THE SKILLS TO SUCCEED

MEETING THE COUNTRY'S EVOLVING TECHNICAL SKILLS NEEDS

A report produced on behalf of the Institutes of Technology Network

INSTITUTES OF TECHNOLOGY

Technical. Skills. Work.

FOREWORD

by Lord Sainsbury of Turville

We are living in a time of extraordinary and exciting change. Electric vehicles are now starting to travel on our motorways, agriculture is being revolutionised, and many clean energy projects are underway.

Behind each of the most innovative advancements of our times are countless individuals with the highest level of technical skills. Their skills are what drive the nation's wellbeing and prosperity, as scientific and technological innovation drive economic growth. But if we are to keep up with the pace of change, we must work to break down the barriers preventing more people from gaining those skills.

This is why Institutes of Technology (IoTs) exist: to ensure the technical skills and knowledge needed to overcome the biggest challenges we face are accessible to all. IoTs provide training in STEM (Science, Technology, Engineering and Maths) based occupations. Located across England, IoTs are a national network of partnerships between local colleges, universities and leading employers. Backed by a £290 million government investment, they deliver the very best in technical education. From construction to cyber security, agritech to aerospace, IoTs provide high-quality education and training, using state-of-the-art technology and facilities.

What makes IoTs different is that the courses and training provided are designed and delivered with local and national employers. Rather than doing things the way they have always been done, IoTs are constantly innovating, with a unique agility to respond to local workforce needs. And because they are located up and down the country, IoTs help keep the best and brightest living and working in their communities – helping shape a brighter future for themselves and the areas where they are based.

IoTs also help increase diversity in the workplace by providing new routes into sectors that have considerable need for fresh talent. For many years our economy has suffered from a shortage of highly skilled technicians, and IoTs provide everyone with an opportunity to acquire the knowledge and skills to have a well-rewarded and fulfilling career.

This report sets out to illustrate how IoTs are approaching the training, reskilling, and upskilling of the country's technical workforce. From sustainable construction and innovations in energy to electric transport and data-led agriculture, and even cyber crime, this report shows the crucial role IoTs are playing in tackling some of the biggest challenges facing us today while preparing us for the challenges of tomorrow.

We know that the highest performing systems of technical education include a national system of respected qualifications, good career guidance for all, expert teachers, industry standard facilities, and funding that is targeted where it can have the most benefit. With T-levels, higher technical qualifications and IoTs, we are at the start of a period of reform which has the potential to create a world-class system of technical education. This will not only benefit industry but also greatly help people of all ages and backgrounds to have rewarding and fulfilling careers.

THE SKILLS TO SUCCEED: MEETING THE COUNTRY'S EVOLVING TECHNICAL SKILLS NEEDS

A report produced on behalf of the Institutes of Technology Network
June 2022

INSTITUTES OF TECHNOLOGY

Technical. Skills. Work.

CONTENTS

INTRODUCTION

by Rosa Wells, Chair of the Institutes of Technology Network

The world is changing rapidly, and we have big challenges to solve. But with exciting new technologies providing innovative solutions, we are living in a time that offers new opportunities for people with high quality technical skills. In the past, those skills and those opportunities weren't accessible to all. Many people and communities were left behind.

Institutes of Technology (IoTs) were created to change that.

In this report, we look at five of the most pressing challenges facing our communities and our country today. And the ways in which IoTs are working alongside local employers to teach the technical skills needed to tackle them.

It looks at: construction and how the modern methods taught by IoTs are helping build a more sustainable future; the ever-evolving threat of cyber attacks and how IoTs are plugging the skills gaps needed to keep us and our data safe; how IoTs are preparing people with the skills needed to not only design and build electric vehicles, but also maintain them; how IoTs are working with local employers to create courses that aim to identify and apply greener energy sources; and finally, the future of agriculture and how IoTs are helping the industry to evolve.

Aligned with the Government's Levelling Up agenda, the Institutes of Technology Network exists to ensure that individuals, no matter where they are or what their background, can play a critical role in driving innovation and growth across the country. If we don't have a technical workforce that is representative of the society within which we work, we will fall short of meeting the expectations of the next generation; to create a better world which is more inclusive and sustainable.

Since launching in 2019, IoTs have already had a positive impact at a local level. And their impact is only set to grow as technology becomes an increasingly intrinsic part of our lives.

Institutes of Technology aren't just looking to the future. They're shaping it. By training, upskilling and reskilling England's technological workforce.

CONSTRUCTION: BUILDING A SUSTAINABLE FUTURE

B uildings account for 40% of UK energy consumption[i], so when it comes to the Government's ambition of reaching net zero by 2050, the construction industry has a big part to play. The sector is one of the largest in the UK economy – employing 3.1 million people or over 9% of the workforce[i]. But with an ageing workforce (32% are over 50, and just 10% are under 25)[i], it's more important than ever to help current and future talent in the industry upskill in technology that will help achieve these ambitious targets.

Modern methods of construction taught by Institutes of Technology (IoTs) place a focus on sustainability. For instance, conventional building materials used to include timber, blocks and brick which can be less sustainable solutions. New methods encourage the use of different materials such as glass and plastic – which can be infinitely recycled without losing any of their properties, or steel which is quicker to build with than normal construction methods.

Waste is also a major issue when it comes to the construction industry. According to the Department for Environment, Food & Rural Affairs (Defra), construction, demolition, and excavation generated around three fifths (62%) of total UK waste in 2018[ii]. Not only is this bad for the environment, it's bad for business too. The Construction Leadership Council (CLC) has warned that in recent months, the cost of materials has increased significantly leading many manufacturers to announce price rises of between 5-10%[iii]. This is due to a perfect storm of factors – from material shortages due to reduced production during the pandemic, through to rising energy costs – a trend that is likely only to worsen. As an industry, it quite literally cannot afford to let materials go to waste unnecessarily.

IoTs, such as Black Country and Marches, East London and West London are teaching modern construction skills that can help significantly cut waste in the sector by doing a lot of the planning and preparation work digitally. For instance, 8D Building Information Modelling (BIM) is a process of creating a digital 'model', which can then be tested against a number of different elements, such as weather, light, ground conditions and temperature. This helps to determine whether the design is fit for purpose, and if not, adjustments can be made before the physical build process starts – reducing the risk of having to demolish a build or parts of it. The use of BIM is an excellent example of how digital technology can be used to help ensure the planning, design and building of structures is efficient, as it allows users to understand how making one change to a model might impact the rest of a building.

71%
of the public would consider a home to be worth more if it was sustainably constructed[iv].

77%
of people in the UK think it is important for construction companies to focus on sustainability when building new homes[iv].

Additionally, digital technology can help ensure the build process is phased efficiently and that the timeline and order of work are as precise as possible. This also means only the people required at the site for the relevant phase are on the ground, resulting in reduced staffing costs and a reduction in the amount of waste created by personnel on-site. Institutes of Technology are committed to training and upskilling a pipeline of learners to meet the demand for new skills supporting 'Green Growth' (fostering economic growth that is environmentally sustainable) and 'Modern Methods of Construction' (a process which focuses on off-site construction techniques to produce more, better quality homes in less time), to support the Government's strategy to be net zero by 2050.

CYBER: TACKLING THREATS TO NATIONAL SECURITY

O ver a 12-month period in 2021/22, 39% of UK businesses and 30% of charities reported suffering cyber security breaches or attacks[v]. And it's likely this threat will increase. We are becoming ever more reliant on digital technologies, which will provide us with a multitude of benefits but will also mean more opportunities for information to be intercepted and exploited.

Organisations of all sizes and sectors can be targeted, so it's little surprise that 82% of businesses now see cyber security as a high priority (up from 77% in 2021)[vi]. However, around half (51%) say they face a basic technical cyber security skills gap, and 44% of cyber vacancies posted since the start of 2020 are reported as being hard to fill[vii].

Institutes of Technology (IoTs), including South Central, Swindon and Wiltshire and West of England, are plugging this gap by teaching skills that can be applied to the ever-evolving threats to cyber security. These include the psychology of attacks, and defence tools and mechanisms.

Students learn to perform password cracking to understand the implications of poor password strategy and the effect that quantum computing

will have in making password security redundant. They are also introduced to the dark web (in a controlled environment) to familiarise themselves with the ways in which cyber criminals interact, how it is policed, and learn about cryptocurrencies – which are often used to fund cyber crime as they are a mechanism for receiving money without being traced.

South Central Institute of Technology (IoT) is developing a dedicated Digital Forensics Unit for 2023 to provide learners with a critical pathway into cyber security occupations within industry and the police. Advanced security techniques,

77%
of the public think the likes of banks, social media companies and shops need to do more to keep their customers' data safe[iv].

More than half of people in the UK are worried about the risk of

CYBER THREATS,
either at home or in the workplace[iv].

such as steganography, will be explored and performed. As one of the oldest methods of concealing secret information, steganography is now used to launch ransomware attacks and exfiltrate information from organisations without detection or to hide incriminating evidence from the police.

Giving people an understanding of how cyber criminals operate is essential in countering the crimes. It enables the workforce to take proactive and reactive steps to defend national security in an ethical way.

But it's not just about the technology. Building teamwork and leadership skills are a key part of the IoT experience, which is why students have the opportunity to put their newfound knowledge into practice by running a hackathon with visiting sixth-form students from local schools.

Cyber security is a huge area of growth and opportunity. The sector workforce has grown by around 50% in the last four years, with demand for skills often outstripping supply[viii]. The skills IoTs are teaching in this area will help build a robust and talented workforce that will strengthen the UK's future cyber security capability.

ELECTRIC VEHICLES: DRIVING TRANSPORT INNOVATION

Low carbon engineering is a critical part of the plan for net zero. Electric vehicles (EVs) will play a major role in this, as the Government has set an ambition for all sales of new cars and vans to be effectively zero-emission by 2040[ix]. EVs provide positive alternatives to carbon dioxide-generating petrol and diesel vehicles, but there are also challenges to consider.

A key challenge is a shortage of people with the skillset to design, build and maintain EVs. Currently, most EVs on the market are relatively new and so won't have experienced many faults. However, when they begin to age and require repairs, there may not be enough mechanics with the skills needed to fix them. The Institute of the Motor Industry predicts that the UK is heading for a shortfall of 35,700 technicians to service the volume of zero-emission vehicles predicted to be on UK roads by 2030[x].

It's vital those working with EVs are properly skilled – both to meet demand and from a safety perspective. The batteries which power EVs require different skills and knowledge to manufacture, service and maintain them compared to the traditional combustion engine. There's a requirement for skills that service the entire lifecycle of a battery, from cell production to re-use and recycling, that Institutes of Technology (IoTs) can help fill.

National Express, an employer partner of Greater Birmingham and Solihull Institute of Technology (IoT), has made it a requirement for all its engineers to be fully skilled in working on hybrid and electric vehicles – for instance, having a thorough understanding of diagnosis, testing and repair of vehicles and components. In addition to National Express, Greater Birmingham and Solihull IoT is working with a number of other big automotive employers in the region to address the future shortage in the design, build and maintenance of EVs by upskilling their existing workforce and equipping future employees with the skills needed to ensure they are ready for future demand in green motoring.

> The appetite for electric cars is increasing, as over a **THIRD OF PEOPLE** in the UK plan to buy or lease one at some point in the future[iv].

> Almost **64%** of people in the UK would like to see more public transport running on green energy[iv].

EVs have huge potential to help solve societal issues that go beyond reducing carbon emissions. For instance, the West of England IoT has been working with local employer, Westfield Sportscars, to consider different ways of creating and utilising EVs. Last year, the partnership trialled driverless pods that provide efficient and green transport for tourists and locals, can be used as an alternative to private cars – which provides huge benefit for people living with disabilities and those unable to drive – and can even be used as street sweepers, picking and sorting through rubbish and recycling.

JULIAN TURNER, CEO, WESTFIELD SPORTSCARS WEST OF ENGLAND IOT

" Driverless pods create several opportunities – they provide transport with zero tailpipe emissions, reduce the number of cars on roads and reduce the number of accidents. They can also be used to increase efficiencies in hospitals, reducing the time it takes to get medication to patients from hours to minutes. However, currently we import 98% of our vehicles into the UK from overseas, and a nationwide skills gap means we simply don't have the workforce here for the software or manufacturing side of the business. We're working closely with West of England IoT to address this, providing both training in building electric vehicles, as well as mini pods for students to work on to gain hands-on experience.

We've also played a part in West of England IoT's work with the local community, introducing 1,200 people in the region to the Driverless Sweeper (an autonomous, pure electric road sweeper), the Chesil E Speedster (the first fully-electric sportscar), the mini pod (a smaller version of the driverless pod that allows students to code journeys and learn the skills of autonomous driving) and the passenger pod (a six-seater vehicle used for transporting passengers on pre-defined routes). We showcased the technology on Weston-super-Mare seafront over the summer in 2021 as part of a live learning experience for IoT students. Working with the IoT to help shape courses and provide people with the necessary skills to realise the potential of driverless pods will mean we can reap the benefits sooner. "

ENERGY: POWERING THE NATION IN NEW WAYS

The Government aims to decarbonise the UK power system by 2035. Currently, more than 90% of our homes are heated by fossil fuels, making up a third of the UK's total gas use[xi]. Not only is this extremely detrimental to the environment, but it's also becoming financially untenable. The UK is in the grip of an energy crisis as European gas prices increased by more than 200% last year, while coal costs doubled[xi]. As a nation, we desperately need to discover and apply alternative, greener energy sources if we are to tackle climate change and the energy crisis.

Research from the UK Energy Research Centre (UKERC) suggests investment in renewable energy can create three times as many jobs as investing in fossil fuels[xii]. We know that if we create the roles and teach the skills needed, the results could be vital for the economy – as well as the planet.

With the right planning, it's possible to increase the pace of deployment of offshore wind farms by 25%, vastly increasing our capabilities in this area. The Government estimates that employment in the wind industry will increase 170% by 2026, to 70,000 employees[xiii] – but the skills will need to be in place to create a pipeline of talent.

South West Institute of Technology (IoT) is uniquely positioned to teach the skills that will help achieve this with 700 miles of coastline it is harnessing this geographical advantage. The IoT is working with local employers to develop and teach the latest in offshore wind energy technology and other low-carbon energy solutions.

Heat pumps are a low-carbon heating technology that will help decarbonise heat in homes by extracting energy from outside and transferring it into heat to be circulated around the home. To meet the Government's target of installing 600,000 heat pumps every year by 2028[xiv], we need a skilled workforce that can understand, install and repair these systems at the pace and scale needed to meet the country's net zero targets.

North East IoT is training students how to assess a property for the most efficient source of energy. This includes whether it is adequately insulated for heat pumps. Many of the homes in the local area are relatively old and, given the complex differences of domestic and commercial buildings in the UK, knowing how to retrofit them to use sustainable energy efficiently is key. This means understanding the application of all heating and venting technologies.

Currently, only

1 IN 8 PEOPLE

in the UK use renewable, sustainable or green sources of energy but, if cost wasn't a factor, almost half would choose to do so[iv].
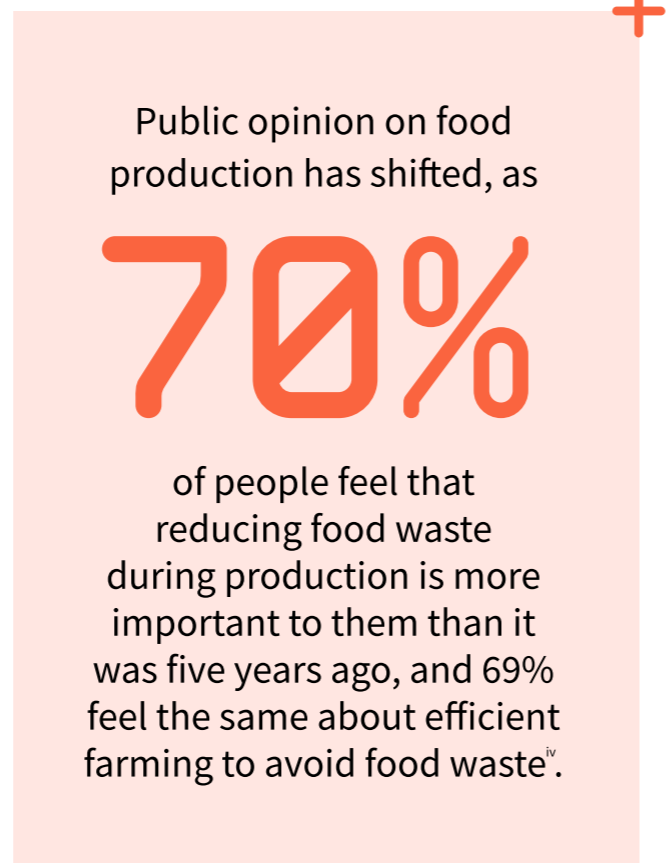
There is no silver bullet. No[i] single form of renewable energy is likely to be substantial enough, accessible enough or affordable enough to work on its own. A combination of methods is needed to create energy solutions that suit the many different regions and differing infrastructure of the UK.

Institutes of Technology are currently working with employers to identify these different methods and create targeted courses that will help develop the skills needed to prevent a future skills gap.

AGRICULTURE: CULTIVATING TECHNICAL SKILLS

The UK's agriculture sector is facing unprecedented challenges.

A labour shortage, exacerbated by the effects of Covid-19 and the UK's exit from the EU, has had a significant impact. In Summer 2021, the National Farmers' Union (NFU) reported that there were an estimated 500,000 unfilled vacancies across the industry[xv]. Riviera Produce Ltd reported that it "left over £500,000 of produce to rot in the fields" due to a lack of staff, and Boxford Suffolk Farms Ltd said it "had to waste approximately 44 tonnes of fruit" last year[xvi].

Public opinion on food production has shifted, as

70%

of people feel that reducing food waste during production is more important to them than it was five years ago, and 69% feel the same about efficient farming to avoid food waste[iv].

The sector also faces environmental challenges – in total, it accounts for at least 10% of all UK greenhouse gas emissions[xvii], including 68% of total nitrous oxide emissions[xviii], which are contributors to climate change.

Nitrogen is an essential soil nutrient to enable crops to grow. However, the production of nitrogen fertilisers uses large amounts of natural gas and energy. Therefore, we need to be sensitive in our treatment of the land and application of fertilisers.

The industry recognises it needs to evolve – and Institutes of Technology (IoTs) are helping to pave the way. Yorkshire and Humber Institute of Technology (IoT) is supporting shifts in agricultural practice by teaching skills that will help farmers run their businesses more efficiently and reduce the sector's carbon footprint.

Yorkshire and Humber IoT is upskilling those working in agriculture so that they can make the most of advances in data-led technology. Farmers are now learning how to interpret data, such as that used in advanced GPS technology to help accurately plant and maintain crops. Using precision technology to do this improves soil health and reduces reliance on carbon intensive inorganic fertilisers.

Robotic systems have also been able to help solve some of the labour shortage crisis. Lightweight robots (which also avoid the soil compaction issues caused by heavy farming machinery) can carry cultivators, seed drills, spreaders and sprayers – all controlled by GPS and with the ability to work 24/7. This will provide huge relief to many working farms.

Satellite images are used to assess the condition of crops, which a farm management system then uses to determine which parts of the field require more fertiliser and which need less. The information is translated to the tractor in the form of a map of the field, indicating where more or less of the fertiliser should be applied. As the tractor travels across the field, the fertiliser spreader is constantly monitoring the weight of product in the spreader, the application width and the forward speed in order to control the amount of product being applied. This high-tech approach enables the farmers to be precise in the application of the fertiliser, minimising waste, making it more cost effective for the farm and reducing the amount of fertiliser being applied to the land to lessen any impact on the environment.

JAMES RICHARDSON,
FARM MANAGER,
BISHOP BURTON FARM
YORKSHIRE & HUMBER IOT

"

The use of technology within agriculture varies greatly from farm to farm; some farmers are using progressive techniques, while others are using more traditional methods. In the current climate, using technology for processes such as fertiliser application is a big asset as it is much more efficient, particularly important given the cost of fertiliser has increased by 250% in the past 12 months due to the price of gas.

To get more farms engaging with the latest technology, we need farmers to be trained to use it – we found that many degree-qualified staff new to the business didn't have the skills to use data-led technology. This is why we're working as part of Yorkshire & Humber IoT to upskill people with the knowledge of how precision technology works and how to use it in a practical setting. Learners are taught how to take readings from the equipment and then see how this correlates with what they can see in the field. This way of learning helps to instil confidence in the application of technology in farming, and in turn, encourages the industry to evolve.

"

SECTOR SPECIALISMS

across the Institutes of Technology Network

Whether helping to modernise long-established sectors like agriculture, to improving sustainability within the automotive sector, or making our digital lives safer, it's clear that the skills taught at Institutes of Technology (IoTs) will contribute to a positive, lasting impact on our nation. With the ability to respond to local workforce needs, IoTs are innovative in their approach and uniquely placed to teach the skills needed to tackle some of the country's biggest problems.

IoTs offer quality education and training in a range of sectors, including:

Aerospace
Agriculture
Automotive
Business & Management
Construction
Creative
Digital
Energy
Engineering
Food & Drink
Healthcare
Manufacturing
Pharmaceuticals
Science
Transport

LOCATIONS OF THE INSTITUTES OF TECHNOLOGY

Following the Government's announcement in April 2019, the first wave of 12 Institutes of Technology (IoTs) are now in operation. These are made up of more than 40 further education colleges, around 60 leading employers and 18 universities. Visit institutesoftechnology.org.uk to discover the regional partners within each IoT.

A second wave of nine additional IoTs in areas not currently served by the existing network was announced in December 2021 and are in development while they complete the Department for Education's approval process.

IOTS IN OPERATION

A   Black Country & Marches IoT
B   East London IoT
C   Greater Birmingham & Solihull IoT
D   North East IoT
E   Lincolnshire IoT
F   London City IoT
G   South Central IoT
H   South West IoT
I   Swindon & Wiltshire IoT
J   West of England IoT
K   West London IoT
L   Yorkshire & Humber IoT

IOTS IN DEVELOPMENT*

M   Cheshire & Warrington IoT
N   East Midlands IoT
O   Greater Manchester IoT
P   Lancashire & Cumbria IoT
Q   South Coast IoT
R   South East IoT
S   South Yorkshire IoT
T   Stoke-on-Trent & Staffordshire IoT
U   Sussex & Surrey IoT

*Official names to be confirmed.
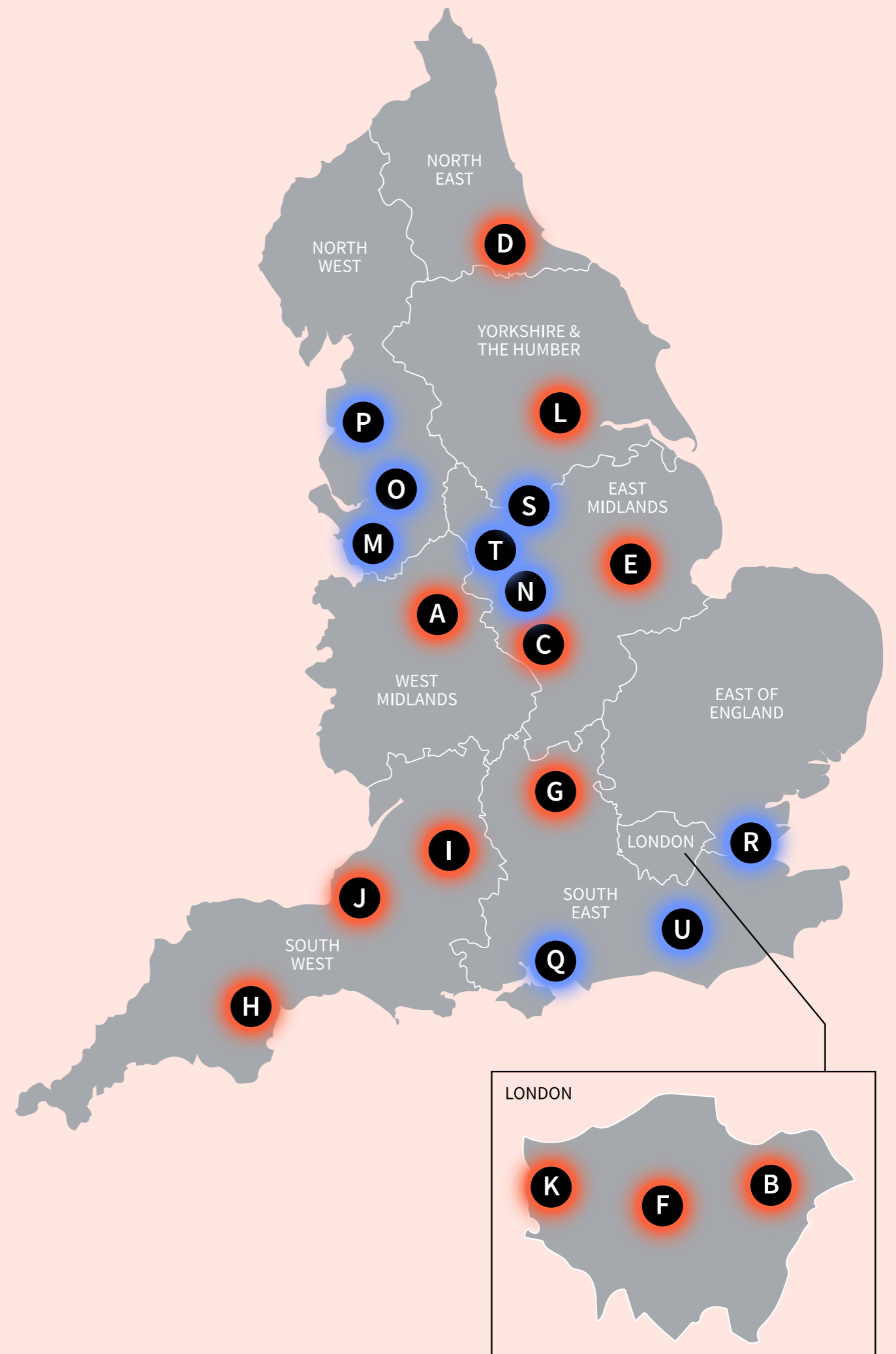
ACKNOWLEDGEMENTS AND CONTRIBUTORS

Black Country & Marches IoT

Georgina Barnard*

East London IoT

Jason Turton*

Claire Wilsher

Greater Birmingham & Solihull IoT

Michael Burke

Faye Kent

Rosa Wells*

North East IoT

Mark Anderson

Ashley Deane

Sharon Grant*

Francesca Smith

South Central IoT

Paul Gartside

Christopher Kearney

Lee Parker

Preeti Vohra

Alex Warner*

South West IoT

Stephen Mariadas*

Swindon & Wiltshire IoT

Steven Benge

Neil Brayshaw*

Tony Gilbert

Lynne Plested

West of England IoT

Claire Arbery*

Lisa Fletcher

West London IoT

George Baho

Mark Byerley*

Asif Khan

Lucy McCann

Yorkshire & Humber IoT

Annabel Jelley*

Bill Meredith

James Richardson

*Institute of Technology Lead

SOURCES

i   https://www.gov.uk/government/publications/construction-sector-deal/construction-sector-deal

ii   https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste

iii   https://www.constructionleadershipcouncil.co.uk/news/construction-product-availability-statement-11/

iv   Research carried out by Censuswide of 2,011 people from 16/05/2022 - 19/05/2022

v   https://www.gov.uk/government/news/businesses-urged-to-boost-cyber-standards-as-new-data-reveals-nearly-a-third-of-firms-suffering-cyber-attacks-hit-every-week

vi   https://www.gov.uk/government/statistics/cyber-security-breaches-survey-2022/cyber-security-breaches-survey-2022

vii   https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1072767/Cyber_security_skills_in_the_UK_labour_market_2022_-_findings_report.pdf

viii   https://www.gov.uk/government/publications/national-cyber-strategy-2022/national-cyber-security-strategy-2022

ix   https://www.gov.uk/government/publications/cop26-declaration-zero-emission-cars-and-vans/cop26-declaration-on-accelerating-the-transition-to-100-zero-emission-cars-and-vans

x   https://tide.theimi.org.uk/industry-latest/news/2026-marks-cross-roads-ev-skills-gap

xi   https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

xii   https://ukerc.ac.uk/publications/green-jobs

xiii   https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1003569/gjtf-annex.pdf

xiv   https://www.gov.uk/government/news/pm-outlines-his-ten-point-plan-for-a-green-industrial-revolution-for-250000-jobs

xv   https://www.nfuonline.com/updates-and-information/food-supply-chain-calls-for-action-to-solve-labour-crisis/

xvi   https://committees.parliament.uk/publications/9580/documents/162177/default/

xvii   https://www.ukri.org/blog/the-climate-for-change-in-uk-agriculture/

xviii   https://www.gov.uk/government/statistics/agri-climate-report-2021/agri-climate-report-2021