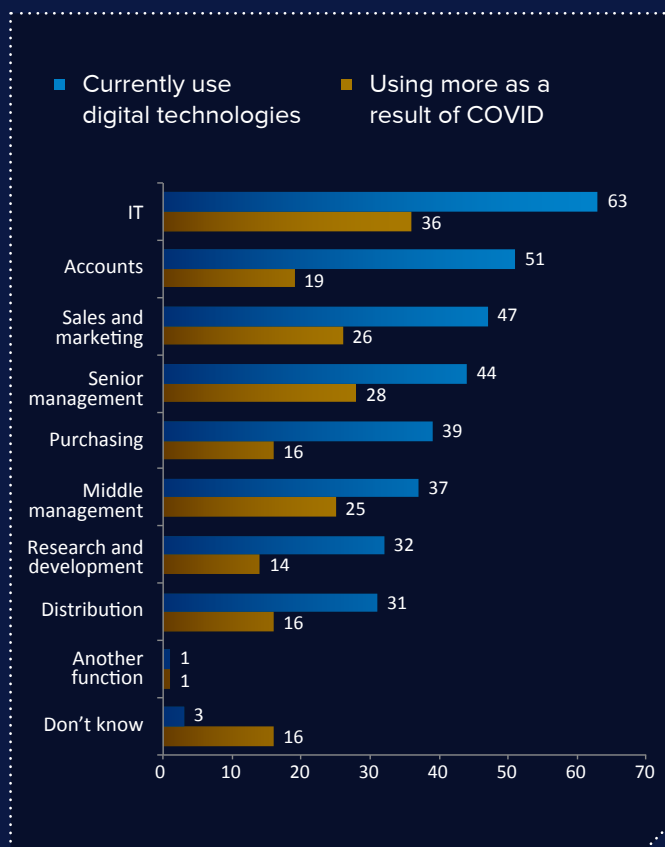


Figure 1: Use of digital technologies by business function

While IT departments were unsurprisingly the most prolific technology users, the findings show a notable impact of COVID-19 on the use of technologies by those in management roles.

More than a quarter of senior (28%) and a quarter of middle managers (25%) are using more technology because of the pandemic. This not only reinforces the view that digital technologies have proved key in delivering stability and resilience, but may also point to a wider top-down approach which has contributed to the general acceleration of digital adoption which our study reveals.



Analysis: A PUSH IN THE RIGHT DIRECTION

Andrew Borland, Industrial Engagement Manager at the University of Liverpool's Virtual Engineering Centre

Necessity is the mother of invention, as the saying goes, and the profound challenges presented by COVID-19 have necessitated a new approach to work for most of us.

That's why almost half (45%) of the businesses who told us that they've increased their use of digital technologies said that most of this change was directly due to COVID-19, and almost all (95%) attributed at least some of it to the pandemic.

It seems an increased appetite for digitisation may be one silver lining to come from COVID-19.

That is welcome news because digital transformation has a major role to play not only in building resilience but in helping UK Plc to gain competitive advantage, through smarter, faster and more precise ways of working and access to new markets.

Yet, for many businesses those pull factors have long been shrouded by a misconception that digital innovation is 'not for them,' that it's something only technology-based companies can take advantage of.

It's a perception barrier that isn't helped by the fact 'digital' itself is an opaque term with myriad definitions.

At the Virtual Engineering Centre, we've spent ten years assisting businesses of all sizes and sectors to evolve how they work by using digital technology. Some seek assistance executing a specific strategy, others need more fundamental help to demystify what digital innovation means in the context of their business. For the latter, they're often just in need of a push in the right direction to trial a new approach.

Our research suggests the pandemic has provided that push for many businesses. It is a source of optimism that COVID-19 has also had a major impact on the use of digital technologies by senior management, given this group's ability to influence wider adoption.

As we enter the recovery, there is an opportunity to galvanise this appetite for trialling new approaches into more profound digital innovation, focused on lasting transformation to unlock the competitive advantage emerging technologies can deliver.

4. Exploiting the benefits of digital transformation

While improved resilience has been a key outcome of the high levels of digital adoption found by our research, many businesses have been able to do more than just survive.

Our findings show that the pandemic has spurred businesses to embrace wider digital transformation, enabling them to pivot, expand and adopt new ways of working.



Four fifths of businesses stated that adopting digital technologies during COVID-19 has changed their business model



A quarter have made major changes

This technology-enabled transformation has led to a wide range of benefits identified by our sample.

BOOSTING THE BOTTOM LINE

When asked about the impact of digital technologies on aspects of their business during COVID-19, over half (**54%**) claimed it had improved revenue and profitability.

The majority (**57%**) also stated that the use of digital technologies had delivered a positive impact on the timescales of their work.

This suggests that businesses have improved productivity, due to their increased use of digital technologies, resulting in a positive impact on the bottom line.

CUSTOMER ENGAGEMENT

The biggest impact has been on the customer experience, with almost two thirds (**64%**) stating that digital technologies have improved this aspect of business performance.

A quarter of our sample (25%) also cited improved customer satisfaction as a key benefit of their investment in digital technology and 32% said it had had a positive impact on communication with clients.

This improved customer engagement correlates with a positive impact on business development. Over a quarter (**29%**) of our sample cited new business generation, from either existing or new customers, as a key benefit of their investment in digital technologies.

INNOVATION & EXPANSION

Evidently, businesses have also leveraged technologies to help them develop novel products and access new markets.

- Almost half (**46%**) said digital technologies had improved market or product innovation

Digital technologies have also enabled businesses to increase their geographical footprint and expand their businesses into new territories.

- Three quarters (**77%**) stated that they had been able to expand geographically
- Almost a quarter (**22%**) stated that they have been able to do this substantially



Analysis: THE DRIVERS FOR DIGITAL TRANSFORMATION ARE EVOLVING

Dr Andy Levers, the University of Liverpool.

The diverse range of benefits highlighted by our research respondents reflect wider changes in the drivers for digital transformation which have emerged in recent years.

When we used to think about why businesses would use digital tools, the focus was all on improving productivity. While that remains a key objective, a broader range of needs have come to fore. Ensuring employee safety, responding to changing regulations, reaching customers and building loyalty are all increasingly on business' list of priorities when it comes to digital transformation. Of course, these drivers are particularly relevant in the context of COVID-19, and this is reflected in the results of our research.

Our study has found that customer engagement has been a key priority for businesses during this period of disruption. Deprived of face-to-face contact, and with traditional sales channels like exhibitions moving online, businesses have turned to digital tools to enable them to find, engage and build rapport with customers in new ways.

In this context it's easy to see why sales and marketing was identified as one of the business functions to

experience the highest increase in digital technology use (Figure 1, page x), cited by over a quarter (26%) of respondents. In our work with businesses, we've seen first-hand how technologies like simulation, and augmented reality (AR) have enabled businesses to showcase their products and services, where physical demonstrations are no longer viable.

COVID-19 has clearly brought employee safety to the fore as a key issue. For factories, and even offices, this has prompted a need to review the spatial requirements that will enable safe, socially distanced working. As a result, we've experienced an increased demand for businesses to create digital twins of their workplaces to assist them in re-planning layouts and processes. This can be achieved efficiently using LIDAR scanning to map an environment and then recreate it virtually. From here businesses can comprehensively review their workplaces, from mapping air flow, foot traffic routes or desk plans in offices, to minimising human interaction with components in manufacturing operations. Alongside the benefits to health, wellbeing and safety, this can also deliver greater efficiencies.

Not only does this avoid the unwarranted disruption and downtime of taking facilities offline, it also equips businesses with a forever tool, which can be used to plan for future changes.

As these drivers evolve, we're seeing different professional roles become involved with planning and implementing digital transformation. It's no longer exclusively the domain of ICT teams. As awareness of the possibilities and potential benefits of digitisation increases, we're just as likely to be working with HR experts and Sales Directors as we are CTOs.



CASE STUDY:

Augmented Reality supports remote sales and international expansion for North West Manufacturer

Heap & Partners, one of the UK's leading design-manufacturers of industrial valves has grown its international customer base through the adoption of augmented reality (AR) and 3D printing.

Many of Heap & Partners' products are large and heavy, weighing up to 40kg, which presents logistical challenges to showcasing them in front of customers. With trade shows and remote meetings a key route to market, it needed a digital solution to boost engagement with prospective customers. This need has been made even more urgent by the COVID-19 pandemic removing the ability for face-to-face meetings.

Working with digital innovation experts from the University of Liverpool and the Science Technology Facilities Council's (STFC) Hartree Centre, Heap & Partners developed a light-weight 3D-printed equivalent of its product, backed by an iOS-based AR app, based on a CAD drawing.

The app presents an X-ray style AR representation of the internal workings of the valve. By highlighting a component, the prospective customer is presented with a summary of the features and technical data associated with the highlighted component, helping to expand their understanding of its benefits and potential.

Heap & Partners were able to successfully deploy the new app at an international trade show within days of the project finishing. It's now used across the majority of the company's product line.

The project ensured that Heap & Partners were able to respond immediately to the coronavirus pandemic, using its digital capabilities to maintain engagement with prospects.

The company's new capabilities have also allowed it to offer support to several healthcare organisations during the COVID-19 pandemic, accelerating the development and 3D production of valves to ensure correct airflow levels in ventilators. The company has also used its expertise to prototype and print face mask visors for care homes across the UK.

PLANS TO INVEST

Our research finds many businesses planning for a more digitally-enabled future, with 59% stating that going forward they will invest more in digital technologies.

Increased adoption is also planned by the vast majority, with 80% of businesses stating that they were interested in using a digital technology that they didn't currently use in the future.

When asked to identify specific technologies they plan to use (Figure 2), data analytics generated the most

interest (20% of respondents), followed by Internet of Things sensors and devices (14%) and authentication and fraud detection technologies (14%).

Interest in video conferencing was low (8%), but that is because adoption is currently extremely high and there is little space for growth.

While this appetite for adoption was lower among small/micro businesses, two thirds (66%) of businesses still identified themselves as being interested in adopting new forms of technology.

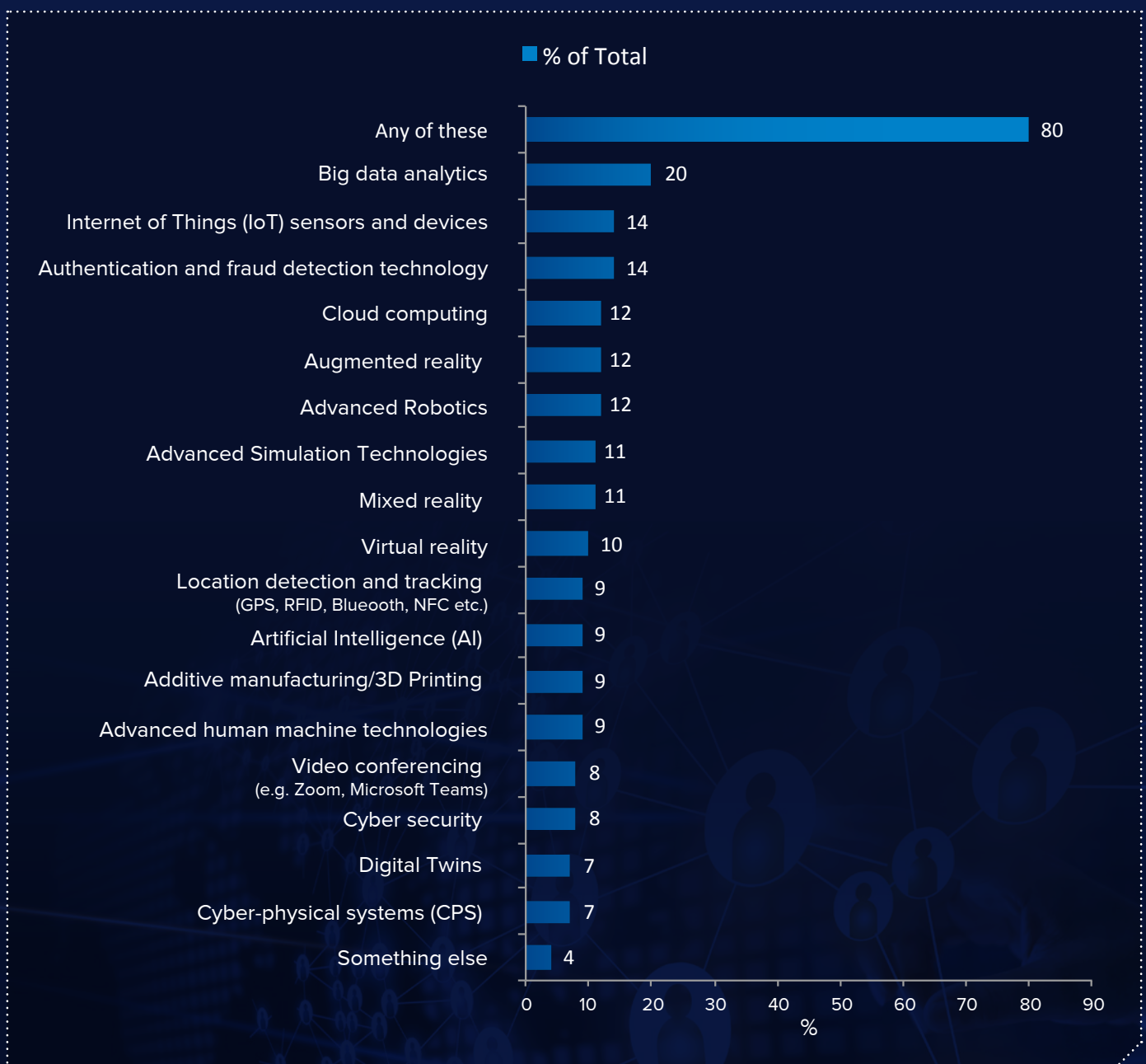
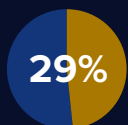


Figure 2: Adoption plans

5. Defining a strategy and building the business case



of businesses do not have a digital strategy, despite 80% planning on adopting a new technology



Over half believe that a failure to invest in digital technologies is a major risk to their business

Decision makers in businesses of all sizes have a growing awareness that in the new normal, digitisation must be considered alongside every other element of corporate strategy.

Indeed, the majority of our sample (52%) believed that a failure to invest in digital technologies would be a major risk to their business.

Despite this, our research revealed that almost one in three companies still don't have a formal digital strategy in place.

The factors holding back formal digital strategies which existed pre-pandemic have been magnified by the disruption of COVID-19. Many businesses have even less time, money, or talent to devote to formalising a digital strategy in the face of a clear imperative to do so.

Despite this, more than 80 per cent of business leaders surveyed showed real interest in adopting at least one Industry 4.0 technology (Figure 2, page 12).

There is a very real risk that attempts to implement new technology without a considered strategy, and the right advice, can fall flat; or that multi-year digital roadmaps with no clear pay off can be perceived as a waste of time in the current environment. This can not only derail individual projects but negatively colour the view of CEOs and CFOs and hold back longer-term transformation.

A smart, agile approach to planning, trialling and assessing new digital technologies can avoid this.

The right strategy and business case can harness the pandemic; sparking interest and investment in appropriate digital tools, with marked returns on investment in the longer term.

Working with hundreds of businesses across multiple industries we have identified several hallmarks of successful innovation strategies; key tenets which ensure results are realised quickly, but also sustained over the longer term.

HARNESS NEW DRIVERS TO SECURE BUY-IN

Traditionally, digital innovation projects have tended to be siloed and led by individual engineers or designers who were receptive to new technologies and digital tools. In companies without a dedicated CTO or CIO, securing the investment and green light to roll that out more widely could prove difficult due to not having board-level buy-in from decision makers.

Pre-pandemic, productivity and efficiency gains were two of the main drivers behind a digital strategy. But decision making and investment in this area of business improvement can suffer from inertia; hampered by the assumption that while a business' bottom line may be boosted by action, there is comparatively little risk in inaction.

COVID-19 presents altogether more pressing drivers to develop a digital strategy – and quickly.

Compliance, safety and resilience are major concerns for businesses of all sizes operating in the new normal. They have created a burning platform for decision makers, catalysing digital adoption which may otherwise have taken years.

The ability for remote teams to collaborate effectively has been made possible by free and widely-adopted video conferencing software. The efficiency these platforms provide, and the wider-shift in mind-set this way of working has elicited among leaders who may have previously shunned digital platforms, creates a powerful driver of its own for digital adoption.

This creates an opportunity to harness these new drivers for transformation in order to spark boardroom interest and secure buy-in.

If companies are reducing their capital expenditure on physical assets due to workforces operating remotely, what budget does that free up for investment in cloud-based platforms? Or to test augmented or virtual reality software to support remote sales and marketing processes?

Increasingly, the impetus for digital innovation in B2B supply chains is being driven externally. For large multi-national operating on just-in-time business models, the ability to guarantee resilient supply chains which can report real-time data on component availability and condition has begun to move from a nice-to-have, to a mandatory requirement to do business.

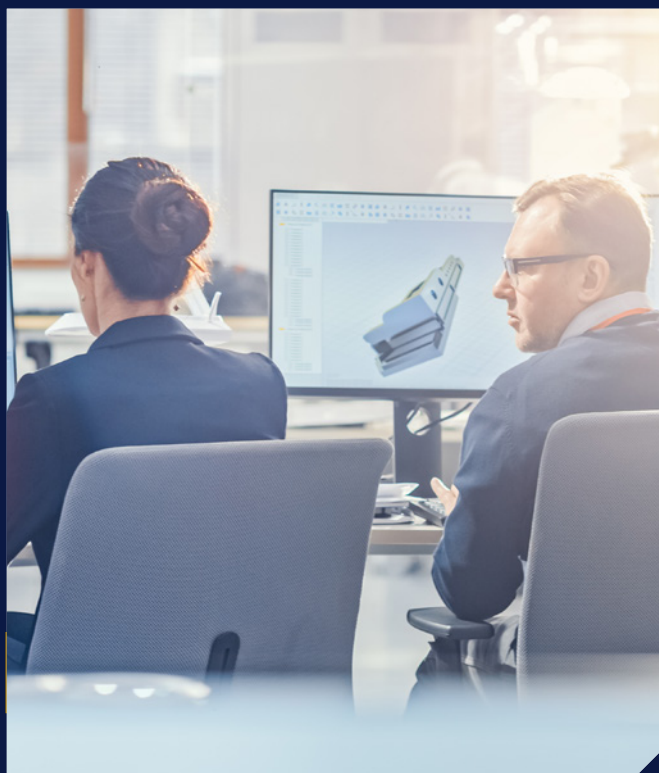
Digital twins enable safe factory restart

The University of Liverpool has worked with several businesses during COVID-19 to create digital twin of their factory, through a combination of LIDAR scanning and existing CAD data.

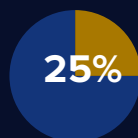
This has enabled simulated testing of a socially distanced production environment in addition to mapping what the introduction of new machinery would mean for efficiency and safety when operating with a reduced workforce.

A combination of sensor technology and cameras alert when occupancy levels or movement breaks new distancing regulations to ensure worker safety.

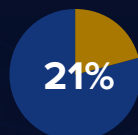
Across the board, these businesses have been able to maintain output through the pandemic while safeguarding their workforces. Many are now exploring how the data captured during this exercise can inform wider strategies to drive efficiency and productivity gains.



BEGIN WITH THE PROBLEM AND BE SOLUTION-AGNOSTIC



One in four businesses cite a lack of knowledge about which technology to invest in as the main barrier to adoption



state that risk of making the wrong investment causes inertia

Many businesses begin digital transformation with limited knowledge of the application of specific technologies, or the order to implement them in. A common mistake, frequently born out of enthusiasm, is to propose a technological solution and search for a problem it can solve.

This is back to front.

The right approach is to be completely agnostic to the technology and start with your business functions.

Which areas are you looking to build resilience in, scale, or to transform completely?



Then, work forwards with the help of experts in the technology who can advise on potential solutions and the order to consider trialling and adopting them in.

The sequence of implantation is an important consideration. Many businesses are very interested in the power of data analytics. But the key pre-requisite to it, and other Industry 4.0 technologies like artificial intelligence high-throughput computing, is the data.

Do you have the data? And if so, how robust is it?

With the right tools and guidance, businesses can capture the baseline data through connected sensor tech, or advanced scanning techniques such as LIDAR, but those technologies need their own implementation strategies.

The threat of disruption is nothing new, but COVID-19 has proved beyond doubt the risk of inflexible strategies and business models.

In so many industries, the virus has made a mockery of five to 10-year plans, placing sharp focus on the here and now.

While businesses further along the digital adoption curve will have been better placed to weather the storm of the pandemic, our research finds that even those with formal digital strategies have been forced to change tack.

The smart move is to plan no further than three years into the future.

Attempting to plot a digital innovation strategy with any certainty on a more extended timeframe can leave a business open to macro-disruptors, such as COVID, or the more predictable but no less destabilising pace of development in digital tools and platforms, that can render existing technology obsolete.

Many CEOs and CFOs will want to see a return more quickly than that. ROI in the new normal needs to be measured in days and weeks, rather than months and quarters.

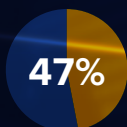
A measured approach is to commission one or two digital innovation pilot projects which can be designed and delivered in weeks and months to secure buy-in. These can run in tandem with the development of an overall strategy, which can and should be adjusted in line with the initial trials.

Too many businesses suffer from missteps at either end of the spectrum.

AN AGILE AND ITERATIVE PROCESS



COVID-19 has caused almost all businesses who have a formal digital in place to change it.



Amost half have had to make major changes



Some commit weeks to researching which technology makes sense on paper and developing a strategy which will only produce gains in the long term. The result can either be paralysis by analysis or lead to inaction.

Others become fixated on a specific in-vogue technology and look to implement at pace without stopping to think whether it's even appropriate for their individual circumstances.

The most successful digital innovation strategies are created by blending a considered approach, informed by experts with industry experience of what's worked and what hasn't, alongside agile testing of relevant technologies.

We recommend assessing new technologies in a sandbox environment which can facilitate risk-free testing. Move quickly and aim to maximise the insight gleaned per unit of time spent: test, assess and either adopt or reject.

Five takeaways to kick-start a digital strategy

1. Begin with the problem and explore which technology can solve it – don't approach this in reverse
2. Harness new drivers presented by the pandemic to spark boardroom interest and secure buy-in
3. Overcome inertia by testing, assessing and either adopting or rejecting low-risk pilot projects quickly in a sandpit environment
4. Explore what budget free or low-cost digital efficiencies may have freed up to support the business case for more advanced technologies
5. Work with industry experts who will reduce wasted effort by highlighting which tech may be the answer – and which is unlikely to be

6. Overcoming barriers



of businesses highlighted that the cost of buying and implementing new technology was the main barrier to digital adoption

Establishing a robust strategy and identifying appropriate technologies are essential first steps for a digitally-driven recovery. But to secure the buy-in required to enact it, and successfully scale pilot projects across a business, proponents of digital innovation must regularly overcome significant barriers.

Our survey revealed that culture, skills, and proving return on investment were three of the main hurdles businesses face (Figure 3).

The findings tally with our experience of working with businesses for more than a decade to address these issues. None of them are new challenges, although the impact the pandemic has had on balance sheets, and the ability to train and on-board staff, may well have magnified them. But these barriers are not insurmountable and the requirement to act to shore-up operations and maintain business continuity has created a burning platform to address them.

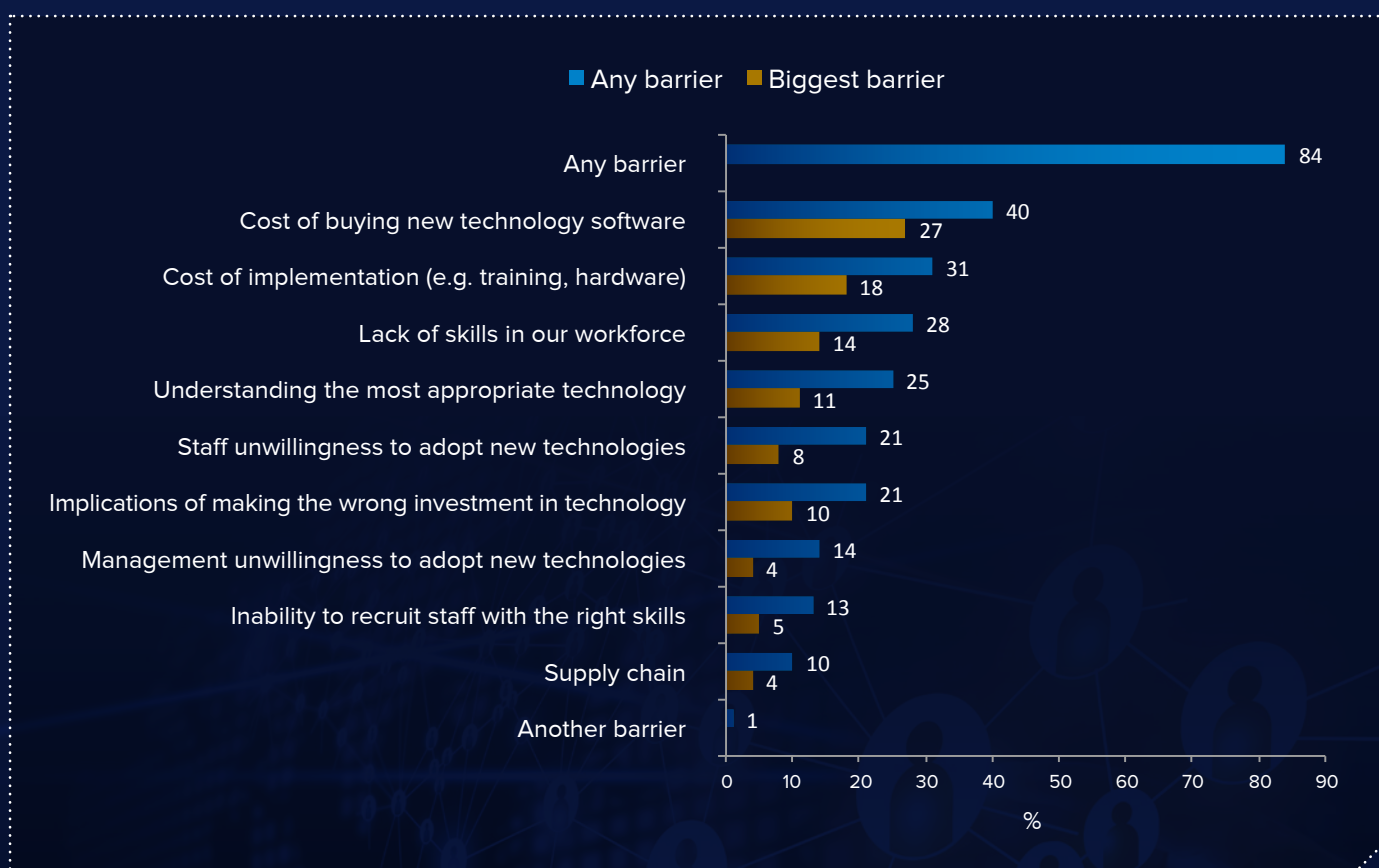


Figure 3: Barriers to adopting digital technologies

ROI AND THE COST OF INACTION

In businesses at the earliest stages of digital maturity, securing the investment to implement novel digital tools has rarely been quick or easy. Finance directors want to see a predictable, quantifiable return on investment in a comparatively short time frame.

When a business is achieving its growth ambitions without emergent technologies, the perceived risk of speculative investment can seem unwarranted.

But coronavirus has rendered this default position unworkable in so many industries. Laboratories, factories and offices have all had to adjust markedly to continue to operate in the face of logistical challenges and restrictions.

For the latter of these, the transformation has been comparatively simple. Aside from modest investment in cloud-based systems, or new hardware to enable home working, many office-based businesses have transformed to digital-first models comparatively seamlessly.

For laboratories or manufacturing facilities, which can't operate from a kitchen table, the pandemic has catalysed investment in digital technology out of necessity.

The question of a return on investment has been simplified – inaction would have rendered these businesses unviable.



23% of businesses are already seeing ROI on digital technologies. Almost half expect to see a return within 12 months

Interestingly, our research found that almost a quarter of businesses that have invested in digital technology during the pandemic have already seen a return on investment and a further 44% expect one within the year.

When establishing ROI, the cost of inaction is a key driver as businesses recover and restart.

For sales and marketing teams who have been unable to visit customers, adopting augmented or virtual reality



tools, or even arranging for prototypes to be 3D printed at a customer site, can maintain revenue streams which would otherwise dry up.

Similarly, businesses which depend on efficient laboratory access for research and development have had to embrace digital technologies to maintain output. Social distancing requirements have resulted in analogue laboratories operating at around 20% capacity.

Companies involved in pharmaceutical development or materials chemistry without digitally-enabled facilities have had to choose to focus the scant laboratory capacity they do have on day-to-day product development to maintain business continuity. In addition to compromising short-term revenue, businesses forced to focus on the here and now are left with no laboratory capacity for longer term R&D. Given many rely on multi-year development programmes, a failure to digitise operations now may have severe longer-term ramifications, stifling innovation and eroding future competitiveness.



CASE STUDY: *ROBOT LAB TECHNICIANS*

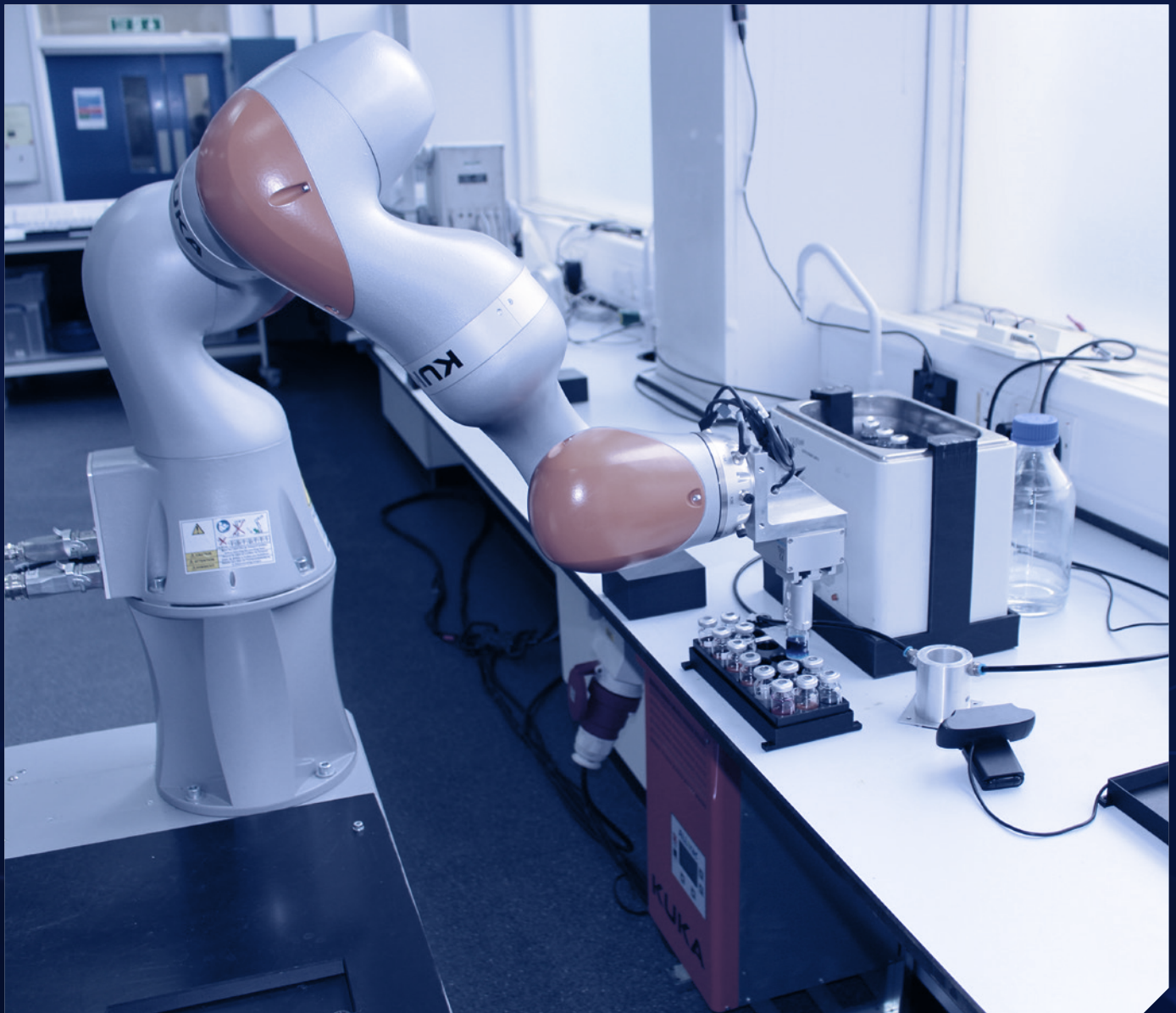
Adoption of co-operative robots (cobots) in R&D is steadily increasing. Their ability to autonomously perform monotonous, repetitive laboratory work with fewer errors, and in less time than a human, is prized.

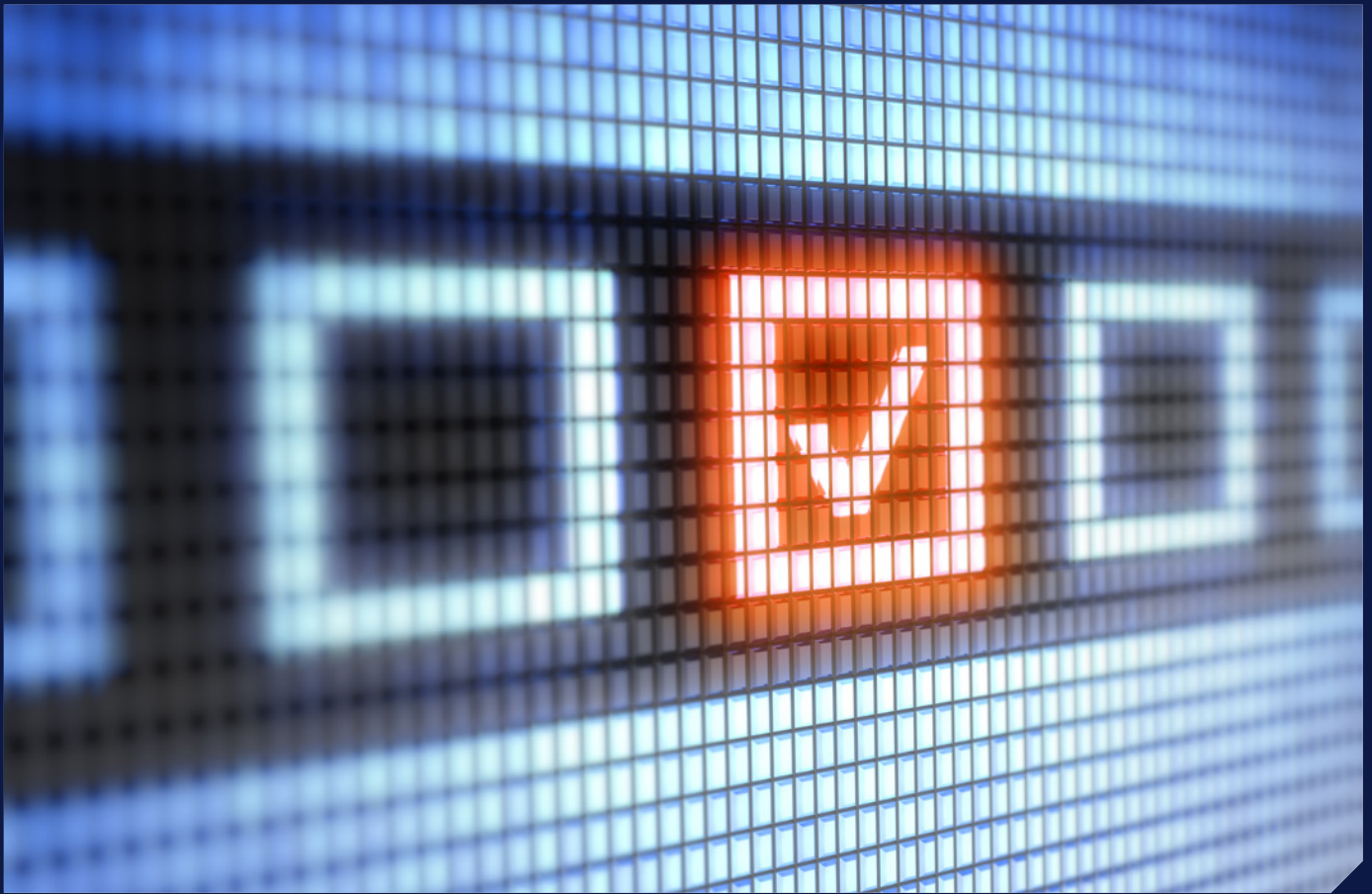
The pandemic has accelerated interest in them due to the reduced numbers of human technicians allowed in labs.

In June, world-leading robotics expert Professor Andrew Cooper, academic director of the University of Liverpool's Materials Innovation Factory, unveiled a cutting-edge intelligent robot.

It can not only work autonomously on individual experiments, but autonomously choose which experiment to carry out next, informed by its previous actions and existing data. It can carry out upwards of 688 experiments over eight days, working for 172 out of 192 hours and moving independently around a lab to do so. It weighs out solids, dispenses liquids, runs reactions and quantifies results.

The sheer volume of tasks this and other robots can accomplish has the promise to rapidly accelerate R&D in the new normal. The headspace it frees up in human technicians also facilitates creative, lateral thinking, supporting novel approaches and breakthroughs which may otherwise never have occurred.





FUNDING

External sources of funding for digital technology have also improved during the pandemic.

Asset finance lenders have moved with the demand. Many are supporting businesses' investments in digital innovation and virtual platforms, in lieu of the buildings or machinery they would have traditionally supported capital expenditure on.

Funding packages are also available through industry specific support organisations, such as Made Smarter in the case of SME manufacturers; or from local authority COVID-19 funds aimed at facilitating recovery through innovation. The LCR Future Innovation Fund, launched by Liverpool Combined Authority in June, is one example. It provides grants of up to £100,000 to support digital transformation in SMEs across the city region.

Another key Liverpool-specific initiative, is LCR 4.0 – which is part-funded by the European Regional Development Fund (ERDF). It provides manufacturers and SMEs with free access to the support required to adopt emergent technologies, de-risking the process and enabling them to make the correct investments.

SKILLS AND CULTURE



of businesses cite a skills shortage as a major barrier to digital innovation.



Almost a fifth reported that staff were unwilling to adopt new technologies.

UK businesses were facing a looming digital skills shortage before 2020 began. McKinsey, the consultancy, estimated that 30% of all UK workers were likely to need to improve their digital aptitude by 2030 in the face of a rapidly changing world of work. It's worth noting that this prediction was pre-pandemic.

The wholesale digitisation of multiple industries that has occurred in response to COVID-19 almost certainly renders that estimate too low. Almost a third of businesses we surveyed cited a lack of skills as one of the main barriers holding back digital transformation.

But the widespread adoption and acceptance of online learning and collaboration platforms, necessitated by COVID-19, may serendipitously provide an answer to a



problem which many industries had struggled to answer pre-pandemic.

It removed logistical barriers to delivering modular learning on demand – which is exactly the kind of training businesses need to upskill their workforce with minimal disruption to day-to-day operations.

Traditionally, businesses looking to incorporate emergent technologies may have been put off by a perceived need to take key engineers, designers or scientists out of their usual role, losing them to long training courses, or even lengthy masters programmes.

But not only is this unnecessary in most cases, it fails to address digital literacy and buy-in of the wider workforce which is arguably of greater importance than individual technical skills.

The best digital innovation strategies look to give 100% of the workforce some level of basic understanding, to ensure everyone involved is aware, receptive and pulling in the same direction. In general, less than 30% of staff then need deeper knowledge, 10% probably need to be technical experts, with less than 3% being leading edge practitioners. Digital strategies stall when they focus just on the skilled few instead of looking to drive a wider cultural change and digital readiness of the whole workforce.

High-level training targeting the entire workforce can be delivered successfully through remote sessions lasting just several hours.

Our research showed that almost a third of senior and middle managers are actively using or encouraging more digital technology – over and above video conferencing platforms – suggesting that wider advocacy is growing.

Many businesses find that once a business starts on a digital transformation journey, they're able to audit their workforce and uncover latent digital potential that many employees will possess. From engineers who might use 3D printing at home, to designers with a background in AR/VR yet to apply it to their current role, assessing which staff have the enthusiasm and aptitude for more involved training is a smart first step.

ON-BOARDING AND TRAINING IN THE NEW NORMAL

Upskilling existing employees will be a mandatory requirement for businesses recovering through digital. But many companies will also need to hire new staff to scale, or end up with a rapidly expanded workforce as the result of a merger or new business function.

On-boarding and upskilling these employees presents challenges given that many businesses are still operating remotely, or face restrictions on the number of people who can access equipment or be on site at any one time.

This does not have to be a barrier to hiring new talent or implementing new technology or systems.

Augmented, virtual or extended reality solutions are being widely recognised as key to on-boarding new staff or bringing existing employees up to speed on new digital tools, without compromising safety, or pausing operations and impacting productivity.



CASE STUDY: *MODULAR REMOTE VR TRAINING*

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A crucial UK Government-backed Energy Innovation Programme exploring alternative power generation systems was facing a delay due to COVID-19.

As part of the initiative, engineering and maritime specialist Cammell Laird had been contracted to design, construct, outfit and deliver modular power plant sections, focusing on fuel assemblies for sodium cooled reactors.

Social distancing regulations and restriction access meant that the company's engineers were unable to carry out required system checks as part of the design and build process for each module.

Experts from the University's Virtual Engineering (VEC) centre were enlisted to devise detailed virtual 3D models of the reactor components to ensure Cammell Laird's engineers could carry out the necessary checks remotely. They will use the models to create a VR "digital twin" which will enable the necessary analysis to be carried out in the virtual world.

Each engineer will be provided with VR equipment to use from home and the VEC delivered remote modular training to upskill them in its use.

This innovative approach has kept the overall programme on track and provided a more efficient way to on-board and train staff in future.



7. Digital innovation with The University of Liverpool



The University of Liverpool has a proven track record of helping businesses to transform, and compete by demystifying and accelerating digital innovation.

With world-leading expertise in computer and data science, robotics, materials chemistry, simulation and immersive visualisation, we can help you define and implement projects to capitalise on new technology, reduce costs and improve productivity, no matter what sector you work in.

Whether you're seeking practical guidance on digitalising how you work, input from world leading academics and technical talent to achieve your commercial goals, or you're simply looking for easy access to state of the art equipment and facilities, we can help.

- Gain competitive advantage by embedding emerging technologies and new thinking into your business with the University of Liverpool's digital innovation capabilities.
- You will accelerate product development, reduce cost and risk, and set world-class academic minds to work solving your problems.
- With the support of technical experts from diverse industry backgrounds, you will harness the University of Liverpool's state-of-the-art technology, facilities and research to innovate and compete in rapidly changing markets.

To find out more about the benefits of working with us visit: www.liverpool.ac.uk/digital-innovation

To discuss how you can benefit from the University of Liverpool's digital innovation capabilities please contact: diginov8@liverpool.ac.uk