We're just not doing enough
Working together to meet the digital skills challenge

A techUK white paper

techUK

THE CFO of a successful local IT series company in the North East of England was recently asked to present to a school assembly of bright and ambitious 16 year old students. When she asked how many of them would like to pursue a career in tech, not a single person put up their hand.

We have to do better than this.

This white paper from techUK focuses on what needs to be done to deliver the digital skills children and young people need, and to create entry-level skills for jobs in a digital world.

In 11 recommendations, techUK identifies best practice of teaching digital skills, addresses key challenges and proposes immediate next steps for Government, businesses, and organisations. More ambitious and better organised collaboration is needed to achieve scale in addressing the digital skills gap and supercharge UK digital talent for the benefit of all.

This white paper was compiled through techUK's Skills, Talent and Migration Group of industry leaders, and builds on previous positions put forward by techUK, including in *Securing our Digital Future: the techUK Manifesto for Growth and Jobs 2015-2020.*

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This white paper does not seek to answer important policy questions regarding the basic digital literacy of the UK population[1], needed for accessing public services in an era of transformation, nor on pertinent issues regarding upskilling the current workforce, which are important issues in the wider debate regarding the UK's future in a digital world.

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The Vision

A PRODUCTIVE ECONOMY

Digital technology businesses are key drivers of productivity and will underpin the future success of the UK economy. The UK is a global leader in innovation and entrepreneurship, and UK start-ups create more jobs than their equivalents in any other major European economy[2]. The UK's phenomenal potential must be matched with a robust and growing talent pipeline to realise the opportunity for the UK to be a global leader in technology for decades to come.

Employees right across professions and sectors use digital technology to make their work easier, better and more productive: care workers, salespeople, restaurant managers, police officers and teachers should all be included in the digital revolution. They need digital skills which keep pace for them to thrive in a digital world.

YOUNG PEOPLE EQUIPPED FOR EXCITING JOBS

Estimates suggest that 134,000 new jobs are created in the tech sector alone per year[3], and Baroness Lane-Fox has highlight that 1 million new digital jobs will be created by 2020[4].

Digital skills education is key to creating exciting work opportunities for young people. Today's formal education system remains key to offering foundational knowledge and skills, but struggles to keep up with the pace of change and needs to be complemented by more flexible learner-driven informal education opportunities.

EVERYONE BENEFITING FROM A DIGITAL WORLD

Digital technology creates opportunities across society and the economy, transforming the way people work, communicate, express themselves creatively and much more – digital skills are required to harness this potential.

Digital skills are key to making the digital revolution work for all. Work and social life, as well as everyday needs such as transport, reading the news, shopping, communication and learning are revolutionised by digital technology. We have to create the skills to empower and inspire everyone to shape the digital world they live in.

This white paper from techUK focuses on what can be done to secure a positive future for children and young people and how to create entry-level skilsl for jobs in a digital world, as we are only a fraction through the digital revolution.

We're just not doing enough

WHEN JOB VACANCIES GO UNFILLED, BUSINESS GROWTH IS HAMPERED

Estimates suggest that the UK economy is losing a potential £2bn from unfilled roles requiring digital skills[5]. A 2014 Tech Partnership and techUK industry survey found 93% of tech firms believed the digital skills gap has a direct negative impact on their business. The shortages most reported by techUK members include Big Data Analysts, highly skilled Developers and Cyber Security specialists as particularly pronounced[6].

STUDENTS NOT TAUGHT THE KEY SKILLS THEY NEED

Computer Science graduates in the UK have the highest graduate unemployment rate of all subjects. Only a third of ICT teachers have relevant qualifications, and only half of ICT or computer science teachers report being confident in teaching the new curriculum[7]. There are no assessments of the successes or implementation challenges of the new computing curricula in England (since 2014) or in Scotland (since 2010). Apprenticeships and industry placements are still not widely recognised as a pathway into professional esteemed careers. Over 8 million young people are estimated to have an interest in trying what Nesta describes as 'digital making', but only 130,000 such learning opportunities were available in 2014[8].

WE NEED:

1. **Foundational digital skills** - Basic computing and STEM skills enable individuals to learn specific digital skills depending on their job and interests. These are required for jobs across all sectors and should be available to everyone in society.

2. **Creative application of digital skills** - The ability to use digital technology to solve new problems is needed across all sectors. For the UK to remain a global leader in tech and a hub for innovation, high-level tech professionals need to creatively apply their digital skills.

3. **Specialist digital skills** - technology and tech careers are becoming increasingly sophisticated, requiring specific professional skills in areas from Cyber Security to Big Data Analytics through to Web Development. These are increasingly high demand and are increasingly sought beyond tech specialist careers, right across the economy.

Together, we, as industry, government and wider players, need to do better in developing digital skills that both the economy and our young people need. In this white paper, techUK makes 11 recommendations to supercharge the UK's digital skills capabilities for the benefit of all, identifying best practice of what works and proposing ways to achieve scale.

Summary of recommendations

1. Demystify tech and inspire young people
- Scale digital learning programmes that engage children with tech early
- Teach tech by making things with it
- Improve students' understanding of tech careers

2. Make tech fun in the classroom
- Implement the STEAM agenda - connecting STEM and the Arts
- Tackle gender bias and aim for a more even gender balance in tech
- Use digital tech to empower children with Special Education Needs

3. Inspire girls to pursue tech subjects and careers
- Champion female role models from the tech industry
- Coordinate open days in tech businesses for girls, not just graduates
- Gain a better understanding of why more girls don't pursue tech subjects

4. Create the digital skills needed across all sectors
- Make young people aware that any job will require digital skills #notjustforgeeks
- Encourage schools to use digital technology in non-STEM subjects
- Create a habit of lifelong self-directed learning using online resources

5. Ensure schools are equipped to teach computing
- Give current ICT teachers the training they need
- Train more ICT teachers to implement the computing curriculum in England and Scotland
- Assess delivery of the new computing curriculum in England

6. Support and empower our teachers
- Equip all teachers with basic digital skills
- Offer industry shadowing programmes to more teachers
- Strengthen teacher support networks

7. Create more apprenticeships in the tech sector
- Put digital skills at the heart of the 3 million apprenticeship target
- Make it easier for SMEs to take on apprentices in digital roles
- Encourage more girls to pursue apprenticeships in tech

8. Create new job entry routes into tech roles
- Emulate the National College for Digital Skills as a model to roll out across the UK
- Increase opportunities for talent coming from underprivileged backgrounds
- Create code conversion courses

9. Make it easier for industry to volunteer
- Increase awareness of the business benefits of volunteering
- Create a matchmaking platform to increase industry volunteering
- Identify volunteering champions in each business

10. Ensure we reach across the entire UK
- Tech business alliances to coordinate digital skills stakeholders in clusters
- Replicate successful local platforms that connect digital skills stakeholders
- Scale up tech business support for teaching digital skills in local schools

11. Adopt a 'Smart Migration' approach to support the UK as a tech nation
- Let UK tech businesses thrive with top international talent
- Consider immigration reform from a growing business perspective
- Enable universities to attract top talent from across the globe

Next steps: A four-point framework to supercharge UK digital talent and meet the skills challenges of the 21st Century

1. SCALE UP successful programmes to help them reach across the UK

Identifying and supporting best practice

Industry, government and organisations should increase support for digital learning programmes

2. COORDINATE efforts through the Tech Partnership and online navigation platforms

Tech businesses should join and champion the Tech Partnership

An online navigation platform should be widely known and function as matchmaker

3. OPEN UP to new ideas on how to close the digital skills gap

We should always be open to look beyond current formal education and curriculum reform

4. MAP the skills pipeline for effective policy and industry interventions

An annual survey on specific digital skills needs

A dynamic map of the digital skills pipeline

1 Demystify tech and inspire young people

Young people use digital technology every day but they are not often taught the mechanisms that underlie it. As a a result, many young people do not feel empowered to shape these technologies or to pursue a tech career. We need to empower and inspire these young peole to shape their digital world, helping users become makers.

Scale digital learning programmes that engage children with tech early

The new computing curriculum in England is was welcomed by industry as a way of engaging children with tech from a younger age. As a complement to this formal learning, informal learning opportunities such as afternoon clubs have proven successful in getting children enthusiastic and to engage creatively with digital technology. Informal learning is popular and demand far outruns available spaces. However afternoon learning opportunities need to become more widely known, as 71% of teachers and 61% of parents in a recent survey were unaware of their existence.[9] For example, techUK is delighted to be a supporter of Code Club[10], which runs over 2500 clubs in the UK for over 36,000 children.

What can be done? Afternoon clubs such as Code Club, Young Rewired State[11], Apps for Good[12] and Coder Dojo[13] should get support and funding from industry and organisations, encouraged by industry bodies such as techUK and the Tech Partnership, to reach more children and become better known among parents and teachers.

Teach tech by making things with it

Informal learning programmes engage children by asking them to make music, pictures, apps or scientific experiments using digital technology. The Tech Partnership offers resources for teachers online for free to help design project-based digital skills teaching[14]. Most popular digital making among young people includes editing digital pictures (76%), creating games (86%) and editing videos or visual effects (85%), according to a Nesta survey[16]. Additionally, teaching through projects helps cater to different skill-levels at once.

What can be done? ICT and computer science teachers should consult these online resources and research to help shape their teaching digital skills assignments. The Department for Education and local Learning Networks[17] of schools, universities, and training providers across the UK should help make teachers aware of these resources.

Improve students' understanding of tech careers

Many students do not pursue tech-related careers because they are intimidated or do not know what to expect from it. Providing informative materials to clarify tech professions to career services can help solve this information gap. In addition, bringing tech professionals into schools who explain their day-to-day as well as their professional journeys is a powerful way to inspire young people about tech careers.

What can be done? The TechFuture Teachers[18] and TechFuture Careers[19] programmes by the Tech Partnership should be more widely promoted to inform school career services about tech careers. Local authorities and tech business alliances should help organisations including STEMnet's STEM Ambassadors[20], TechFuture Ambassadors[21], Founders4Schools[22] and Inspiring the Future[23] to bring tech professionals into more schools.

2 Make tech fun and inclusive for everyone

Digital technology should serve everybody and can be used differently depending on interests and abilities. Making at least basic digital skills available for everyone is key to realising the benefit of digital across society.

Implement the STEAM agenda - connecting STEM and the Arts

Schools should embrace the STEAM agenda, connecting arts and STEM subjects to equip children with digital skills across all areas of interests and occupations. Learning how tech can be utilised to solve problems beyond STEM subjects is essential in an increasingly digitised world. Projects such as Samsung's 'digital classroom'[24], teaching Maths and Science through music at the Royal Albert Hall, help inspire children to apply technology across all subjects.

What can be done? The Tech Partnership, local government and Local Enterprise Partnerships should facilitate more collaborations between industry and schools to help integrate the teaching of STEAM subjects.

Tackle gender bias and aim for a more even gender balance in tech

Girls do not need gender-specific content in order to get excited about technology. Girls need encouraging environments in their schools and homes, especially during the GCSE and A-level years. Later on, they need a tech employer who is conscious about gender biases and commits to aiming for a more equal gender balance. Informal learning programmes such as Apps for Good (for 10-18 year olds) boast high female participation of 50%, without employing gender-specific content[25]. Individual businesses found changing the language of their job descriptions, focusing on avoiding possible gender biases, immediately increased the number of female applicants to the job role.

What can be done? Tech employers, tech-related organisations and educational institutions should help encourage more girls to pursue tech occupations by addressing potential gender biases and explicitly aiming for a more equal gender balance.

Use digital tech to empower children with Special Education Needs

Initial findings by Bournemouth University researchers on Samsung's digital classrooms programme suggest that pupils with Special Education Needs particularly benefit from learning through digital technology, the interdisciplinary and hands-on approach improves their engagement and confidence levels.[26]

What can be done? The potential of digital technology to empower children with Special Education Needs should be researched further through industry-university collaborations and findings should be considered by local government, schools, and digital learning programmes.

3 Inspire girls to pursue tech subjects and careers

Only 17% of tech jobs in the UK are done by women, and 23% of London tech firms have no women at all in senior positions[27,28]. A lack of female applicants makes it difficult for tech businesses to achieve a more even gender balance, and means these businesses miss out on a large proportion of the talent pool. More girls need to be made enthusiastic and confident about pursuing a tech career.

Champion female role models from the tech industry

Baroness Shields said in a recent speech that women with a successful career in technology roles should 'send the elevator back down' and encourage more girls to pursue a career in tech.[29] techUK has our own Women in Tech ambassador, Deputy President Jacqueline de Rojas of Citrix who champions an extensive Women in Tech programme[30] building on techUK's Women in Tech manifesto launched in 2014.[31]

What can be done? More female role models in tech should put themselves forward and should be championed by businesses and organisations. The Your Life campaign[30], launched last year by Education Secretary Nicky Morgan MP, should continue its commendable work bringing female role models with STEM backgrounds into schools and should make it simple for tech businesses of all sizes to join the campaign. Government should continue its support for the pan-European 'Inspiring Fifty'[33] that identifies, encourages, develops and celebrates women in leadership positions within the technology sector. Local authorities with growing tech strengths should amplify events where female professionals explain their STEM career such as those by STEMettes[34] and similar organisations.

Coordinate open days in tech businesses for girls, not just graduates

Studies suggest females need to be engaged at a much younger age to later on pursue computer science degrees and roles[35]. This highlights the importance of tech businesses opening their doors to young girls, as well as to graduates. For example, the industry-led annual #NEDigitalGirls conference on STEM careers in the North East has been growing year by year and attracted 300 girls aged 11-16 in 2015[36].

What can be done? Tech businesses, Local Enterprise Partnerships, local authorities and schools should collaborate to organise more open days and practice-oriented conferences to show young girls the opportunities digital and tech can offer them.

Gain a better understanding of why more girls don't pursue tech subjects

Tech careers are often misunderstood and do not appeal to enough young women, due to what Baroness Shields calls a 'PR problem'[37]. This problem needs to be better understood. Some commentators argue that parental bias can play a negative role. A recent survey by the Institution of Engineering and Technology found 93% of parents are not interested in their daughters pursuing a career in engineering or tech[38]. Research at the workplace suggests that it takes proactive and vocal commitments from the management to increase the representation of women in technology roles, as well as support networks for women, to help retain females in STEM careers[39].

What can be done? Building on these emerging initial findings, more research should be co-funded by universities, Government and industry into the causes of limited uptake of girls into tech subjects and careers.

4 Create the digital skills needed across all sectors

Across the economy, the number of jobs requiring digital skills increases by the day. Young people today will need digital skills almost regardless of their chosen occupation or sector. It is crucial to teach the use of digital tools and devices in non-tech subjects, and to encourage a mindset of lifelong self-directed learning.

Make young people aware that any job will require digital skills #notjustforgeeks

Digital technology is used across society, but digital skills are still not recognised as basic enabling skills alongside mathematics or literacy. Students, but also parents, teachers and guardians should be made entirely aware that digital skills can be acquired by anyone and will be fundamental to working and living in the digital world.

What can be done? The Department for Education should run a social media campaign to demonstrate the need for basic digital skills, as well as the value of pursuing computer science and STEM subjects for a wide range of careers, targeting students at the time of year when they choose GCSE and A-level subjects. Government's successful #notjustforboys campaign through the Department of Work and Pensions could serve as a template for this effort.[40]

Encourage schools to use digital technology in non-STEM subjects

Every job from salesperson to scientist and nurse will require the use of digital devices and tools. Every creative working in music production, graphic design, film and computer games, already needs to be able to work with digital tools. Young people should be trained in the use of digital tools across all areas of interest, including for creative expression.

What can be done? More tech businesses can facilitate access to their technologies for schools, similar to the Adobe Youth Voices programme, to help young people gain confidence and creative skills utilising digital technology.[41] Local Enterprise Partnerships can play a key role in 'brokerage between schools, hubs and edtech developers to encourage innovation and encourage partnership opportunities', as a recent report commissioned by the London LEP acknowledges[42].

Create a habit of lifelong self-directed learning using online resources

Digital technologies evolve at an increasingly rapid pace, and skills learned in youth will already be outdated by adulthood. Traditional learning trajectories that end with university graduation are no longer realistic. Young people should be taught the habit of lifelong self-directed learning to cope with this challenge. An increasing number of online resources are available, ranging from EdX[43] to FutureLearn[44] and Coursera.[45] Digital skills learning platforms include Codecademy[46] and General Assembly.[47]

What can be done? The Department for Education should devise a strategy to incorporate these resources and self-directed learning in formal education. Parents, teachers, university professors and guardians should teach young people the habit of lifelong and autonomous learning.

5 Ensure schools are equipped to teach computing

Passing the computing curriculum in England 2014 and the computing curriculum in Scotland 2010 were welcome steps toward a more digitally skilled society and workforce. The implementation of these curricula however still faces challenges which need to be assessed. More ICT teachers and better training for current ICT teachers are required to deliver on the new computing curricula.

Give current ICT teachers the training they need

Only half of ICT and computing teachers surveyed by Nesta in 2014 reported they were confident in their ability to teach the computing curriculum.[48] To maximise the benefits of the new computing curricula in place in England since 2014 and in Scotland since 2010, teachers across the UK need to be equipped to teach computing to the required standard.

What can be done? The Department for Education should ensure that current ICT and computing teachers get the training and skills they need to put the computing curricula in place in England and Scotland into practice.

Train more ICT teachers to implement the computing curriculum in England and Scotland

The Royal Society reported that in 2012 only 35% of ICT teachers had a relevant qualification, compared to 74% of Mathematics, 80% of English, and 88% of Biology teachers.[49] Government's focus on improving STEM education in schools is welcomed by the tech industry, but the separate need to train teachers to deliver the computing curriculum also needs to be recognised. The tech industry shares the concerns of the UK Digital Skills Taskforce whose recommendation for an additional £20m funding to aid the curriculum's implementation techUK supported.[50]

What can be done? Further to the Prime Minister's pledge to train 17,000 new Maths and Physics teachers, Government should make a commitment to increase the number of qualified ICT teachers and to train them to teach the computing curricula in place in England and Scotland.

Assess delivery of the new computing curriculum in England

To ensure full benefit from the curriculum, schools should be regularly assessed on the curriculum impact, throughput, and implementation challenges including qualifications of teachers. Such assessment could help indicate funding shortfalls, and help judge whether enough time is currently allocated to teaching computer science in schools. This exercise could also help indicate how computer science and digital skills may be better integrated in other subjects.

What can be done? The Department for Education and the Department for Business, Innovation and Skills should jointly carry out an assessment of successes and challenges in the implementation of the computing curriculum in England, and its impact on growing the pipeline of digital talent.

6 Support and empower our teachers

Non-ICT teachers do not always get the digital skills training they need to teach the application of digital tech across all subjects. Teachers need better insights into the tech industry to help them spread enthusiasm and confidence about pursuing a career in tech.

Equip all teachers with basic digital skills

Teachers across all subjects need to be confident and trained in basic digital skills in order to use digital technology in the classroom. Only teachers with digital skills can access the wealth of online educational resources, and spread enthusiasm and knowledge about digital tools and solutions.

What can be done? Teaching qualifications including PGCEs, Teacher qualification college courses and Teach First should make it a priority to add basic digital skills to their requirements. Simultaneously, industry and Government institutions should replicate and scale initiatives such as Samsung's 'Digital Academy' at Harborne Academy training teachers in digital skills.[51]

Offer industry shadowing programmes to more teachers

The Tech Partnership's TechFuture Teachers[52] programme allows teachers to shadow tech professionals and employers in the tech sector for a day. This enables teachers to understand the use of tech at the workplace, and helps them mirror real-world tech problems in the classroom.

What can be done? Tech businesses and schools should continue to work with the Tech Partnership to increase the opportunities for teachers to shadow tech professionals and gain first-hand experience of work in the tech sector.

Strengthen teacher support networks

The UK has half a million teachers and, ideally, all of them should have support networks available to them to exchange best practice on applying digital skills in the classroom. Teacher networks such as the Computing at School Network of Excellence[53] by the British Computer Society and the Department for Education enable teachers to learn digital skills and effective teaching approaches from each other. These networks should be scaled as lasting infrastructure to support teachers to keep up with increasingly fast-evolving digital technologies.

What can be done? The British Computer Society and the Department for Education should work to scale up the Computing At School Network of Excellence. Tech businesses with a strong local presence and local authorities can support teacher networks to increase their reach across the UK.

7 Create more apprenticeships in the tech sector

Apprenticeships in the technology sector can often lead to highly skilled professional development. The formal education system does not produce appropriate graduates for all skilled tech employment, and the skills shortage leaves several tech careers unfilled increasing the opportunities for apprentices to learn highly demanded skills and enter skilled employment.

Put digital skills at the heart of the 3 million apprenticeship target

The tech sector welcomes the Prime Minister's target to create 3 million new apprenticeships, and tech businesses continue to create new apprenticeships by the day to help address the digital skills gap. Tech businesses contributed significantly to meet the 2 million new apprenticeship target before 2015.

What can be done? Government should emphasise the need for more digital components in apprenticeships, not just in for the tech sector but right across the economy, in order to reach the target of 3 million apprenticeships by 2020, and ensure those apprenticeships are truly geared for the jobs of the future.

Make it easier for SMEs to take on digital apprentices in digital roles

Large tech companies have a growing track record of providing apprenticeships, but there remains an untapped opportunity for SMEs. While high-growth 'scale-ups' often need access to experienced talent, more established SMEs can profit from apprenticeships. SMEs in the techUK community point to increased loyalty and specialised skills of apprentices, as well as quicker adding value and lower cost than hiring graduates.

What can be done? More SMEs can benefit from programmes such as Tech City Stars[54], the Tech Partnership's Degree Apprenticeship[55] programmes and Tech Industry Gold Apprenticeships[56], supporting frameworks for apprenticeships. techUK and wider industry should promote the advantages of hiring apprentices to more SMEs. Key players should consider how accessing apprentices for the first time can be made easier for SMEs, including through apprenticeship sharing schemes.

Encourage more girls to pursue apprenticeships in tech

The 3 million apprenticeship target may not be met without attracting more girls into technical vocational apprenticeships. The Scottish Government invested £125,000 in the CareerWISE initiative purely to raise awareness of STEM Modern Apprenticeships to girls and their parents.[57] The 30,000 new Modern Apprenticeship opportunities every year until 2020 pledged by the Scottish Government will focus in particular on attracting girls into tech careers.

What can be done? UK Government should consider funding and campaign models developed by the Scottish Government targetting specifically more girls to apply to apprenticeships in the tech sector.

8 Create new entry routes to tech

In order to increase the domestic talent recruited by tech businesses, industry must seek new ways of training and recruiting. New industry collaborations with educational institutions are being established, with the prospect of significantly increasing the employability of participants.

Emulate the National College for Digital Skills as a model to roll out across the UK

The National College for Digital Skills[58] was announced in 2014 by the Prime Minister and will open to students in 2016. As part of London Technology Week 2015, techUK brought the CEOs of SMEs together with the National College for Digital Skills to support the College's curriculum development in collaboration with industry.[59] The National College for Digital Skills constitutes a new, employability-oriented route into tech careers, backed by companies such as Deloitte and IBM. To create new opportunities for those who may otherwise not have pursued a career in tech, the College will offer a small salary to the its 'Higher-Level Apprentices', aims to attract 40% girls, and 50% students who experienced financial hardship.

What can be done? Government and industry should continue to support the College and should use its first campus in London as a model for rolling out future colleges for digital skills across the UK.

Increase opportunities for talent coming from underprivileged backgrounds

The recent UK Commission for Employment and Skills (UKCES) report argued that the tech sector sector must recruit from a larger pool with different educational and professional backgrounds in order to address the digital skills shortage.[60] techUK is delighted to support the Prince's Trust expanding the 'Get into' model into the tech sector.[61] techUK has also been pleased to be a key partner on the WATIFY campaign, holding workshops with underprivileged young people to stimulate digital entrepreneurship.[62]

What can be done? As the 'Get into IT' programme unfolds in 2015, techUK and other organisations should help drive tech business participation, and should encourage more tech businesses including SMEs to consider programme participants as potential apprentices in their business.

Create code conversion courses

Many young university graduates dream of a career in software or website development despite not having a background in computer science or ICT. Similar to a law conversion course, these graduates should have the opportunity to do 'code conversion' courses. After completing a 1-2 year long course, graduates should be equipped to enter a digital tech profession with a recognised qualification in coding.

What can be done? The Tech Partnership and the Department for Business, Innovation and Skills could convene universities and industry to discuss the possibility of a flagship 'Code Conversion' course.

9 Make it easier for industry to volunteer

Tech businesses want to address the digital skills gap in the short and in the long term, but the business case for volunteering is often not clear and the practical opportunities for volunteering can be difficult to find.

Increase awareness of the business benefits of volunteering

Industry volunteering increases team-building among the staff, makes the business more attractive to potential applicants, contributes to staff personal development and skills, and helps build a skills pipeline into the business e.g. by encouraging more applications for apprenticeships. Currently only 1% of tech business staff volunteer, SMEs are lowest in participation. It is a big ask from employers to call for more staff volunteering, but if more tech businesses were aware of the business benefits of volunteering it is likely that more tech businesses would volunteer.

What can be done? More research into the return on investment on industry volunteering should be done by strong research and facilitating organisations with an interest in digital skills volunteering, such as Nesta. techUK, the Tech Partnership and other organisations should raise the awareness of such research with tech businesses. This research should build on qualitative findings in initial research on business volunteering such as the recent report by Circle Research, Involve, and Heart of the City.[63]

Create a matchmaking platform to increase industry volunteering

techUK's members often voice the view that SMEs need a simple way to engage with digital learning programmes. WeAreDotDotDot[64], an online platform by the Centre for London, pioneers an automated website approach where businesses and individuals can find local engagement opportunities matching their capacities. A nationwide platform by BBC Make it Digital[65], due to launch later this year, may function as such a navigation tool on a UK-wide scale.

What can be done? Businesses, digital learning programmes and other organisations should use WeAreDotDotDot, BBC Make it Digital and similar platforms to increase volunteering activity.

Identify volunteering champions in each business

Organisations working with industry volunteers often suggest that having one 'champion' for volunteering in the business is key. This champion functions as contact person for volunteering opportunities and encourages their business's participation.

What can be done? Tech businesses should increase involvement with digital learning programmes by identifying 'digital skills volunteering champions'.

10

Ensure we reach across the entire UK

As recent reports from NIESR[68], Nesta[69] and Tech City UK[70] have demonstrated, clusters with different tech specialisms in Manchester, Brighton, Newcastle are growing. The North of England has a higher concentration of online retail businesses than the rest of the UK.[71] However more needs to be done to create digital skills across the UK to ensure businesses can recruit the talent they need locally and for local populations to benefit from tech cluster development.

Tech business alliances to coordinate digital skills stakeholders in clusters

The business coalition Dynamo North East[72] promotes technology businesses in the North East of England. Dynamo North East is a successful example for business-led coordination of local schools, digital learning programmes and local businesses including through the Local Enterprise Partnership to create more digital skills. The coalition established an accelerator, brokers apprenticeships, and recently called for £95m investment in a Northern Institute for Technology (NIT).[73] This business coalition can serve as a model champion for digital skills cluster development across the UK.

What can be done? Tech businesses in emerging tech clusters should take the lead creating collaborations with local educational institutions and informal learning opportunities. Where appropriate, Local Enterprise Partnerships should function as convener for these tech businesses.

Replicate successful local platforms that connect digital skills stakeholders

Founders4Schools[74] brings local entrepreneurs into schools to inspire children across the UK. WeAreDotDotDot[75] connects local businesses, learners, schools and informal learning opportunities within East London. These platforms should be assessed as potential models to scale-up or replicate in local tech clusters across the UK.

What can be done? In the North of the UK, the Government initiative Tech North should work with local business partnerships to assess and roll out such platforms. In other tech clusters, business coalitions should be created and supported by local or national Government to collaboratively scale successful platforms to connect digital skills efforts.

Scale up tech business support for teaching digital skills in local schools

Industry staff coming into schools or afternoon clubs to teach digital skills to young people are helping demystify tech careers and help teach state of the art skills. To improve digital skills education across the country, these efforts need to be scaled. More local tech businesses and SMEs in particular should be encouraged to support local schools and digital learning programmes, which they can find through online navigation platforms such as WeAreDotDotDot, Founders4Schools and others. Organisations such as Nesta could help make the incentives for industry clearer and more widely recognised as this engagement directly trains and inspires the talent their business relies on, and brings further benefits of staff volunteering (see Recommendation 9).

What can be done? Existing efforts by tech businesses to support local schools need to be scaled. More tech businesses across regions in the UK, in particular more SMEs should be made aware of the benefits of tech professionals teaching digital skills and should find local engagement opportunities through online platforms such as WeAreDotDotDot or Founders4Schools.

11 Adopt a 'Smart Migration' approach to support the UK as a tech nation

As Prime Minister David Cameron stated in his speech on immigration reform, the UK should "roll out the red carpet for the brightest and the best: the talented workers and brilliant students who are going to help Britain succeed".[76] The tech sector is driving UK productivity and needs access to foreign talent. Upskilling UK workforce for more 'homegrown talent' cannot solve the immediate skills shortages, which require a smart migration policy environment.

Let UK tech businesses thrive with top international talent

techUK members experience the most pronounced skills shortages in the highly-skilled occupations Big Data Analysts, Senior Developers, and Cyber Security Specialists. Earlier this year, the Government's independent expert advisory panel Migration Advisory Committee (MAC) advised the addition of a number of digital roles - ICT Product Managers, Big Data Scientists, Senior Developers, and Cyber Security Specialists, to the Shortage Occupation Lists.[77]

What can be done? The Home Office and the Department for Business, Innovation and Skills should adopt the Migration Advisory Committee recommendations made in February 2015 and add the cited digital technology occupations to the Shortage Occupation List with immediate effect.

Consider immigration reform from a growing business perspective

Education reforms to boost the domestic digital skills pipeline will take a number of years to bear fruit, and even longer for graduates to gain on-the-job experience. The measures recently announced by the Prime Minister to reduce tier 2 (skilled) immigration could have a significant impact on the tech sector and particularly on high-growth SMEs or 'scale-ups'. These businesses are the net job creators and wealth creators in the UK and should not be obstructed from hiring the talent they need to be productive and create jobs and growth in the UK. Evidence-based policy is imperative for understanding the impact of new proposals on the digital skills pipeline. To be a global hub for tech, we must be a global hub for talent, and we should support a migration environment which attracts international talent for those areas which are in short supply from the UK labour market.

What can be done? Government should consider immigration reform from a scale-up business perspective to ensure the package does not harm high-growth businesses and therein hamper UK productivity and job creation.

Enable universities to attract top talent from across the globe

For universities to stay competitive, there must be a feasible option for non-EEA students to find employment after completing their university career in the UK. One in seven start-ups in the UK was founded by a migrant, and scaling UK tech businesses rely on experienced talent from abroad[78]. techUK has repeatedly raised issues regarding the unintended consequences of the closure of the post-study work visa.

What can be done? Government should reinstate the post-study work visa or an equivalent route for the UK to ensure that UK universities remain globally competitive and that talented graduates can then flow into the UK workforce.

Next steps: A four-point framework to supercharge UK digital talent and meet the skills challenges of the 21st Century

1. SCALE UP successful programmes to help them reach across the UK

Identifying and supporting best practice in digital learning programmes will help scale-up the best programmes. Larger scale will help programmes better manage funding and volunteer flows, to absorb temporary shortages or influxes, and to become more widely recognised and better known across the UK.

Industry, government and organisations should increase support for digital learning programmes by supplying funding, volunteers, resources, and regional infrastructure. 'Letting a thousand flowers bloom', should be balanced with scaling the best ideas to grow momentum and create a more effective, sustainable approach to the skills gap.

2. COORDINATE efforts through the Tech Partnership and online navigation platforms

Tech businesses should join and champion the Tech Partnership, the main delivery vehicle for the tech sector to collaborate on closing the digital skills gap. The Tech Partnership sets new standards for qualifications, facilitates apprenticeships, creates teaching materials, generates information on the skills shortage, and leads a range of other tech industry initiatives. techUK works with the Tech Partnership and encourages UK tech businesses of all sizes to sign up today.

An online navigation platform should be widely known and function as matchmaker between learners, funders, volunteers and digital learning programmes. Learners, funders, volunteers, businesses and schools may currently struggle to identify digital skills programmes in their area. Clear and well-known landmarks and directories that help identify successful local initiatives are needed, either locally based like WeAreDotDotDot or nation-wide like the future skills navigation platform on BBC Make it Digital due to launch later this year.

3. OPEN UP to new ideas on how to close the digital skills gap

We should always be open to look beyond current formal education and curriculum reform to address the challenge at hand. Government, industry, educational institutions and organisations should think creatively about innovative ways of further integrating informal learning and formal education. Other sectors that include tech professionals, including the creative industries, should have a prominent voice in specifying industry's digital skills needs and finding ways to develop the digital skills young people and the economy need.

4. MAP the skills pipeline for effective data-driven policy and industry interventions

An annual survey on specific digital skills shortages should be fielded to tech sector businesses to highlight skills shortages, led by Tech City UK and the Tech Partnership. These efforts should be expanded, including to businesses that suffer from digital skills shortages but are not traditionally understood as technology businesses, for instance banks. The House of Lords report 'Make or Break: The UK's Digital Future' called for annual updates to Parliament on the digital skills shortage.

A dynamic map of the digital skills pipeline should be created to better understand the cumulative impact of recent education reforms and wider 'informal education' on meeting the overall digital skills challenge facing the UK. The Digital Economy Unit (DEU) with the Department of Business, Innovation and Skills should collate data on the impact and scale of digital skills interventions, including those cited throughout this report. This would help estimate the likely state of the UK's digital skills capabilities in 2020 and beyond. Government and wider players can then use those insights to demonstrate where more may still need to be done, including where a 'smart immigration' approach is necessary to address the most pronounced shortages.

The UK must understand the direction of its digital skills capabilities in order to maintain its position as a leading digital economy, and also ensure that use of digital technologies drives productivity right across the UK. As the UK embarks on an era of the widespread adoption of new technologies such as the Internet of Things, the priorities raised in this paper become ever more important. As industry, government and wider players, we must work together to meet the digital skills challenge.

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techUK represents the companies and technologies that are defining today the world that we will live in tomorrow. More than 850 companies are members of techUK. Collectively they employ approximately 700,000 people, about half of all tech sector jobs in the UK. These companies range from leading FTSE 100 companies to new innovative start-ups. The majority of our members are small and medium sized businesses.

techUK is committed to helping its members grow, by:

- Developing markets
- Developing relationships and networks
- Reducing business costs
- Reducing business risks.

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