GEARING UP FOR STEM

SKILLS STRATEGY

AND ACTION PLAN

THAMES VALLEY BERKSHIRE

University of Warwick, Institute for Employment Research
on behalf of
Thames Valley Berkshire Local Enterprise Partnership and Adviza[1]

31st March 2017

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Foreword

Vision: Sustaining and developing the talent pool in science, technology, engineering and mathematics ("STEM") across Thames Valley Berkshire through an agreed delivery plan between skills providers and employers

The 'Gearing Up for STEM Skills Strategy and Action Plan' is positioned at the heart of government reforms to education and training. The intention is to ensure a clear connection between the core STEM subjects both to the new Industrial Strategy and the productivity agenda. The Thames Valley Berkshire economy is based on strengths in science and technology and the continued resilience of these is central to its international competitiveness. The ambition and proven creativity in our established businesses relies on knowledge rich networks and a deeply informed supply chain. In turn we all rely on a continuous stream of new talent entering our workforces, challenging old ideas and bringing fresh energy and perspective. The Thames Valley is a great place to live and to work; its infrastructure and connections ensure its openness. Its well-educated population offers further potential in building further future competitiveness, and the Plans contained within this document will help ensure this potential has the best chance of being fully realised.

A sector by sector approach is important in uncovering the real needs of our regional businesses and analysis of the key sectors is covered in providing the necessary evidence to support engagement. The greater the involvement of leading employers and skills providers in delivering this strategy, the better our chances in delivering the further innovation, productivity and jobs we all want for the region.

The Thames Valley Berkshire Local Enterprise Partnership ("TVB LEP") Strategic Economic Plan 2020/21 and Skills Plan 2016 set out vital skills priorities. This Plan builds on these, outlining the actions needed to address the current and expected future skills shortages, skills gaps, skills mismatch and other opportunities in the region. The main outcome should be to build long term bridges between skills providers (schools, FE and HE institutions) and employers that deliver meaningful outcomes for our economy. Identifying the skills, creating inspiration and motivation to want to enter these valuable industries, delivering the skills and maintaining them lifelong are all part of the solution needed.

The Action Plan has more detail around specific interventions to ensure the skills development is throughout all stages of personal development. It also includes the recommendation for monitoring demand and promoting careers for talented people to future proof some sectors including: Agricultural Science, Computer Science, Engineering, Design and Technology, Digital Marketing, Environmental Science, Food Science and Pharmaceutical Sciences. Keeping these in the spotlight, and promoting them appropriately, should keep the supply of skilled people at the level we need it to be to grow our economic impact internationally.

This document identifies a range of employer-led and education-led activities – each informed by the other. These include increasing the number of and impact of Apprenticeships across these industries; ensuring the delivery of appropriate T-levels; 16-19 technical education provision; increasing employability of graduates and post-graduates; creating new 'return-ship' programmes and embedding real experiences of STEM-centred careers in school education.

I would like to express my sincere gratitude to everyone who has worked on pulling this Strategy and Action Plan together. I am indebted to Dr Deidre Hughes OBE and the University of Warwick, Institute for Employment Research (IER) team for all their efforts in capturing the many contributions from the Thames Valley community in the consultation process and with whom we will continue to work as we implement the strategy.

Paul Reilly
Managing Partner
Peter Brett Associates

Introduction: Vision

VISION: *Thames Valley Berkshire's STEM Skills Strategy and Action Plan – empowering more people to be inspired by science, technology, engineering and mathematics and to grow an innovative and vibrant economy.*

Background and context

STEM is the acronym for Science, Technology, Engineering, and Mathematics, and encompasses a vast array of subjects, that fall into each of those terms. This is defined as science, technology, engineering and/or mathematics, following the UK Commission for Employment & Skills (2013) report on 'The Supply and Demand for High level STEM Skills'.[3] In this context, STEM occupations and sectors are divided into:

- Core STEM areas (comprising: Biological sciences; Agricultural sciences; Physical / environmental sciences; Mathematical sciences and computing; Engineering, Technology and Architecture); and
- Medicine and related STEM (comprising medicine and dentistry and medical related subjects).

The Thames Valley Berkshire Local Enterprise Partnership (TVB LEP) Strategic Economic Plan (SEP, 2015/2016 – 2020/21) indicates: '*Alongside London, Thames Valley Berkshire is the UK's economic powerhouse. We need our businesses to reinvest confidently in Thames Valley Berkshire'.* The region is made up of six Berkshire unitary authority localities: Slough, Windsor & Maidenhead, Bracknell Forest, Wokingham, Reading and West Berkshire.

AIM: 'Gearing Up for STEM' aims to increase the number of STEM skilled people available to work in Thames Valley Berkshire and reduce the number of businesses frustrated by the challenges of recruiting and retaining staff with STEM specialism.

The TVB LEP Skills Priority Statement (2016)[4] provides an overview of the skills needed across Berkshire to support and grow the economy. It identifies what Berkshire employers (and national employers) say are their skills priorities and mid-skill occupations likely to be in high demand in the future. It also examines learning supply, with a particular focus on mid-high level provision and includes UK Employer Skills Survey (UKCES, 2016) data on skills and training in the TVB LEP and within local authority areas, such as vacancies that are difficult to fill because of skills shortages, and training provision. There is a strong commitment to finding strategic and practical solutions to: scaling up growth; growing STEM skills; transforming infrastructure; and retaining international companies. The overarching priority is to grow people's potential and bright ideas, and to use both more effectively. Berkshire's continued economic growth depends heavily on the quality of its workforce, as well as good supply and demand side arrangements between industry and education – *see Annex 3.* The SEP Implementation Plan[5] sets out the main reason why the TVB LEP (with its partners) has embarked on a STEM Strategy & Action Plan is to:

> " *significantly raise the quality and profile of STEM provision across Berkshire and to ensure that STEM education responds to the needs of the innovative, forward thinking companies, both large and small, which are based here...To deliver this, we will work with those*

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[3] UKCES (2013)*The Supply and Demand of High-Level STEM Skills,* Evidence Report 77, November 2013 - visit: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/302973/evidence-report-77-high-level-stem-skills_1_.pdf

[4] TVB LEP (2016) *Skills Priority Statement 2016, Reading: Thames Valley Berkshire Local Enterprise Partnership* http://thamesvalleyberkshire.co.uk/Portals/0/FileStore/Employability&Skills/Skills%20Priority%20Statement%202016.pdf

[5] TVBLEP SEP Implementation Plan (4.5) http://thamesvalleyberkshire.co.uk/Portals/0/FileStore/StrategicEconomicPlan/TVB%20SEP%20-%20Implementation%20Plan.pdf

businesses to shape curricula so that they are aligned with the changing needs of STEM based businesses (particularly at technician levels)." (SEP, p. 159)

The Solution Labs – a collaborative STEM project from Berkshire Further Education Colleges – offer prototypes in terms of innovation and technological focus: at Reading College, there is an emphasis on engineering and science; at Newbury College, there is an orientation exclusively to fusion, mechanical and electrical engineering; and at East Berkshire College, the focus is on engineering and science. These approaches adopt a state-of-the-art setting for teaching students (including higher level Apprentices), but also as a resource made available (on a commercial basis) to micro and small businesses in TVB. Small companies often struggle to afford proto-typing equipment such as: 3-D modelling, printing, simulation, etc. but at certain points in time, having easy access to these is critical in relation to their own future growth. There are also examples of businesses within TVB taking a lead on STEM activities e.g. Cisco, Microsoft, PBA and Network Rail are co-sponsoring the Reading University Technical College with a particular focus on computer science and engineering. The UTC Reading has achieved 'Outstanding' recognition from Ofsted for its computer science and engineering excellence.

For many organisations and businesses, recruitment is proving very challenging, particularly in relation to staff with an in-depth knowledge of science, technology, engineering and mathematics; in this domain, the challenge of competing internationally was highlighted as a key concerns by employers, particularly given the volume of high quality science graduates emerging from South Korea, China and India. There is an urgent need to equip Berkshire's already-employed people to engage and upskill in STEM i.e. recognising that learning and training occurs throughout an individual's working life (rather than one-off sporadic episodes). In up-skilling the existing workforce, account must be taken of the skills that businesses are seeking, now and in the future. Where particular skills are in very short supply, businesses need to be able to find solutions, recognising that this might sometimes require international migration. Many of Berkshire's businesses are internationally mobile, and there is an urgent requirement to ensure that they can find the people they need.

The University of Warwick Institute for Employment Research (IER) was commissioned by Thames Valley Berkshire (TVB) LEP, Adviza and the Skills Funding Agency, to examine STEM developments across Berkshire. The research was designed to help 'close the gap' between local STEM employer skills needs and the skills available from the workforce and potential workforce. The work was undertaken from early January – mid-March 2017. The IER team will undertake a review of the success or otherwise of the STEM Skills Strategy and Action Plan in mid 2018.

The requirement was to produce an evidence-based STEM Skills Strategy and Action Plan that would identify:

- how to align STEM provision to strengthen and create capacity in key areas of economic growth (in particular with SMEs) and to explore potential models for a TVB Institute of Technology;
- how to improve the STEM talent pipeline, including reducing gaps in provision and addressing STEM skills shortages and skills mismatch; and
- how to maximise opportunities for collaborative working to further optimise STEM skills across the region, including identifying and responding to emerging needs and building greater awareness of opportunities across the community.

It would also take into account recommendations from national STEM strategies and research reports. The IER team will undertake a review of the success or otherwise of the Skills Strategy and Action Plan in mid 2018.

The IER research team was led by Dr Deirdre Hughes OBE, Principal Research Fellow, with Dr Daria Luchinskaya, Research Fellow; Dr Clare Lyonette, Principal Research Fellow; and Olga Siemers, Doctoral Researcher.

The important question

TVB is the most productive sub-region in the UK and the stated LEP goal is to remain so, and science, technology, engineering and mathematics (STEM) is critical to achieving this. Economic output is derived through a combination of capital and labour inputs, as well as a third, less tangible variable, Total Factor Productivity (TFP). TFP measures the residual output not accounted for through capital and labour. Economists argue that TFP is predominately influenced by advances and innovations in technology. Whilst difficult to estimate accurately, economists argue that it is increases in TFP that tend to drive genuine and sustainable increases in productivity and economic growth. This raises two important questions for TVB:

- *Does TVB's current and future workforce have the skills and knowledge to exploit technological advances and innovations both now and in the future?*

'Gearing up for STEM' aims to increase the number of STEM skilled people available to work in Thames Valley Berkshire and reduce the number of businesses frustrated by the challenges of recruiting and retaining staff with STEM specialisms. From 2017 – 2018, the focus of activities will be to promote:

- the importance of STEM skills by raising awareness and increasing demand for STEM careers and employment opportunities; and

- STEM apprenticeships at all levels ensuring that provision is in place to meet employer demand.

Overall, the strategic objectives will be delivered through a broad range of *commitments, collaboration* and *co-operation* with partners. Collectively these '3 Cs' are aimed at creating a highly skilled and highly productive STEM economy, where investment in people and skills development are both recognised as major contributors to successful economic, educational and social outcomes.

Methodology

Many organisations, including small and medium enterprises (SMEs), large companies, professional bodies, trade associations, education business partnerships, universities, colleges, schools and government departments were consulted – see Annex 1. This also included moving beyond the region to consult with nearest neighbours in Oxfordshire, Winchester and London, as well as contacting South East regional STEM experts. The methodology involved:

- **A literature review** to capture robust evidence on STEM issues drawing on UK and wider literature. This included a brief review of the Employer Skills Survey[6] which contained information on 1,019 employers in the TVBLEP area. The literature review forms part of the STEM evidence base that will feed into planned events during 2017 - 2018. Key headlines are embedded within the STEM Skills Strategy and Action Plan. A 'Gearing Up for STEM Literature Review' paper will be published separately on the TVBLEP, Adviza and IER websites.

- **A Berkshire survey of 151 employers,** including small to medium-sized enterprises, was undertaken by BMG Research on behalf of IER (February 2017) using CATI (Computer-Assisted Telephone Interviews). The aim was to gather employers' views, particularly SMEs, on a range of STEM issues.

- **A series of 21 stakeholder interviews** were conducted by telephone and/or through face-to-face visits with key stakeholders in each of the six TVB geographical areas. The aim was to listen to the voices of educationalists, employers and STEM experts and capture their views on STEM developments in Berkshire. In addition, a '*Have Your Say*' web-link was created for future use by TVB LEP and Adviza to capture views on what more needs to be done as the

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[6] The Employer Skills Survey is a survey of 91,000 employers across the UK about information relating to employers' skills needs and investment in training.
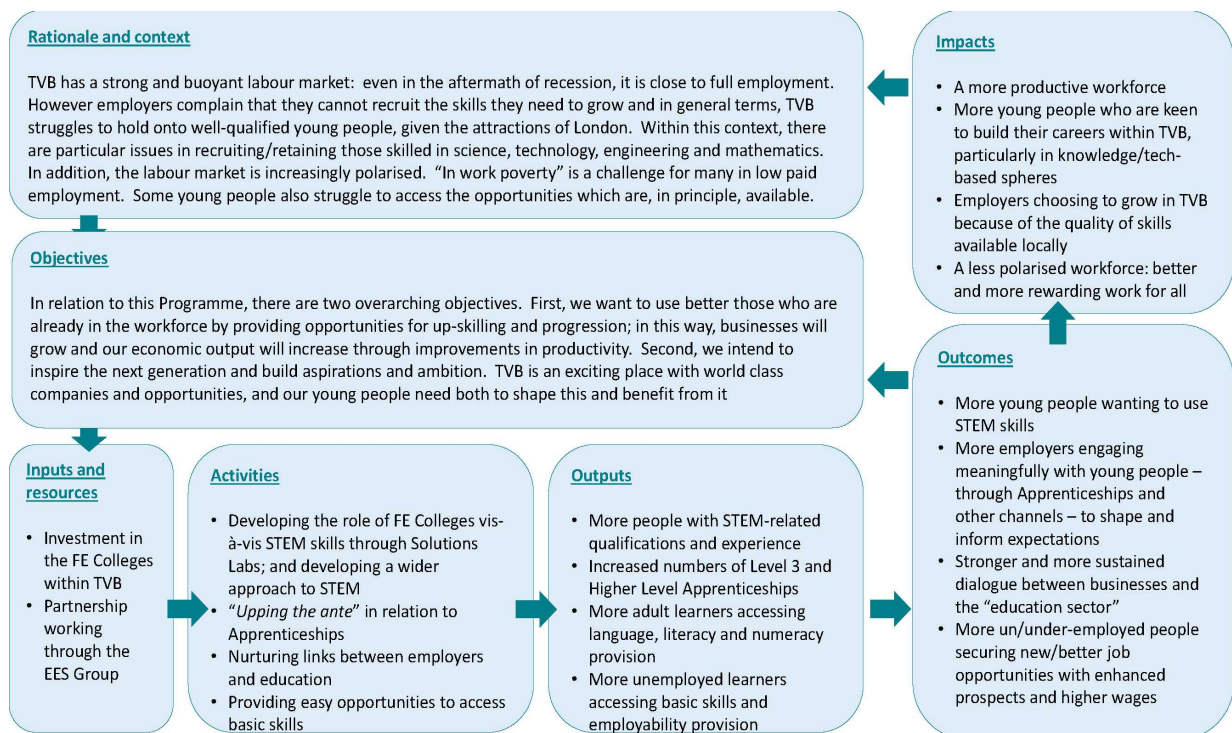
STEM Skills Strategy and Action Plan unfolds. The online prototype yielded **1 further detailed response** included in the findings.

- **A series of 6 case studies** representing differing types of industry and education institutions to gain deeper insights into how the schools/colleges/universities/training providers' work on STEM issues to better connect young people and adults to the realities of the world of work – see below. The aim was to showcase some examples of good and /or interesting STEM policies and practices designed to stimulate further discussion at a local and regional level.

The approach has built upon an evidence-based appraisal of Berkshire's STEM challenges and opportunities in the coming years and, as you shall see, the STEM talent pipeline in this region has many strengths. However, there are trends that need to be reversed in order to grow a dynamic, innovative and vibrant economy that provides more STEM opportunities, as discussed more fully below. Early in the research, it was made clear by some employers that they do not relate easily to the 'STEM' acronym. They indicated this acronym is often shorthand used by educationalists and can often hide specific industries, sectors and occupations that have their own unique identity. This has implications for how best to present and promote this strategy and action plan so that more employers step up to engage with this agenda as it unfolds over the next two years.

The 'STEM logic chain' below (Figure 1 below) provides an overview of TVB LEP's specific focus on driving up STEM dialogue and action across the region.

Figure 1

Rationale and context

TVB has a strong and buoyant labour market: even in the aftermath of recession, it is close to full employment. However employers complain that they cannot recruit the skills they need to grow and in general terms, TVB struggles to hold onto well-qualified young people, given the attractions of London. Within this context, there are particular issues in recruiting/retaining those skilled in science, technology, engineering and mathematics. In addition, the labour market is increasingly polarised. "In work poverty" is a challenge for many in low paid employment. Some young people also struggle to access the opportunities which are, in principle, available.

Objectives

In relation to this Programme, there are two overarching objectives. First, we want to use better those who are already in the workforce by providing opportunities for up-skilling and progression; in this way, businesses will grow and our economic output will increase through improvements in productivity. Second, we intend to inspire the next generation and build aspirations and ambition. TVB is an exciting place with world class companies and opportunities, and our young people need both to shape this and benefit from it

Inputs and resources

- Investment in the FE Colleges within TVB
- Partnership working through the EES Group

Activities

- Developing the role of FE Colleges vis-à-vis STEM skills through Solutions Labs; and developing a wider approach to STEM
- "*Upping the ante*" in relation to Apprenticeships
- Nurturing links between employers and education
- Providing easy opportunities to access basic skills

Outputs

- More people with STEM-related qualifications and experience
- Increased numbers of Level 3 and Higher Level Apprenticeships
- More adult learners accessing language, literacy and numeracy provision
- More unemployed learners accessing basic skills and employability provision

Impacts

- A more productive workforce
- More young people who are keen to build their careers within TVB, particularly in knowledge/tech-based spheres
- Employers choosing to grow in TVB because of the quality of skills available locally
- A less polarised workforce: better and more rewarding work for all

Outcomes

- More young people wanting to use STEM skills
- More employers engaging meaningfully with young people – through Apprenticeships and other channels – to shape and inform expectations
- Stronger and more sustained dialogue between businesses and the "education sector"
- More un/under-employed people securing new/better job opportunities with enhanced prospects and higher wages

Findings

A new Industrial Strategy

The government's recent Industrial Strategy (HMG, 2016)[7] offers a strong foundation for businesses and educationalists to jointly explore innovative ways in which science, technology, engineering and mathematics (STEM) skills can be increased and improved across TVB. The recent Chancellor's Budget (March 2017)[8] set out major proposals for expanding free schools, driving up 3m apprenticeships by 2020, 15 new technical education routes, new student loans, lifelong learning pilots, 'returnships' for people who have taken career breaks and investment in an additional 1,000 PhD places in areas aligned to the Industrial Strategy – around 85% will be in STEM disciplines and 40% will directly help strengthen collaboration between business and academia through industrial partnerships.

National STEM trends

Evidence from the latest labour force projections from Working Futures (2014-2024) predict annual growth in total employment of 0.5% for the UK. Skills shortages are particularly acute in construction, but also strong across the science and engineering, ICT and manufacturing sectors, and especially in London and the South East of England. Demand for science, research, engineering, and technology professional occupations across the UK was projected to expand by 12.7 per cent (218,000 people) between 2014 and 2024, and for Science, research, engineering, and technology associate professional occupations – by 5.3 per cent (30,000) over the same period.[9]

- **S**cience – The total number of people employed in scientific occupations is projected to increase. The total scientific workforce was projected to rise to 7.1m people or 22 per cent of the total UK workforce, by 2030 – an additional 1.4 million people compared to 2009 (Science Council 2011).[10] Demand for technical-level staff is forecast to increase by 4,000-6,000 people per year over the next decade to 2025, and for professional-level staff – at around 10,000 per year over the same period (Science Industry Partnership 2016). This equates to between 180,000 and 260,000 new scientific staff to 2025.[11]

- **T**echnology – In 2015, there were 1.8 million people working in the technology sector in the UK – 1.1 million in technology enterprises and 0.7 million in technological jobs in other parts of the economy (Tech Partnership 2016).[12] Almost two thirds of technology employment was in the IT sector, followed by telecoms services (18 per cent), and technology sales and distribution (11 per cent) (Tech Partnership 2016). There are some differences in classification, as, for example, Tech Nation estimated that there were over 1.5 million jobs in the digital technology sector in the UK in 2016 (Tech City and NESTA 2016).[13] Between 2005-2015, employment in the technology industries increased by 7.7 per cent, however, this growth rate is expected to slow to 3.2 per cent over 2015-2025 (Tech Partnership 2016). Part of the explanation could be related to the automation of jobs, with 40 per cent job losses (25,000 workers) expected in technological manufacturing. Analysis by PWC further corroborates the

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7   HMG (2016) Industrial Strategy
8   Chancellor's Budget (March 2017)
9   Working Futures (2016) Table 4.5, p. 76. Expansion demand refers to the projected net change in employment levels, over and above 'replacement demand' (replacing members of staff who leave). https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/513801/Working_Futures_final_evidence_report.pdf
10 This figure includes primary science occupations (e.g. those that are entirely science-based and require scientific skills and knowledge, e.g. chemists, engineering technicians, pharmacists) and secondary science occupations (e.g. those that require a mix of scientific and other skills, e.g. environmental health officers, teaching professionals).
11 Science Industry Partnership (2016) The UK Scientific Workforce: Industry Demand and Skills Supply. http://www.scienceindustrypartnership.com/media/529050/sip_science_industry_demand_for_skills_final.pdf
12 Tech Partnership (2016) Datasheet: The tech industry workforce, February 2016
13 Tech City and NESTA (2016) Tech Nation 2016: Transforming UK industries http://www.techcityuk.com/wp-content/uploads/2016/02/Tech-Nation-2016_FINAL-ONLINE-1.pdf

potential job losses in manufacturing more broadly owing to automation technology and global competitive pressures (PWC 2016).[14]

- **E**ngineering – Demand in engineering enterprises for 265,000 skilled entrants annually through to 2024, of which around 186,000 will be needed in engineering occupations, to meet both replacement and expansion demand. The total size of employment for those with level 3 skills will shrink, although significant replacement demand of around 57,000 entrants per year at this level will remain. At level 4 and above, the annual requirement for engineering occupations is expected to be just over 101,000 annually. Postgraduate engineering and technology degrees are successful internationally, but the proportion of UK-domiciled graduates is becoming too low to be sustainable in the long-term (down to 25% of taught engineering and technology postgraduate qualifications, in 2014/15) (Engineering UK)

- **M**athematics – The Mathematical sciences make a substantial contribution to the UK employment and economy – 2.8 million people in 2010 (Deloitte 2012).[15] The number of people employed in jobs where a mathematical sciences qualification (including HE, FE, and others) was an essential requirement rose by 20 per cent between 2011 and 2013, to 2 million people (Council for Mathematical Sciences 2015).[16] There is a particular focus on the demand for teachers with sufficient mathematical and numerical skills. In 2015, there were 1,550 maths teachers and 1,770 numeracy teachers (46-48% part-time) in English FE colleges, with a further 820 maths and numeracy teachers in Sixth Form Colleges (33% part-time) (Gatsby 2015).[17] Part-time FE teachers who teach up to GCSE maths typically do not hold degrees in mathematics, and often possess a GCSE A*-C in maths as their highest maths-related qualification (op.cit).

Over the coming years, 42% of businesses expect to have more jobs requiring intermediate level skills, and 74% expect to demand more higher level skills.[18] Many employers, particularly SMEs, need more people to specialise in STEM subjects. But small to medium-sized enterprises (SMEs) will need greater support and encouragement to engage with education than their larger counterparts. Large employers can perform a key role in communicating STEM priorities and nurturing SME engagement in this regard.

Local findings

For the Thames Valley area, the leading sources of employment growth are: information technology (+26,000), professional services (+13,000) and support services (+5,000). There are predicted to be a high number of job openings, with jobs in relatively high concentration in the area (2012 to 2022) in jobs relating to digital technologies, life sciences, sales, creative industries and education. Many employers, particularly SMEs, need more people to specialise in STEM subjects, for example:

> *"We are just desperate for people who have got the skills and the knowledge to bring our business into the next century, next decade. That they come ready to work and that they want to advance my business. And it's not about money – it's about people that are keen, that have the knowledge."* (Employer, Agriculture)

> *"The business is growing and we're connecting locally with schools, colleges and the university to let them know we need more people with STEM knowledge, we're changing our approach to recruitment, offering more employee support activities and*

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14 PWC (2016) UK Economic Outlook March 2016. https://www.pwc.co.uk/assets/pdf/ukeo/ukeo-sectoral-employment-march-2016.pdf

15 Deloitte (2012) Measuring the economic benefits of mathematical sciences research in the UK. https://www.epsrc.ac.uk/newsevents/pubs/deloitte-measuring-the-economic-benefits-of-mathematical-science-research-in-the-uk/

16 Council for Mathematical Sciences (2015) The Mathematical Sciences People Pipeline. http://www.cms.ac.uk/files/News/article_5630c69e789971.96989222.pd f

17 Gatsby Foundation (2015) Profile of the Mathematics Teaching Workforce in the College Sector in England. http://www.gatsby.org.uk/uploads/education/reports/pdf/profile-of-the-maths-teaching-workforce.pdf

18 CBI/Pearson (2016) Employer Skills Survey, London: January 2016

overall increasing the numbers of STEM apprenticeships." (Employer, large company)

But small to medium-sized enterprises (SMEs) may need greater support and encouragement to engage with education than their larger counterparts.

> *"We need education and training providers to make clear what they can actually offer micro-businesses and offer concrete support to help them grow their business drawing on local resources."* (Educationalist)

NFER findings indicate SMEs tend to engage with education on 'a more ad hoc and infrequent basis and with a narrower range of activities compared to their larger counterparts. Thus, some SMEs may have a limited view of what type of STEM activity constitutes engagement with education' (NfER, 2012).[19] This highlights the need to extend SMEs' perceptions of what types of STEM activities constitute engagement with education – there may be scope to engage some SMEs with education and schools in highly innovative ways in which they had not previously conceived. Given most SMEs do not have their own HR personnel engagement is often driven by individuals who are passionate about the benefits of employer engagement in education. In this regard, large employers can also perform a key role in communicating STEM priorities and nurturing employer engagement in education through their supply chains.

Language

The research findings highlight it is easy to forget that science, technology, engineering and mathematics mean different things to different people, particularly when it comes to employers and educationalists. Some employers stated they do not relate easily to the 'STEM' acronym. They indicated this acronym is often shorthand used by educationalists - it can often hide specific industries, sectors and occupations that have their own unique identity. There was universal agreement on the need to focus more on skills in demand and to educate more people on connecting their learning to the world of work.

Key facts

- o 27% of all jobs in Berkshire are classified as STEM jobs, compared to 22% across England as a whole

- o 68% of jobs in Berkshire are in small or medium-sized companies

- o 14% of people working in Berkshire are self-employed - most young people who are self-employed work in construction, hairdressing and arts / literary occupations

- o 81% of Berkshire residents work in the private sector and 19% in the public sector (including the NHS, schools, local government and emergency services)

- o 1 in 10 jobs in Berkshire are IT specialist roles. This is three times the national average

- o Job positions that employers in Berkshire find most difficult to fill include: software developers; engineers; health workers and teachers.

- o 27% of Berkshire employers who recruit school leavers believe they are poorly prepared for work.

- o Over a half (56%) of all jobs in Berkshire require mid-level qualifications but only a third (33%) of residents have their highest level of qualification at this level.

- o According to the latest Index of Multiple Deprivation data[20], Wokingham, and Windsor and Maidenhead are among the least deprived areas of the country.

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[19] NfER (2012) *Exploring the engagement of STEM SMEs with education: Key Findings Research Summary,* Berkshire, Slough
https://www.nfer.ac.uk/publications/SMES01/SMES01.pdf

[20] DCLG Index of Multiple Deprivation – see data Annex: Deprivation -
https://www.gov.uk/government/collections/english-indices-of-deprivation

- The Thames Valley as a whole has a lower level of benefit claimants, than national and regional figures. This reflects the fact that there is a buoyant labour market in the area, with more jobs than applicants. Levels are however highest in Slough and Reading than in any of the other areas.

'In work poverty' is also challenge for those in low paid occupations and there is a need to raise the profile of level 2 jobs as a stepping stone into higher level work to allow people to grow in confidence and reach their full potential. There are also opportunities to align promotional marketing on STEM opportunities linked to up-skilling, new and emerging pathways, flexible learning routes and financial support available, where possible. These factors alone help explain the urgent need for a Berkshire STEM Skills Strategy and Action Plan.

In this context, a wide range of STEM specialist organisations and activities (both within and outside of TVB) were identified – see Annex 2. Also, for more details on *'What's so special about TVB?'* – see: Annex 3.

How to align STEM provision to strengthen and create capacity in key areas of economic growth (in particular with SMEs) and explore potential models for a new Institute of Technology

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The IER team focused on building upon the existing priority areas recognising that most of Berkshire's priority sectors and job families (and therefore skills issues) are common across the whole of Berkshire. There are, however, some local clusters of economic activity likely to create higher demand for certain skills in some areas. For example, the logistics sector is particularly prevalent in the Slough (and to a lesser extent Thatcham), the sub-region's finance and insurance sector is concentrated in Reading and the hospitality sector is most prevalent in and around Windsor, and, to a lesser extent, in Reading *(TVBLEP Skills Priority Statement 2016, p. 10).*

The TVB LEP Skills Priority Statement (SPS) is a good starting point. It clearly highlights the importance of STEM skills to the local economy. For example:

Digital technology skills are in high and growing demand
The digital technologies sector dominates the Berkshire economy. A significant proportion of the workforce are employed in the sector (14% compared with just 4% nationally) and it is by far the most important sector to Berkshire in terms of its forecasted contribution to future economic growth. Across the economy as a whole, approximately 1 in 10 jobs in Berkshire are digital technology specialist roles, which is three times the national average. Many employers, particularly SMEs, struggle to recruit digital technology specialists, and believe that there needs to be more local training provision. Open source software is one area which may warrant particular focus.
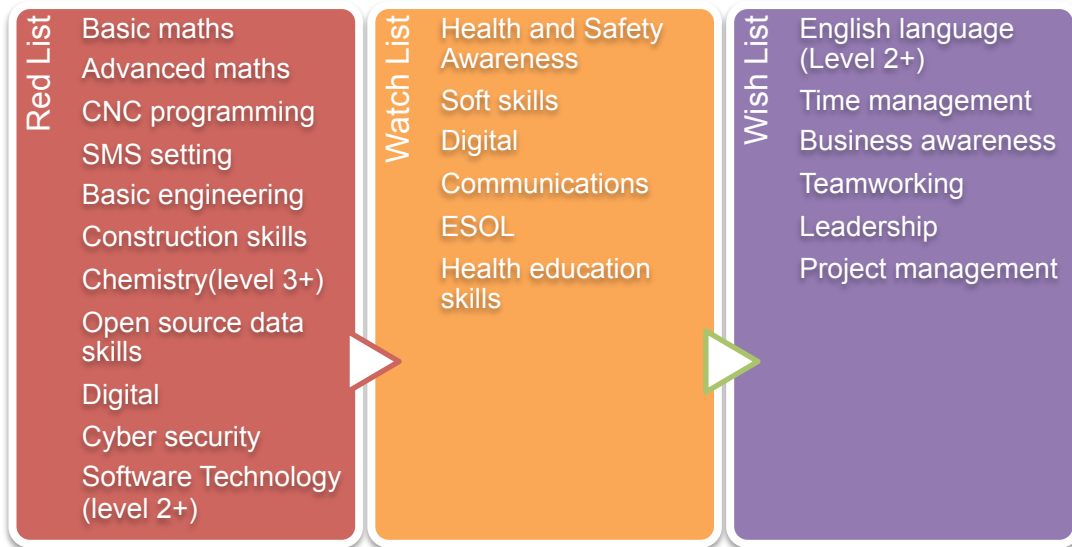
Other STEM skills
There is a need for skills in STEM subjects at all levels, particularly at Level 3 and above. These skills are critical for all six of Berkshire's priority sectors. Engineering roles can be particularly difficult to fill. Findings indicated there is demand for diverse delivery routes such as: more combined classroom, employer engagement, and/or workplace learning; more STEM access courses, particularly for women returners; more STEM evening classes for adults in their local communities; more 'pop up' starter facilities for budding STEM entrepreneurs within science parks, college and university premises; and greater use of ICT to deliver STEM massive and/or vocational open online courses (MOOCs /VOOCs), or alternatively, online podcasts and Youtube videos that include information on student loans and career pathways. The majority of respondents identified these examples as positive ways forward.

Typology: Red, Watch and Wish List
The Science Industry Partnership (SIP) typology is used to illustrate TVB LEP and IER's research findings into skills demand across the region. This is a useful framework to inform

more detailed discussions in each of the six geographical areas of Berkshire. The lists below are best described as 'a snapshot in time', given the short duration of the research. These include sectors, occupations, generic and specific skill demands reported by key informants. These 'snapshot in time' findings can further critiqued in the context of local geographical areas, as part of a series of STEM consultation events organised across the region by Adviza. The 'Red List' below denotes reported skills shortages, sectors and occupations requiring immediate action. The 'Watch List' denotes those occupations where possible future shortages in specific sectors are anticipated. The 'Wish List' denotes those areas where multidisciplinary skills are in high demand, but rarely available.

Red List	Watch List	Wish List
Basic maths	Health and Safety Awareness	English language (Level 2+)
Advanced maths	Soft skills	Time management
CNC programming	Digital	Business awareness
SMS setting	Communications	Teamworking
Basic engineering	ESOL	Leadership
Construction skills	Health education skills	Project management
Chemistry(level 3+)		
Open source data skills		
Digital		
Cyber security		
Software Technology (level 2+)		

Further analysis of key findings highlight reported demand in the following sectors and occupations:

Red List
Digital technologies - Software Developers, Software Engineers, Cyber Security Specialists, IT business analysts, architects and systems designers *(particularly Big Data Specialists), Web design and development professionals, Electronics engineers, Laboratory technicians, and other engineering professionals, and STEM teachers. Some further examples were given of sector specific shortages (yet to be quantified) in Agricultural Science, Computer Science, Design and Technology, Environmental Science, Food Science, Health and Pharmaceutical Sciences, and Digital Marketing.

Watch List
Other STEM sectors - Financial professional and business services, life sciences and healthcare, construction and the built environment, medical practitioners (particularly GPs), nurses (including specialist nurses, nursing auxiliaries and assistants), dental practitioners, pharmacists, Insurance professionals, electricians, surveyors, mechanical engineers, heating and ventilation engineers. Some further examples were given of sector specific shortages (yet to be quantified) in civil engineering, logistics, biological science, design and technology, and sustainable energy.

Wish List
English language (level 2+) was also mentioned as a desirable subject to further strengthen STEM skills, alongside time management, business awareness /entrepreneurship, teamworking, leadership and project management skills.

> "There's a level 2 shortage, particularly in electrical and electronic engineering."
> (STEM Education Provider)

"The jobs that we create, there are no relevant courses in the area that have been carried out. There are some that are close but either they do are not at the level of skills that we need or they are slightly not fit to purpose. We are in the building where there are many engineering firms and we all do similar sort of things. We all have similar problems with the recruitment. We are perfectly happy to take youngsters on but we struggle with getting people with the relevant skills for our industry." (Employer, Manufacturing)

"The main gaps we see are in ICT, construction and engineering, particularly motor vehicle engineering. We are seeing skills gaps in all of these areas especially at levels 2 and 3." (STEM Education Provider)

"Part of the gap that exists is through the transition from education into apprenticeships. The standard school teaching does not necessarily prepare those who have an interest in STEM in the construction industry for the working world, particularly at the level 3 Technician role. By looking to develop more options at school/college, those entrants will be more ready to come into the industry." (Professional Body)

Whilst STEM provision is available in each of the six geographical areas, local authorities report specific shortages in STEM for Wokingham and the priority areas for Slough currently are information technology, telecommunications, construction, logistics, and business services. The main STEM gaps are in level 3 upwards with major gaps in levels 4-6, engineering level 2 shortage, particularly in electrical and electronic engineering. In the cases where shortages in levels of study were specifically highlighted this is mentioned in the main report. But some degree of caution is needed given the sample size and short timescale for completion of the research.[21] Further research is recommended to quantify the level of demand in each area. The reasons why STEM gaps exist varied from a lack of demand from within local communities to changing recruitment patterns within a rapidly changing world of work.

Across Berkshire, there are widespread concerns about poor labour market signalling, skills shortages and skills gaps when it comes to STEM, particularly careers support for young people. Many employers anticipate an increasing need for people with higher-level skills, and express decreasing confidence in their ability to recruit these in sufficient numbers. For example:

"The main issue related to STEM recruitment is related to recruiting apprentices. We see some decline in maths skills and abilities over the last 5 years" (Employer, Construction)

"There are not enough young people coming out of school at level 2 for engineering." (STEM Education provider)

So far, technical education remains the poor relation of academic education. The Sainsbury Review of Technical Education (op.cit) and the subsequent Government Post-16 Skills Plan (BIS/DfE, 2016)[22] have put the spotlight on finding ways to address the technical and academic divide. The Thames Valley Area Review of Post-16 Education and Training (2016)[23] identified where provision could be improved, while ensuring provision of quality education and training, better responsiveness to local economy and employer needs, and improving performance and efficiency in a tight fiscal climate. Recommendations were made

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[21] Further research outside the scope of IER's current remit is required to quantify the actual level of demand in each of the above-mentioned sectors and occupations.

[22] BIS and DfE (2016) *Post-16 Skills Plan*, London: Department for Business, Innovation & Skills and the Department for Education, July 2016
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/536043/Post-16_Skills_Plan.pdf

[23] Thames Valley Area Review, Final Report -
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/585770/Thames_Valley_15_November_2016_FINAL.pdf

on whether colleges should remain standalone institutions, or pursue plans for reorganisation, collaboration or mergers. The TVB LEP informed this review, focusing on Levels 2 and 3 education and training provision (technician level). They paid particular attention to apprenticeships in the area (see Skills Priority Statement, pp. 69-78). The analysis aimed to identify any current training provision gaps that could be improved. The three main areas where gaps were found were: **Digital Technologies, Engineering and Construction.**

CASE STUDY 1
UTC: WORKING WITH INDUSTRY TO FILL SKILLS GAPS
UTC Reading opened in September 2013, as a result of a shortage of computer scientists and engineers in the Reading area. UTC delivers computer science and engineering qualifications for 14-19 year olds within a 15-mile radius of the campus. The aim is to educate and train the next generation of technicians, engineers and industrial innovators, solving real-life industrial and community problems. UTC draws on the expertise and resources of its industry and academic partners, refreshing the curriculum with their guidance and input. Computer Science is a core curriculum subject in UTC Reading at Key Stage 4, and provides specialisations at Key Stage 4 and progression pathways at Key Stage 5, to include: Programming and software development; Networking and communications technologies; Engineering and systems.

The skills gap – **'particularly Computing and Engineering:** 'Civil engineering is quite high on the need here and computer programming, software development'.

Girls in STEM: 'When you have a mixed team working together…you're going to bring in all perspectives and ways of working, and two industries in particular (Computing and civil engineering) lost out on that. If you just get more females interested, you'll probably close the skills gap completely'.

Drop-off in interest at the start of secondary school: In primary school both boys and girls are keen on engineering and computing, 'then they hit 11 and go to secondary school and into a very strict and rigid curriculum which doesn't have any engineering in it, don't do a great deal on careers…there's 3 years of time where they almost re-normalise'.

Lack of focus on STEM careers among local schools; competition with the UTC: 'Considering these are the top 4 or 5 careers or job roles desperately needed in this area, it's hard to believe that a school isn't making that connection'. Schools do not identify the UTC as a potential career path for a student: 'it's a battle zone out there; you don't want to be losing 5 good kids just before they start their GCSEs… we're also recruiting loads of their staff in Computing and Engineering which is hard to recruit as it is'.

What do we do about it?
*   **Focus more on apprenticeships:** UTC students often opt for apprenticeships, 'particularly those that have degrees attached to them…they don't want the debt that a university degree might bring'. UTC 'probably ahead of the curve' in challenging traditional views about university.

*   **Influence the media/improve the profile of apprenticeships**: Media advertising on the percentages of students going to particular Russell Group universities within schools: 'the big headline that the media jump on'. 'So where is the percentage of students who went into higher-level apprenticeships in blue-chip companies, where is that equivalent?' A lot of 'forward-thinking companies are now adjusting the balance between graduate and apprenticeship schemes'.

*   **Provide better preparation for work:** UTC's overarching aim is to get young people into Computing and Engineering jobs; 'the qualifications are part of that journey'. In other schools the qualifications are the journey in itself ('very results-driven and not much exposure to apprenticeships'). Many UTC students end up working for their industry partner organisations (e.g., Cisco has around 12 UTC graduates); 48% of those choosing apprenticeships went to their industry partners: 'that's great, and it's great for the companies that work with us'. **Schools to capitalise on the UTC's**
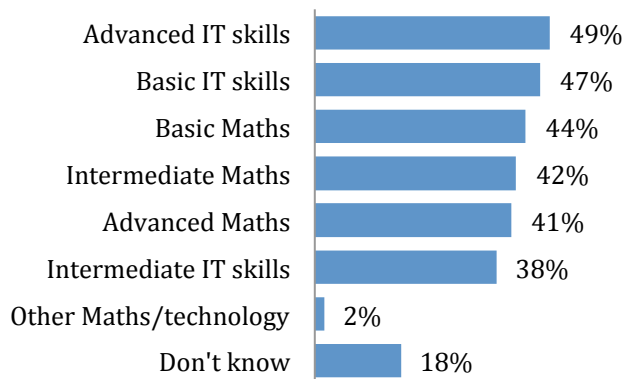
- **resources; see as partner, not competitor:** 'UTCs can be a hub for the other schools', e.g., UTC runs a STEM hub but many schools feel threatened or have competing priorities.

- **Start young and target girls:** 'Getting women into STEM has to be addressed at 7 before stereotypes set in'. UTC runs female-only tutor groups, with support from industry partners.

- **Get Ofsted involved and better careers advice and guidance**: If Ofsted compelled schools to consider their local job market and how much weight each school gave to this in relation to its educational priorities, schools would have to respond (but need to provide support in linking up with industry). Ensure that the school leadership teams (including governors) are fully behind careers advice and guidance, 'particularly in STEM… making sure that they know what the local area needs'.

- **Work more closely with parents** on understanding the opportunities around apprenticeships and university and the skills needs of the local area.

- **Compulsory volunteer days for staff in industry**: based on organisational size, staff should have to work with schools on a certain number of days to help deliver the Tech curriculum (not 'abstract', but practical work); if 'a one-man band or an SME, this could mean one day a year'.

Visit: http://www.utcreading.co.uk/

From the Berkshire STEM employer survey, among the 43 employers who reported a STEM skills gap – see Figure 1 below.

Figure 1: Maths and/or technology skills shortages

Advanced IT skills — 49%
Basic IT skills — 47%
Basic Maths — 44%
Intermediate Maths — 42%
Advanced Maths — 41%
Intermediate IT skills — 38%
Other Maths/technology — 2%
Don't know — 18%

Unweighted sample base = 43

Amongst employers that require staff with Maths and/or technology skills, a quarter (24%) said their business finds it difficult to recruit staff with these skills. This increases to 32% in the information and technology sector. In terms of the level at which recruitment difficulties have been experienced within STEM occupations, employers have struggled with both senior and junior positions in most areas. However, difficulties experienced for recruitment into finance occupations have tended to relate to senior positions. From the stakeholder interviews, the majority of respondents highlighted the need to focus greater attention on technology and engineering skills. For example:

> **"***UTC's overarching aim is to get young people into Computing and Engineering jobs; 'the qualifications are part of that journey'. In other schools the qualifications are the journey in itself ('very results-driven and not much exposure to apprenticeships'). Many UTC students end up working for their industry partner organisations (e.g., Cisco has around 12 UTC graduates); of the 52% of students who went into*
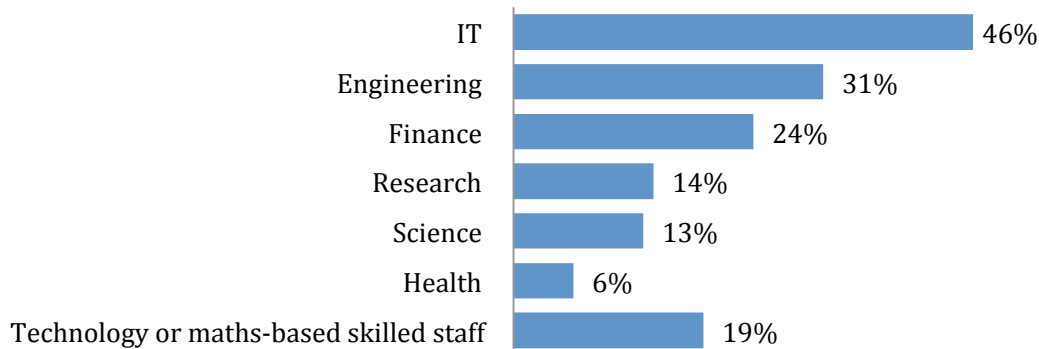
apprenticeships last year, 48% went to their industry partners: 'that's great, and it's great for the companies that work with us.'' (UTC Reading)

From the Berkshire STEM employer survey, of those that have recruited any staff into STEM occupations in the last 2 years, 32% have experienced difficulties. This equates to 7% of all employers. Around half of businesses with 50+ staff at the site that have recruited have experienced difficulties in filling STEM roles. STEM occupational areas in which employers have experienced difficulties recruiting are summarised in Figure 4 below. Most frequently mentioned were IT roles (46% of those experiencing difficulties), followed by engineering roles (31%).

Some of the stakeholders identified concerns that if there is too much focus on what is needed *today*, this can fail to adequately consider what skills will be needed in the future. This issue is especially important given the rapid pace of technological change and the time lag between students in secondary education and their employment – eight years can elapse between the start of GCSEs and the end of a university degree. Therefore, consultation with employers who work in high-technology areas was considered important to makes sure that the skills being offered are ones that will be needed in the future. More fundamentally, teaching young people the foundations of, and principles behind different subjects, for example, computer science would help to ensure that they are capable of adapting to rapid changes in technology. From the Berkshire employer survey, occupational areas in which employers have experience difficulties recruiting are outlined in Figure 2 below.

Figure 2: STEM occupational areas in which employers have experienced difficulties recruiting

Unweighted sample base = 19

IT	46%
Engineering	31%
Finance	24%
Research	14%
Science	13%
Health	6%
Technology or maths-based skilled staff	19%

There were key challenges outlined by some in education who highlighted how they struggle to keep up with latest technological advances in businesses e.g. computer programming and customised ICT systems are highly prevalent. For example:

> *"We have the challenge of keeping up-to-date with what IT employers are using in the workplace e.g. new programming language." (STEM Education Provider)*

> *"There is an issue in that design and technology is not in the bucket."* (STEM Education Provider)

The findings show that the 'T' element is significantly under-developed in schools and colleges partly due to the rapid pace of change and also the costs associated with education institutions purchasing new equipment for students to practice on as part of their formal schooling. It was highlighted that:

> "*Serious pressures on education, training provider and local authority budgets between now and 2020 means we need to form new alliances between technology experts and those working in public sector education to ensure technology-driven schooling is totally relevant for 21st century workplaces."* (Educationalist)

> "*Maths and IT skills are the two main shortfall areas when it comes to skills gaps in Berkshire (and elsewhere)…the requirement for young people to repeat their maths if they don't get a grade C or above first time around can often detract from the investment needed in high-level ICT skills development. Is this the right priority, particularly for those who repeatedly fail to make the grade and then drop-out*" (Educationalist)

> "*There is a real need for high quality Computer Scientists and yet there are many unemployed computer science graduates (a disjoint between quality of supply and demand need). Possible reasons: people not having the right skill set; some not being fit for work, not motivated by the workplace ('just after the money'). The right candidate is 'very malleable, really smart, learns really quickly.' 'Mathematicians make fabulous programmers, we're always pleased to take them on and they have a generic skill set* " (Employer, digital technology).

The majority of participants called for more employers to come forward to co-create curriculum, co-design opportunities and co-partner with schools, colleges and universities to give more young people and adults exposure to and experience of the world of work, particularly for those whose networks are limited - see Annex 2 for examples within (and outside of) TVB.

From an employer perspective, there is a great deal to be done to improve the "T" element with STEM – see Case Study 2 below.

CASE STUDY 2
FAIRSAIL: IT'S 'T' TIME
Fairsail is currently ranked as 'the fastest-growing tech scale-up in the UK', growing from £1m to £10m revenue in 3 years, and doubling its workforce to 135 by 2016. A cloud software business with its HQ in Reading, the company was founded in the UK almost 10 years ago but operates on a global basis: still privately-held, but Sage24 now has a 20% stake. Customers are mid-sized businesses with an average size of around 600 people.

We are a technology company, passionate about the whole STEM area…bringing the right people on board is absolutely critical to our success'.

A particular skills gap: The T (technology) is the single biggest problem in STEM. 'To build a business like Fairsail, you need to know how things actually work and you need people who can programme and code. It's not enough to have just done Maths and/or Biology. We need people that have done Computer Science (CS)'. There is less of a gap in Maths and Science (core subjects at GCSE level). Fairsail's CEO quoted figures which showed that there are only 143 students doing 'A' level CS in Berkshire (a relatively new 'A' level replacing ICT): 'these are people who are going to be our programmers in 5 years' time…in the UK's oldest tech corridor…and there are 143 of them'. The percentage of females following this route needs to substantially increase.

What is the impact? Fairsail is already shipping programmers in from Italy and Spain to fill the gap: one option is to move software development off-shore: 'that's a shocking outcome for the UK, that's an admission of failure…but if this doesn't get fixed, that's exactly what we will have to do'.

What do we do about?
- **Acknowledge the problem**: This is a key gap and unless people care about it, nothing will change. Publish the statistics on 'A' levels more widely to highlight the problem.
- **Identify a champion(s)**: A senior leader who can champion STEM and pull in relevant people to work together (e.g., a local MP, University Vice-Chancellor, senior business and education leaders).

- **Set targets**: A target of 5000 young people doing Computer Science 'A' level by 2022 (and fast-track some students and older learners to do it in a year): 'let's have a big hairy goal that we all approach together, I'd love to see something like that'.
- **Target teachers**: Provide a 'coding for dummies' course for all teachers because 'unless they're a bit more comfortable with it, then they're just going to be locking the doors and saying go away.' Use industry to help with this i.e. technology companies are best placed to teach coding: 'as soon as you open a book it's out of date'. 'We need buy-in' from Berkshire's teaching professionals.
- **Start early**: Target 11-year olds upwards to increase the level of interest and enthusiasm for STEM subjects, particularly the 'T' element.

Quick wins:
- **Identify role models** from every SME in Reading to go into schools and talk about Technology: 'inspire the teachers and students'. Make better use of female alumni working in technology industries.
- **More schools to promote STEM for girls:** 'Imagine if schools or after school clubs set up a coding class and made it cool…it's how it's packaged' – focus on changing the image to address gender stereotypes.
- **Make the most of STEM opportunities**: Schools should capitalise on CSR requirements in large Technology companies: 'companies are desperate to offer things…they will offer things like Tech boot-camp because it makes them look good'. Technology organisations could also help to write the curriculum within universities: 'brings it up to date'.
- **Institutes of Technology (IOT)** 'I think UTCs are brilliant…I would love to see ten times the number. We already have UTCs so why not do more of those?' 'Don't get distracted'; focus on what works already.

Visit: *https://www.fairsail.com/*

Institute of Technology

The government intends to support the creation of new Institutes of Technology with a £170m allocated for capital funding (HMG, 2017). Potential bidders will be able to adopt models best suited to their local needs. These institutes will increase the provision of higher-level technical education, which only exists on a limited scale in the UK today. The intention is to ensure that an Institute of Technology is available in all areas. For example, a person could study a level 3 (A-level equivalent) at a local college, before moving on to study a higher-level technical qualification at an Institute of Technology. New 'T-levels' in 16-19 Technical Education will deliver the recommendations of Lord Sainsbury's panel (IPTE, 2016)[25].

The skills gaps identified by the University of Reading were:

> *"…definitely around the Tech skills…there's a major gap in terms of the skills, the supply and demand'. Supply issues are accentuated due to the large number of Tech companies in the area: 'we have a significant number of enquiries from employers…for placements for graduates and to meet those skill gaps."* (University of Reading)
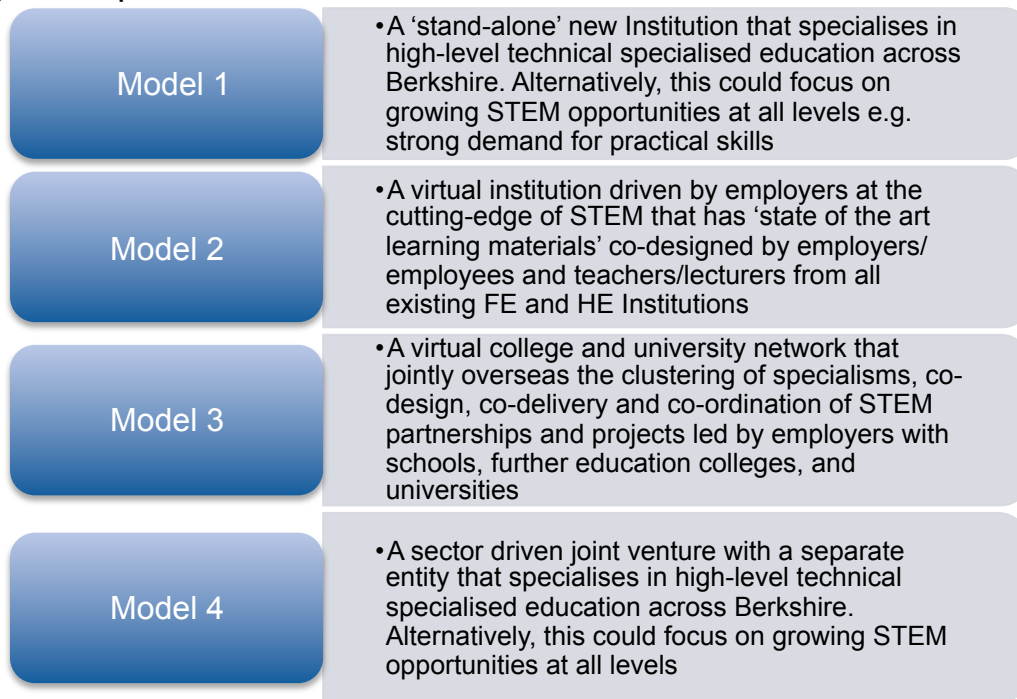
Our findings indicated the need to fundamentally improve the status, value and understanding of technical education skills generally, including STEM specific skills, as a rewarding route to work. From the Berkshire STEM employer survey, the majority of employers (84%) said they would welcome an Institute of Technology in Berkshire. One in eight (13%) said they would not and the remaining 3% did not know if they would or not. A TVB LEP Working Group is being established to explore options in this regard. Within the 'Gearing Up for STEM' research, participants in the stakeholder interviews and case study visits were asked their views on what is actually needed in this regard.

Each of the six case studies within this report offer more detailed insight to what provision is lacking that could be improved by an Institute of Technology and/or greater levels of promotional STEM activity. Findings from telephone and/or face-to-face visits also indicated

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25   IPTE (2016) *Report of the Independent Panel on Technical Education,* London, April 2016. p.7.

the majority were very keen to explore all available options. Some suggested models were described as follows in Figure 3 below to feed into local planning.

Figure 3: IoT potential models

Model 1	• A 'stand-alone' new Institution that specialises in high-level technical specialised education across Berkshire. Alternatively, this could focus on growing STEM opportunities at all levels e.g. strong demand for practical skills
Model 2	• A virtual institution driven by employers at the cutting-edge of STEM that has 'state of the art learning materials' co-designed by employers/ employees and teachers/lecturers from all existing FE and HE Institutions
Model 3	• A virtual college and university network that jointly overseas the clustering of specialisms, co-design, co-delivery and co-ordination of STEM partnerships and projects led by employers with schools, further education colleges, and universities
Model 4	• A sector driven joint venture with a separate entity that specialises in high-level technical specialised education across Berkshire. Alternatively, this could focus on growing STEM opportunities at all levels

There were mixed views on what was needed when it comes to a new Institute of Technology in TVB. For example:

> *"It would be good to have an institution that is focused on STEM and to have all the relevant courses in one institution, which need to have closer ties to industry"* (Employer, small business)

> *"An IoT could provide higher value, more focussed education which would meet the needs of the industry. By having a centre of excellence that meets the current needs of the construction industry for technical training, a higher skilled entry level workforce, through apprenticeships, would start their career path in the industry."* (Professional Body)

> *"There need to be multiple routes available. We have already got colleges offering high level routes of studying technology. So, it would be of interest to create a new Institute of Technology delivering technical education."* (STEM Education Provider)

In nearly all cases, interviewees welcomed this new forthcoming initiative. However, some employers emphasised that:

> *"Predominantly, if you want to deliver higher level technical education the gap is the link to the industry in the area."* (Large Employer, Engineering)

It was also suggested the Institute of Technology could potentially act as a hub for apprenticeship schemes. For example:

> *"A lot of big companies run their own apprenticeship schemes 'but the SMEs might not want a whole apprentice, they might want to share one'. IOTs could also 'make enormous use of online resources, MOOCs etc….but it has to have a base…the place that people know they can come to on a Tuesday evening to use the IT equipment, to upskill and get some advice…the more technology moves forward, the*

more we need to make sure that that interpersonal relationship stays there"
(Educationalist).

A LEP Working Group is being established to explore all options.

CASE STUDY 3
REDWOOD TECHNOLOGIES: CREATE AN INSTITUTE OF TECHNOLOGY TO RIVAL MIT

Redwood Technologies started in 1993 as a hardware and software engineering company (now 100% software engineering). About 12 years ago a sister IT company was set up (Content Guru), providing communication services on the cloud. Around 1000 enterprises use the company to manage their complex communications (email, webchat, telephone, social media, etc.). Redwood currently has around 140 staff but is growing (plans to take on at least another 60 people this year), with around 70-80% coming from a STEM background (ideally Computer Science, but some Maths and Physics graduates), hiring mostly from Russell Group universities.

The skills gap: 'There is a real need for high quality Computer Scientists' and yet there are many unemployed CS graduates (a disjoint between 'quality of supply and demand need'). Possible reasons: people not having the right skill set; some not being fit for work, not motivated by the workplace ('just after the money'). The right candidate is 'very malleable, really smart, learns really quickly.' 'Mathematicians make fabulous programmers, we're always pleased to take them on and they have a generic skill set'.

What do we do about it?
Branding important: 'We must brand this strip (in Bracknell/Reading corridor) Tech Valley' – a great concentration of IT/Tech companies: 'we don't think about it but we must protect it' (need Computer Scientists to succeed).

Build a world-class Institute of Technology, create a halo effect and remain global:
'…the equivalent to MIT, a pinnacle organisation where we can say we've got an institute of technology in Tech Valley…. Currently there is no strongly Tech-focused university and institution…that's the very pinnacle of what we need to do educationally – be absolutely up there in terms of the research we carry out, in terms of the entities that people can work with'. Advantages: 'To take advantage of the many multinationals in the area' (e.g., Fujitsu, Vodafone, etc.), as well as many mid-sized organisations and 'exciting start-ups' so 'a spectrum of businesses that could be associated with it'.

- Capitalise on international links, with London and Heathrow close by. Then use a 'halo effect' with connections into other universities and FE colleges 'but we're going for this platinum brand'. This would 'draw talent into the area' and 'we want to keep that clustering effect of big IT, mid-sized and fast-growth IT'.
- Use Reading University as the organisation they would go to due to its geographic location and because they have the land available: 'and we'd start there'. Set up similar to Henley Business School: 'can we build something that's an MIT equivalent?'
- Remain as a global player after Brexit (e.g., Panasonic are selling their European offices in Bracknell; although remaining in the area, 'they are much more liquid and able to re-establish in France or Germany' if it all goes wrong with Brexit). As a business, 'we don't want to find ourselves suddenly isolated…there's a slight agenda there to make sure we offer a lot in the region'.

Promote flexible careers for women in STEM: IT allows flexible work practices (e.g. home working) making it possible to have a career AND raise a family rather than having to choose one.

Universities and schools need to provide the right tools for students: Many students do programming but not in useful or relevant programming languages: 'we need to get people not being lazy with courses…technology is really fast'; at school 'get them to use tools that are industry tools…you have to force yourself to be constantly learning…Universities have to up their game'.

University support in attracting talent creates a win-win: 'There should be an obligation if you're a university to help people get employment…and that doesn't preclude them from

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making a bit of money from it'. Also, the university could help with identifying ('sign-posting') particular students' strengths and weaknesses: 'as a student it would force you to up your game'. Would certainly help organisations.

Focus on international trade: 'Let's work really hard at becoming great traders again' (e.g., set up trading posts in different countries; try and make the most of Brexit, specifically in relation to trade: 'having an international view on business – a global environment' while also celebrating things that are local, e.g., the Thames Valley.

Create a local buzz for young people: The area can be a challenge, in spite of the number of tech organisations: nowhere to socialise: 'the area is really lacking…we've lost a lot of people because we're based in Bracknell'. A need for cohesion, e.g., the LEP could have gatherings of recent graduates: 'build an informal community, create a buzz…get that feeling of a cluster which is what we're really after'.

http://www.redwoodtech.com

Post-Brexit

Moving towards a post-Brexit era, economic development and renewal will require greater forms of agility. This should be powered by the skills and entrepreneurship of people in localities, including those up and down supply chains in different STEM sectors.

- For businesses, a key imperative is the ability to recruit the right talent and to develop and use individuals' knowledge and skills effectively for business growth. Those highly dependent on attracting and retaining international talent from the EU will face new challenges post-Brexit.

- For individuals to get in, get on, and move up in learning and work (UKCES, 2014)[26], this will require new forms of careers adaptability and resilience unmatched in the past. Many people are having to change jobs and fields of work more often than in the past. The 'gig economy',[27] portfolio work and growing demand for decent quality jobs are on the increase (Warhurst, 2016).[28]

From those who responded to the Berkshire STEM employer survey – see Figure 4 below , one in five employers (20%) reported that the UK's exit from the EU will make it more difficult to recruit and retain staff in STEM occupations. This increases to half the employers with 50 or more staff. Fewer employers think it will be less difficult (14%). Most of the remainder (56%) currently think there will be no change, while one in ten employers (10%) do not know. There were some concerns that uncertain immigration policies may hold back businesses when it comes to recruiting from a 'ready made' overseas talent pool.

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[26] UKCES (2014) *Climbing the Ladder: Skills for Sustainable Recovery,* Sheffield, Wath-Upon-Dearne. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/378968/Summer_What_0v41.pdf

[27] https://www.forbes.com/sites/nextavenue/2016/01/24/gig-economy-better-for-boomers-than-millennials/#79e3cf2fc3c6

[28] Warhurst, C. (2017) *Accidental tourists: Brexit and its toxic employment underpinnings,* Dublin: Eurofound. Retrieved from: https://academic.oup.com/ser/article/doi/10.1093/ser/mww043/2896901/Brexit-understanding-the-socio-economic-origins

Figure 4: Whether it will be more or less difficult to recruit and retain staff in STEM occupations following the UK's exit from the EU (all respondents)
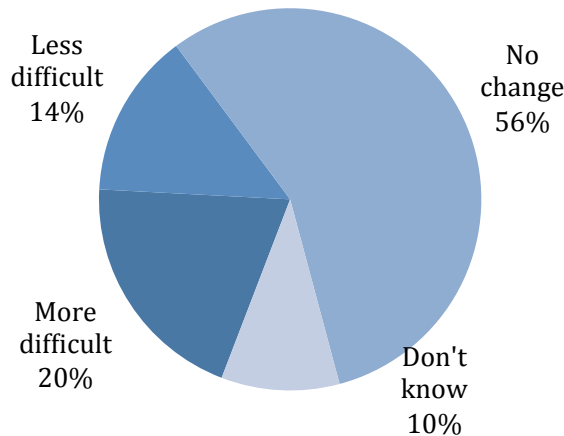
Unweighted sample base = 151

Within the stakeholder interviews, the majority of participants indicated the need to urgently prioritise STEM at a national, regional and local level to help address current and future skills shortages and skills gaps that are likely to be further exacerbated in a post-Brexit area. There were clear messages that more needs to be done to nurture local talent, particularly 16 – 24 year olds who are experiencing prolonged transitions in education and for adults facing uncertain futures. There were some concerns that uncertain immigration policies may hold back businesses when it comes to recruiting from a 'ready made' overseas talent pool.

> *"Don't make it harder to hire non-Brits because the gap in skills will take 5-10 years to fix"* (Employer, small-sized company)

> *"Remain as a global player after Brexit (e.g., Panasonic are selling their European offices in Bracknell; although remaining in the area, 'they are much more liquid and able to re-establish in France or Germany' if it all goes wrong with Brexit). As a business, we don't want to find ourselves suddenly isolated…there's a slight agenda there to make sure we offer a lot in the region"* (Employer, Technology)

Potential restrictions on the free movement of labour, following the EU referendum result, highlight skills shortage issues:

> *"No problem recruiting but we do have a problem recruiting people from this area and country…we're relying more and more on European and overseas skills for the STEM subjects than growing our own at home' (60-70% of applicants are from overseas, some of whom have studied in the UK). Recruiting from overseas costs a lot more and takes a lot longer with visa processing."* (Employer, large company)

In addition, key local issues include the cost of housing and lack of STEM teachers; something TVB LEP aims to address through its cross-cutting Skills and Economic Plan (SEP). Most of the above issues raised by respondents are inter-twined, therefore, it is timely to redouble collective efforts to improve STEM education and training for all.

Many employers anticipate an increased need for people with higher-level skills, and express decreasing confidence in their ability to recruit these in sufficient numbers. The 'T' element is significantly under-developed in schools, colleges and higher education due partly to the rapid pace of change and also the costs associated with education institutions purchasing new equipment for students to practice on as part of their formal schooling. Professor Sir Adrian Smith's forthcoming independent report[29] to Government into the feasibility of compulsory

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[29]   On 17th March 2016, the government announced Professor Sir Adrian Smith will review maths teaching for 16 to 18-year-olds, with a focus on skilling a future teaching workforce.

maths study for all pupils up to 18 is likely to put the spotlight on the 'M' element both nationally and regionally.

Findings from stakeholder interviews showed a strong appetite to do more locally to significantly increase STEM skills at all levels. There were clear messages that more needs to be done to nurture local talent, particularly 16 – 25 year olds who are experiencing prolonged transitions in education, as well as many adults, particularly those with STEM knowledge and skills that are currently under-utilised e.g. career switchers and women returners.

How to improve the STEM talent pipeline, including reducing gaps in provision and addressing STEM skills shortages and skills mismatch

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A compelling careers offer

In most countries, careers work and public policies are based on the notion that this is both a private and a public good. Labour market economists and educationalists have long recognised that high quality careers work matters when it comes to the effective functioning of the labour market, the economy, the education system, and achieving social justice (IPTE, 2016).[30]

For the first time in recent years, government has indicated it wants to ensure that "*great careers guidance provides the first rung on the ladder of opportunity, helping everyone to achieve their full potential…A total of £90m is being invested in careers over this Parliament*" (op.cit). In reality, the figure may be higher as this does not include £87m (circa) currently being invested in the National Careers Service. The careers market for services to young people (2012 – present) is largely unregulated and there exists a multiplicity of private, public and voluntary sector providers offering free and/or costed services in a highly competitive environment. Careers work includes:

(i) *careers education* (including self-development, exploration and management);
(ii) *work-related learning* (about types of work, developing skills for and through work); and
(iii) *careers information, advice and guidance* (Hutchinson, 2013).[31]

There are calls for improvements in education and skills, supported by careers provision for people of all ages[32]:

> "*Our improved education and skills system must be supported by high-quality careers provision…Careers provision continues to be patchy and inconsistent – both in schools and in later life. The Government is reviewing the current* **careers offer for people of all ages***, and will build on the best international evidence to publish a comprehensive strategy later this year for careers information, advice and guidance*"(p.45).

> "*We can see first-hand the negative effects of young people not getting the support they need in schools to make well-informed decisions.*" (Employer, small business)

A plethora of reports all reaffirm the critical and urgent need for improvement in careers services for young people, in line with the Education Act 2011 and Revised Statutory Guidance (DfE, 2015)[33]. Schools have an obligation to secure access to independent and

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[30] IPTE (2016) *Report of the Independent Panel on Technical Education,* London, April 2016. p.7.
[31] Hutchinson, J. 2013. *School Organisation and STEM Career-related Learning. York*: National STEM Centre.
[32] Prior to the 2010 general election, the Conservative Party had included in its election manifesto a commitment "*to create a new all-age careers service*" in England (Conservative Manifesto, 2010) to correspond to those already developed for young people and adults in the rest of the UK.
[33]
      https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/440795/Careers_Guidance_Schools_Guidance.pdf

impartial careers guidance for their pupils. The Gatsby 'Good Guidance' principles (Gatsby, 2014) are acknowledged by government as a useful framework for schools to adopt. At present, young people have access to a national helpline and web-service with no face-to-face local careers guidance (NCS providers and other agencies can provide such traded services to young people, but not as the National Careers Service). A government-led national careers strategy is anticipated later in the year which should create local opportunities to 'piggy back' on this to drive up improved careers provision for all of Berkshire's young people.

The education and training markets are changing at a rapid pace. The reforms set out in the Academies Act (2010) and subsequent Education Act (2011) made a significant impact on how schools and colleges are organised and run. There now exists a plurality of provision including: state schools, free schools, academies, university technology colleges (UTCs), independent schools and colleges, and further education colleges. Greater autonomy is devolved from government to head teachers and college leaders to run their institutions and teach lessons, as they deem appropriate e.g. many Academy Trusts are members of sponsored 'chains' or trusts operating under varying degrees of collaboration with industry.[34]

The careers marketplace in TVB LEP (and elsewhere in England) is crowded with key players such as: the Careers and Enterprise Company CEC), National Careers Service, Education Business Partnerships (EBPs), Jobcentre Plus, Local Authority Traded Services, National Apprenticeship Service (NAS), Universities and Colleges Admission Services (UCAS) and many other local and national initiatives e.g. LEPs, charities, social enterprises and sole traders. In all cases, these and other STEM intermediaries appear to be doing their best locally to work in the interests of young people and employers – see: Annex 4. Some employers reflected on local arrangements, for example:

> *"The careers system is in a complete mess and its time for us to step it and try to get this sorted. It's hard to believe that so many young people and parents are simply left to educate themselves on the myriad of options out there…where do they go if they want some solid independent careers advice?"* (Employer, Engineering)

Across Berkshire, there are widespread concerns about poor 'labour market signaling' e.g. STEM skills shortages and skills gaps, particularly careers support for young people, and educational opportunities for adults from under-represented groups in STEM industries. Positive steps have already been taken by TVB LEP to drive up STEM skills through joint working with further education colleges and the creation of Solution Labs. In addition, STEM links between education and employers are being nurtured by a wide range of organisations, including the Careers and Enterprise Company, in each of the six geographical areas – see Annex 3. But, there is complexity and confusion in the careers marketplace with multiple players in competition.

> *"We really struggle to get into schools to talk about vocational routes…this is a highly competitive area and most schools want to hold on to their best students…the current system needs a really good shake-up."* (Educationalist)

> *"Many schools are reluctant to let go of their academically able students"* (Employer, Technology)

> **"***Too many organisations are working in silos ad treading on each others toes, basically duplicating effort. There are too many companies chasing schools and many simply switch off."* (Educationalist).

There are local concerns about inequality in careers provision for young people, parents/carers and careers education training for teachers, particularly in schools.

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[34] Statistics indicate 54% of academy schools in England are currently members of multi-academy trusts (MATs) comprising at least two or more schools (DfE, 2015). Even those schools that are not part of such arrangements, that have converted to academies in isolation, are encouraged to work with other schools in their locality and, depending on how well they are performing, either to provide support to or be supported by partner schools.

"Parents can't be expected to fix the problem of inadequate careers advice in schools. It's okay for people like me who have great networks that my children can tap into, but what about those who don't have the support at home…STEM careers advice for parents should be a high priority in Berkshire." (Employer).

'Let's bring parents and children from schools together with the people from industries in Berkshire. Let them go away with having a conversation.' (STEM Education Provider)

'It would be good to find a way of bringing teachers into the conversation about STEM opportunities. We aren't making the most of collective STEM resources and expertise in the area. We would like our local university to open its doors to more teachers and offer them STEM professional development days working with growth industries.' (Educationalist)

In most cases, it was highlighted that teachers are under pressure delivering to set targets and have limited exposure to corporate environments which leaves little time for STEM activities. For example:

"A lot of teachers have never been in a corporate environment…they're not aware of a lot of things that are going on and they're not experts in that area, not qualified to be giving careers advice." (Major employer)

Findings ways to alleviate concerns about young people's lack of exposure to and awareness of the changing world of work was identified as a key imperative, for example:

'STEM activities need to start early in primary schools to inspire children try out all sorts of activities and the address gender stereotypes. As well as exciting Astronauts like Tim Peake, ordinary people can also share what it's like to go to work and make things happen.' (Employer, medium-sized company)

'We don't see much evidence of young people coming to us work ready…it's difficult for us to get into schools.' (Employer, medium-sized company)

Meaningful encounters with employers, particularly in workplace settings were identified as an important means of building young people's confidence and network , for example:

*'There is no shortage of employers willing to do more.. it's just a question of working out which activities will have most impact.' (*Employer, large company)

'It would be terrific to have more employers inviting students into their workplace to learn about innovative projects that might excite them to achieve good exam results.' (Educationalist)

Young people having access to impartial and independent careers guidance was also cited as lacking, for example:

'It really important for parents to know what they and their children are entitled to when it comes to getting careers advice in school. Nowadays good leaders should really be on top of this.' (Employer, small company)

'I'm a school governor and I'm asking questions about the type of careers work being delivered throughout the entire system.' (Employer, medium-sized company)

'This is a problem that isn't going to go away…it needs urgent attention at a national and local level.' (Educationalist)

Also, teachers' awareness of labour market trends and greater investment in continuous professional development (CPD) was identified as hugely important, for example:

> "Continuing professional development for teachers is really important. It is not only about teachers talking to teachers, but industry should be involved in supporting CPD. Role models should be involved in CPD to provide some ideas and impact. For example, placement of teachers in the industry should be a key feature." (STEM Education Provider)

> "There is a teachers' placement programme, called 'STEM insight'. This program provides opportunity for teachers to experience a short snappy placement to create a better understanding of a huge variety of careers within STEM. I think that we need more of these programs because many teachers have never experience the diversity of the world of work." (STEM Education Provider)

For adults, there were indications that more needs to be done to support women returners, careers switchers with STEM skills from other sectors and older adults such as: more flexible working arrangements to fit around childcare or other caring responsibilities; more bite-sized STEM career learning opportunities; and more creative ways of inspiring adults to keep on learning given the financial and other associated costs.

There is a need for key agencies to come together to create 'a compelling careers offer' for young people and adults in Berkshire. This was a recurring theme throughout the research, though the former was identified as an initial key priority. Practical examples given included: a governor in every school and college keeping the spotlight on careers provision; a careers curriculum with STEM opportunities highly visible; the formation of careers clusters based on key themes to cascade good and interesting STEM developments. The notion of a compelling 'careers offer' for young people in TVB that brings together careers providers for collaborative working to optimise the STEM pipeline was identified as a positive way forward. Lessons learned from other areas such as London[35], Cornwall[36] and other regions[37] may be useful in this regard.

Under-represented groups

At a time of heightened national and local attention to improving education in the fields of science, technology, engineering, and mathematics, more work is needed - particularly on reaching deep into communities and networks as a strategy to boost knowledge and interest in the subjects. Despite decades of inventions, post-16 STEM participation rates remain stubbornly lower than projected requirements (HoC, 2016)[38], particularly in key areas, such as the physical sciences and engineering. Working class, women, and those from particular minority ethnic backgrounds (e.g. Black Caribbean and Pakistani/ Bangladeshi) are persistently under-represented.[39]

> "The construction industry always struggles to recruit females into the front line roles. This is not a new issues and there have been many projects about Women in Construction over the last 15-20 years to identify and encourage entrants. Ongoing awareness raising is the only way to do." (Professional Body)

> 'We need more local awareness raising activities e.g. STEM competitions and clubs.' (Educationalist)

[35] *London Ambitions: Shaping a careers offer for every young Londoner* - https://lep.london/sites/default/files/documents/publication/London%20Ambitions%20Careers%20Offer.pdf

[36] *Cornwall Careers offer 2016 -2020* - http://www.cornwall.gov.uk/media/23345753/cornwall-careers-offer-web.pdf

[37] Sheffield City has developed an all-age strategy for careers work with people of all ages.

[38] HoC (2011) Raising the Age of Participation, London: House of Commons - https://www.publications.parliament.uk/pa/cm201012/cmselect/cmeduc/850/85005.htm

[39] Archer, L., Dewitt, J., & Osbourne, J. (2015) Is Science for Us? Black Students & Parents Views of Science & Science Careers, *Science Education,* 99, pp. 199 -237 http://onlinelibrary.wiley.com/doi/10.1002/sce.21146/full

'There aren't enough STEM champions or ambassadors.' (Educationalist)

The Chancellor's Budget (March 2017) sets out further steps to achieve this ambition which presents new possibilities for new STEM developments across TVB:

- *Lifelong learning pilots* – The changing nature of work makes retraining and reskilling essential and so the government will spend up to £40 million by 2018-19 to test different approaches to help people to retrain and upskill throughout their working lives.

- *Return to work support* – The government will work with business groups and public sector organisations to identify how best to increase the number of returnships, supported by £5 million of new funding. Returnships offer people who have taken lengthy career breaks a clear route back to employment.

- *Loans* – To promote equality with full-time undergraduate study and support lifelong learning, the government confirms the terms of maintenance loans for part-time undergraduates, previously announced at Spending Review 2015. These loans will become available for degree level study in 2018-19, with an extension to distance learning and sub-degree study in 2019-20. New loans will provide up to £25,000 for doctoral study and have the potential to reach a wider range of students and research than before.

Girls constitute the group that is most likely to dis-engage with STEM. Although both boys and girls show high levels of interest in science at primary school (Murphy & Beggs, 2005)[40], gender differences emerge once science is no longer compulsory, with girls opting out of science even though their performance is as good as or better than that of boys. Girls made up 39% of 2014 A-level entrants for mathematics, and 21% and 8% for physics and computing; it is notable that girls outperform boys in STEM subjects at both GCSE and GCE level, including Mathematics and Further Mathematics (WISE, 2015).[41] Government forthcoming plans to introduce lifelong learning pilots and 'returnships' for people who have taken career breaks provide additional opportunities to focus on under-represented groups. Archer & Mendick (2014)[42] make explicit five key factors below that robust research findings show to be important:

1.	***Attainment:*** differential attainment contributes to uneven patterns of STEM participation, particularly in relation to social class.
2.	***Teacher perceptions/ practices:*** Strand's (2012)[43] research found that minority ethnic (particularly Black Caribbean) students are less likely to be entered into higher tier examinations than White students, even after controlling for prior attainment. Research also shows how the characteristics popularly associated with the 'ideal student', and particularly the 'ideal Physics student', tend to be aligned with white, middle-class masculinity, against which female/ working-class/ minority ethnic learners tend to be judged negatively, even if they are achieving well.
3.	***Perceptions of science/ scientists as white, male and middle class:*** Evidence from Aspires (2015)[44] suggests that young people regard STEM as white, male and middle-class, which contributes to the perception that STEM is 'not for me'.
4.	***Science capital:*** Science capital refers to science-related qualifications, interest, understanding ('scientific literacy') and social contacts (e.g. knowing someone who works in a

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[40] Murphy, C., & Beggs, J. (2005). *Primary science in the UK: A scoping study. Final report to the Wellcome Trust.* London: Wellcome Trust.

[41] WISE 2016, London

[42] Archer, L, De Witt, J. Osborne, J., Dillon, J., Willis, B. & Wong, B. (2013) 'Not girly, not sexy, not glamorous': primary school girls' and parents' constructions of science aspirations, Pedagogy, Culture and Society, 21:1, 171-194.

[43] https://berarespectingchildren.wordpress.com/2014/06/24/social-class-ethnicity-and-stem-participation/

[44] KCL (2015) *Aspires: Young People's Science & Career Aspirations,* London: Kings College London.

STEM-related job). ASPIRES found that the more science capital a family has, the more likely a child is to aspire to a science career and/or to study science post-16.

5. **The 'brainy' image of science:** ASPIRES found that young (particularly working-class/Black) people overwhelmingly associate science with being 'clever' or 'brainy', which contributes to a view of post-16 science as only for the 'exceptional few'. The English education system's culture of early specialisation and restricted access to Science A levels (compared to other subjects) appears to exacerbate these issues.

A lack of role models and images in society further accentuates the problem:

"It's not cool to be too clever and we're trying hard to reverse this idea in our STEM contact with school pupils" (STEM expert)

"Generally, more girls and women follow apprenticeships than men, but there are lower numbers of girls in core STEM apprenticeships in all growth areas" (WISE)

"From a micro-business perspective there's little time to chase after schools, colleges and universities – they need to come to us with practical ideas that can support our business and then we can help them by nurturing raw talent – we're willing to give people a second chance!" (Employer, small-medium-sized business)

'It is how these subjects are presented, particularly to young females…More encouragement needed well before GCSEs: 'the younger the better'. Girls at Key Stage 3 are often interested in Science but by Key Stage 4 this disappears – problems with the 'branding' of STEM, particularly for girls.' (Research Company)

There are many STEM initiatives that exist within and outside of Berkshire – see Annex 2 for examples of good and/or interesting policies and practices. There are also STEM initiatives both online and offline who challenge **s**tereotypes from a very young age by creating new toys, e.g., the new Lego characters based on black female scientists covered in the new film 'Hidden Figures'; new Barbie. But also, there is a need to be careful and avoid the 'pink' stereotype, and perhaps appeal to girls, as well as other under-represented groups in STEM, by using a creative approach.

"Us girls in tech don't see ourselves as girls, we just see ourselves in the industry, we absolutely hate girl initiatives. [They should be] inclusive initiatives. [We] don't want to see the whole girl thing because then it just becomes pink. And I think if you are putting more creativity into STEM you are going to capture these people anyway, you don't need to say that this is for girls or boys. I think it's more about the packaging and marketing rather than what sex or gender it's aimed at." (Company that helps tech start-ups)

The Institute of Engineering Technology (IET) sponsors 'women into STEM' talks, open to all students and advertised externally. On provider reported:

"It's an issue for boys as well as girls that we can't get enough girls into STEM" (Education provider).

There is likely to be an increased demand for STEM provision for 16 to 25 year olds with special education needs (SEN). The local authorities are keen to support an improvement in appropriate STEM progression pathways for these learners to support them to move into adulthood or on to adult social care packages. There were concerns expressed about the relatively small numbers of individuals taking a STEM traineeship, but these are a vital stepping stone to STEM apprenticeships for those who are not yet work ready or have English and maths grades that do not yet allow them to access the opportunities they want.

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CASE STUDY 4
WISE: TARGET FEMALE RETURNERS TO FILL SKILLS GAPS

Started by a female aeronautical engineer in the 1980s, WISE is now a social enterprise which supports organisations across the UK to get more women into STEM – from the classroom to the boardroom. It focuses on 'core STEM' activities where women are still in the minority (Physical Sciences, Maths, Computing and Engineering), i.e., where major skills shortages exist. Around 160 organisations who want support to widen their talent pipeline pay an annual membership fee to WISE (including some higher education institutions (HEIs) and further education (FE colleges). The head office is based in Leeds with peripatetic STEM support services delivered throughout the UK.

The skills gap – the talent pipeline: 'About half of schools (mixed state secondary schools across the country) don't have any girls studying Computing at 'A' level'. For those who do choose to follow this subject, there can be a sense of isolation from other female peers: 'where you're the only girl…that can be daunting and there's a high likelihood they drop out'. There is a need to get more of a critical mass, grouping the girls who want to do STEM subjects together and putting good support mechanisms in place, e.g. role models.

The skills gap – female leavers: Some evidence that many women in the Thames Valley had left high-powered, long-hours jobs in London and wanted something local for childcare purposes; they tended to either leave work altogether or downgrade into lower-level jobs: 'not using their qualifications'. These women could be upskilled (for those with existing STEM qualifications) or retrained in STEM and flexible working supports put in place.

Quick wins
Increase women returner projects e.g. Sky ran a 14-week flexibly delivered course for women who want to learn to code and work in technology, i.e. full-time days; part-time and also evenings/weekends. Participants did not need a Computer Science degree. The course was open to any age and training was free of charge. The rationale for this flexible approach was to enable women who needed to work during the day and/or those who had childcare or other caring commitments to fit this in to their everyday lives. This proved extremely popular – 'They were overwhelmed by demand' and offered courses in London and in Leeds. This employer leadership approach could potentially be replicated in Thames Valley Berkshire due to the large number of technology companies in the area.

Also, the Scottish Government pilot project for women returners focused on engineering in the energy sector. In this model, 6 companies paid the living wage to women for a 12-week placement which provided support in CV writing, interview preparation and support networking. The pilot also provided support to companies on how to introduce policies such as flexible working. Evaluation findings showed that both the employers and the women found this approach beneficial. The Scottish government has since announced they will roll the model out on a bigger scale.

Identify financial gains for employers: These projects were quite cost-effective in recruiting good people and the companies recognised the returns. Companies spend a lot on recruitment campaigns: 'this was another way of spending the same money but actually getting a good result'. 'Focusing on practical projects like that…actually putting numbers on it: this is what the cost was per woman, people can do the sums then…good value for money'. Visit: https://www.wisecampaign.org.uk/

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Starting early

Evidence from King's College London (2015)[45] suggests that many young people regard STEM as white, male and middle-class, which contributes to the perception that STEM is 'not for me'. Efforts to broaden students' aspirations, particularly in relation to STEM, need to begin at primary school. They suggest the current focus of 'most activities and interventions –

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[45] KCL (2015) *Aspires: Young People's Science & Career Aspirations,* London: Kings College London. p. 4 - http://www.kcl.ac.uk/sspp/departments/education/research/aspires/ASPIRES-final-report-December-2013.pdf

at secondary school – is likely to be too little, too late.' Fundamentally, they argue 'STEM capital' is needed to support aspirations to STEM careers.

Reducing the gaps

Ways to reduce gaps in provision in order to optimise the STEM talent pipeline were identified as follows: *firstly,* there is a need to incentivize individuals by giving them improved access to innovative and personalised labour market intelligence /information (LMI) linked to occupations, salaries and openings. This should build on exemplars of best practice already in the region such as the use of open source data through 'LMI for All' made available on apps, tablets and websites. *Secondly,* companies could potentially set their own key performance indicators (KPIs) within their strategic priorities to provide more exposure to and experience of the world of work to strengthen the connection between learning and the workplace e.g. more tasters, trials and interns etc. There could be opportunities to develop incentives for STEM employers, particularly SMEs, to offer work experience through competitions and/or business awards. *Thirdly,* the expansion of STEM apprenticeships, new standards and job opportunities is widely anticipated. There will be a need to monitor apprenticeship and traineeship trends and to feed this information into local communities, particularly SMEs. *Fourthly,* the talent pipeline can be improved by schools, colleges, training providers and higher education institutions' sharing and building on existing initiatives that promote specific STEM industries within and across Berkshire such as: joint competitions or themed weeks, including open days, and taster projects that are open to adults and not just promoted to young people in schools and colleges. *Fifthly,* there are opportunities to showcase employers who have successfully enabled vulnerable and/or under-represented individuals into STEM careers.

Addressing skills shortages and skills mismatch

The ultimate aim is to ignite enthusiasm, hope and optimism when it comes to individuals' making personal and financial investments in learning and work.

This requires more concerted effort by employers, educationalists, enterprise agencies, trade and professional bodies and careers providers to collectively provide and/or connect with STEM ambassadors in each of the six geographical areas – see typology above feeding into the 'Gearing Up for STEM: Action Plan'. It was noted there appears to be very differing levels of STEM ambassador representation across Berkshire. Work experience placements into STEM opportunities were identified as an area that requires greater attention. Strong leadership will be necessary to drive the STEM Skills Strategy and Action Plan forward, and most importantly, to drive up individuals and families' awareness of STEM opportunities.

From the Berkshire STEM employer survey, one in five employers report links with educational establishments (21%). These are likely to be with schools (11%), FE colleges (11%), and/or universities (9%). Larger employers are more likely than average to have such links e.g. 32% of employers (employing11-49 staff) and 38% of employers (employing 50+ staff) do so. Just under half of all employers would consider further links with educational establishments (45%) and are equally likely to consider links with schools (34%), FE colleges (35%) and universities (31%). Comparing those who already have links with those that do not, the majority of those with links already would consider further links (83%), while only 34% of those without links currently would consider them.

> How to maximize opportunities to further optimise STEM skills across the region, including identifying and responding to emerging needs and building greater awareness of opportunities across the community

A strong network

As a direct result of the 'Gearing Up for STEM' funded programme, which includes this strategy paper, there is an opportunity to build a strong network of stakeholders who, by working collaboratively, can maximise the impact of efforts to close Berkshire's skills gaps. There is scope to build a CEO-led STEM network to leverage the unique capacities of private, public and third sectors to drive forward this strategy and action plan. There are also opportunities to rally trade and professional bodies working with SMEs in particular, to foster

collaborative education and employer working links – and organisations such as Adviza and the EBPs are central to making this happen.

Marketing campaign

There is also a unique opportunity to manage a county wide marketing campaign promoting the Gearing up for STEM programme under the headline WOOP "Worlds of Opportunities" with key partners each contributing to building greater awareness and engagement in the mission of this programme.

Schools

There continues to be a deficit in the number of specialist Maths and Physics teachers in schools (nationally), and too many schools lack the capacity to offer students the Technology, Engineering and Mathematics courses they need. There has been a significant shortfall in the number of new recruits for Design and Technology and Computer Science teachers entering Initial Teacher Training Programmes in 2015/16.[46] A negative national trend reflected locally in this research study. The Government has reformed the content of GCSE and A level courses to make them more knowledge-based with rigorous assessment. From September 2017 onwards, the grading system for GCSEs is changing to a number based system with 9 being the highest and 1 being the lowest grade. Significant effort will be needed to help others understand where and how STEM fits into the new system.

The UK Office for Budgetary Responsibility (OBR) estimates more fiscal tightening over the next four years, particularly in the public sector (Oxford Economics, 2017). [47] Many local authority services have experienced cumulative cuts to the order of 45 per cent (JRF, 2015)[48] and the National Audit Office (2016)[49] indicates schools in England must reduce spending by 8per cent per pupil by 2020 - the biggest real terms cut in a generation. In February 2016, the National Audit Office (2016) reported between 2011 and 2014 the number of teachers leaving the profession increased by 11 per cent, while the rate of vacancies and temporarily filled positions doubled from 0.5 per cent to 1.2 per cent.[50] Furthermore, there has been a rise in the number of classes being taught in secondary schools by teachers without a relevant post-A-level qualification. Citing physics as an example, it was revealed that the proportion of classes taught by a teacher without a qualification in the subject rose from 21 per cent to 28 per cent in the four years to 2014.

There is a need to promote more specialist science, maths, design and technology and computer science teachers to fill existing and future vacancies in schools. Also, this reported ' ' provides an opening for more STEM employers (and suitably motivated and qualified employees) in Berkshire to step up activities in the co-design and co-delivery of highly innovative collaborative STEM education and this is needs to part of the consideration of an IoT.

The issue of teacher's having restricted access to continuous professional development (CPD) to update themselves on latest industry technological advances was a key barrier identified as part of this research. However, we came across examples of good and interesting approaches that have the potential to be replicated elsewhere e.g. employer buddying schemes e.g. GlaxoSmithKline, mentors and volunteer employees going into the classroom e.g. Peter Brett Associates; Sygenta placements for teachers - see also case studies in the main report.

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[46] Department for Education and National College for Teaching and Leadership, Initial Teacher Training Census for the Academic year 2015/16, England, Nov 2015

[47] Oxford Economics (2017) *The Green Budget 2017*, in association with ICAEW and the Nuffield Foundation. Retrieved from: https://www.ifs.org.uk/publications/8825

[48] JRF (2015) *The Cost of the Cuts: The impact on Local Government and poorer communities,* York: Joseph Rowntree Foundation, p.3.

[49] National Audit Office (2016). Government schools budget cuts. London: National Audit Office. in The Independent, 14th December 2016. Retrieved from: http://www.independent.co.uk/news/education/education-news/government-schools-budget-cuts-3bn-nao-a7473186.html

[50] http://www.telegraph.co.uk/education/educationnews/12148830/Growing-teacher-shortages-as-Government-misses-recruitment-targets.html

There are many examples of schools in Berkshire having innovative approaches, working with employers/employees, careers providers, charities and training providers to deliver STEM education both within and outside of the mainstream curriculum. These should be gathered systematically and shared across careers clusters in Berkshire. While recognising there is a considerable amount of effort, careers support, skills and expertise in promoting STEM education in schools in Berkshire, it is not universal. There are gaps in STEM provision which need to be addressed so that all schools are able to benefit from these opportunities. There are also opportunities to enhance existing provision.

Apprenticeships

Government and businesses are moving forward with new Apprenticeships and the Apprenticeship Levy arrangements (DfE, 2017).[51] Whilst the Apprenticeship Levy will immediately impact on large employers the wider reform agenda impacts on all employers. Businesses report tangible economic benefits from hiring apprentices. According to the Association of Accounting Technicians (AAT, 2014)[52], nearly three quarters (72%) of businesses surveyed for the Department for Business, Innovation and Skills stated that apprentices had improved product and service quality, while 68% said that apprentices had improved productivity. Hiring apprentices has also often brought additional benefits, such as improved staff morale, staff retention and organisational reputation.

Apprenticeships play a key role in equipping individuals with the necessary skills to drive growth in the TVB economy. Currently approximately 17% of Apprenticeships started in TVB are in STEM subjects, compared with 18% nationally. Central Government has set a target for the UK to support 3 million Apprenticeships by 2020. This would require an approximately 40% increase in the number of Apprenticeships being undertaken, an increase of 2,300 starts. Based on current proportions, this will mean at least an additional 400 STEM Apprenticeship starts per year.

Research undertaken by the Thames Valley Area Review of Post 16 Training and Education found that the two main gaps in which there appears to be gaps in Apprenticeship provision in TVB are Engineering and Science and Construction. To facilitate these Apprenticeships, there is a need for greater collaboration between schools/colleges and employers to ensure a ready supply of young people coming forward to fulfill the roles offered. These Apprenticeships are vital to equip the next generation with the necessary skills to drive growth in the TVB economy.

Universities will be providing degree apprenticeships across almost all of the available standards. Current growth is being driven by: chartered manager, digital and technology, and engineer-related degree apprenticeships. Figure 5 below provides an overview of existing level 6 & level 7 apprenticeship standards (initial estimates).

Figure 5:   Existing level 6 & level 7 apprenticeships standards

Level 6 & 7 standard already approved	% of total offer	No of apprentices 2015 – 2018	% growth 2015 – 2018
Chartered Manager	36%	2775	1685%
Digital and Technology solutions professional	33%	2530	240%
Engineering professional	20%	1490	910%

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51 https://www.gov.uk/government/publications/apprenticeship-levy-how-it-will-work/apprenticeship-levy-how-it-will-work

52 https://www.aat.org.uk/sites/default/files/assets/The_Value_of_Apprentices.pdf

The Berkshire STEM employer survey respondents that have recruited in the last 2 years were asked if they have used specified recruitment channels to fill vacancies for STEM occupations. Apprenticeships and work experience for school/college students have been the most commonly used. Around two-thirds of those recruiting in the last 2 years have used a range of sources (68%). From the Berkshire STEM employer survey, three in ten employers (29%) would be willing for any staff to become ambassadors for STEM occupations. This proportion is lower than average in construction businesses (12%) and higher than average in the professional, scientific and technical activities sector (42%). This increases with business size to 37% of employers with between 11 and 49 staff and 65% of employers with 50+ staff.

In 2016/2017, nearly 2,500 Berkshire employers offer Apprenticeships. Advanced Apprenticeships are more popular in Berkshire than nationally. Reading has the highest volume of apprenticeships (674), followed by West Berkshire (468), Slough (368), Windsor and Maidenhead (327), Bracknell Forest (322) and Wokingham (262).

In Berkshire, the current figure for apprenticeships uptake is around 20% in STEM occupations.[53] The stakeholder interviews revealed a strong appetite to focus more on creating high quality apprenticeships in STEM skills shortage and skill gap areas at all levels. There are reported gaps in design and provision, for example:

> *"Last year we looked for a technician working in the lab to examine road and rail design 'and there were no suitable apprenticeship courses out there at all within the local area…if you do not have a programme that's designed in a specific way – it's got to match up directly against the apprenticeship' (e.g., laboratory content was the particular problem)."* (Employer, Research)

> *"Before training people in house, they need to have some basic training and understanding. The larger firms are able to do all these, where for a small firm it is critical. We would like to do the training ourselves but it is not practical to do it. So, it would be lovely to have the educational establishment within the local area, who run the relevant courses."* (Employer, SME Engineering)

> *"We anticipate reducing our long-standing graduate intake and increasing our apprenticeship intake this year. Payment of the levy will force new behaviours and this can truly benefit young people who are highly motivated to get a foothold into work."* (Employer, Engineering)

> *"Almost 50/50 at x go on to university or apprenticeships. 'We just make sure that they're aware of all the options'. Students often opt for apprenticeships, 'particularly those that have degrees attached to them'. They are ready to work at 18, they want to earn money, 'they don't want the debt that a university degree might bring'."* (Education provider)

> *"Unfortunately, many local employers are not knocking on our door wanting to discuss their specific training needs – we have lots of micro-businesses nearby and more work is needed to convince them on the advantages of taking on an apprentice(s). If more could be done to encourage large employers to work closer with their supply chains to embrace STEM skills this would really make a difference."* (Educationalist)

It was reported there is poor media coverage on apprenticeships, for example:

> *"Across Berkshire there is poor media coverage on apprenticeships that explains the real benefits to young people and adults. We don't have enough STEM role models going into schools from an early age. If individuals can gain practical STEM skills this can equip them well for the rest of their working lives."* (Employer Body)

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[53] Source: TVB LEP, March 2017

"Maybe local competitions in Town Halls and community centres, as well as after school clubs would stimulate interest in ordinary people having a go at science and maths e.g. hands on challenges etc. This would make it more fun!" (Employer, small business)

"Gather more facts and figures on apprenticeship statistics, salaries and success stories to help educate parents who might be sceptical about this route. This would also help teachers in their everyday conversations with students." (Educationalist)

Berkshire STEM employer survey respondents that have recruited in the last 2 years were asked if they have used specified recruitment channels to fill vacancies for STEM occupations. Apprenticeships and work experience for school/college students have been the most commonly used – see: Figure 6 below. Around two-thirds of those recruiting in the last 2 years have used a range of sources (68%).

Figure 6: Recruitment channels used to fill vacancies for STEM occupations in the last 2 years (where recruited)
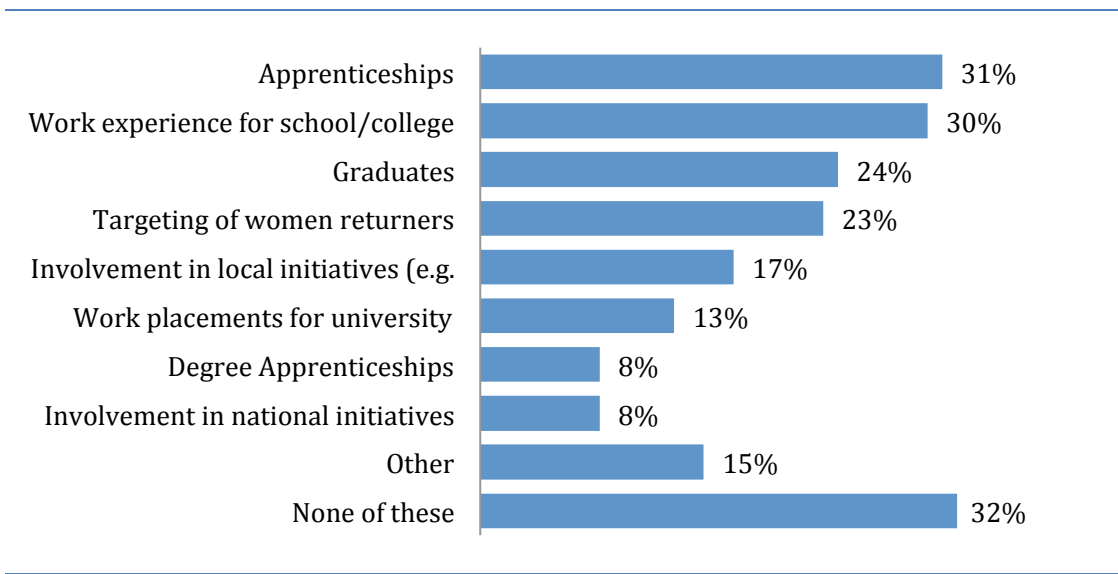
Unweighted sample base = 51

The extent to which any employers that employ staff in STEM occupations plan to use these recruitment channels reflects actual use – see Figure 7 below. A lower proportion than have used plan to use any (60%) but this will include employers that have no plans for recruitment at all. Again, the recruitment channels for which there is most likely to be planned use include Apprenticeships and work experience (both mentioned by 31% of employers). Involvement in local initiatives, however, moves up the list to become the third most likely recruitment channel to be used.

34

Figure 7: Recruitment channels that employers plan to use to fill vacancies for STEM occupations in the next 2 years i.e. those that employ staff in STEM occupations
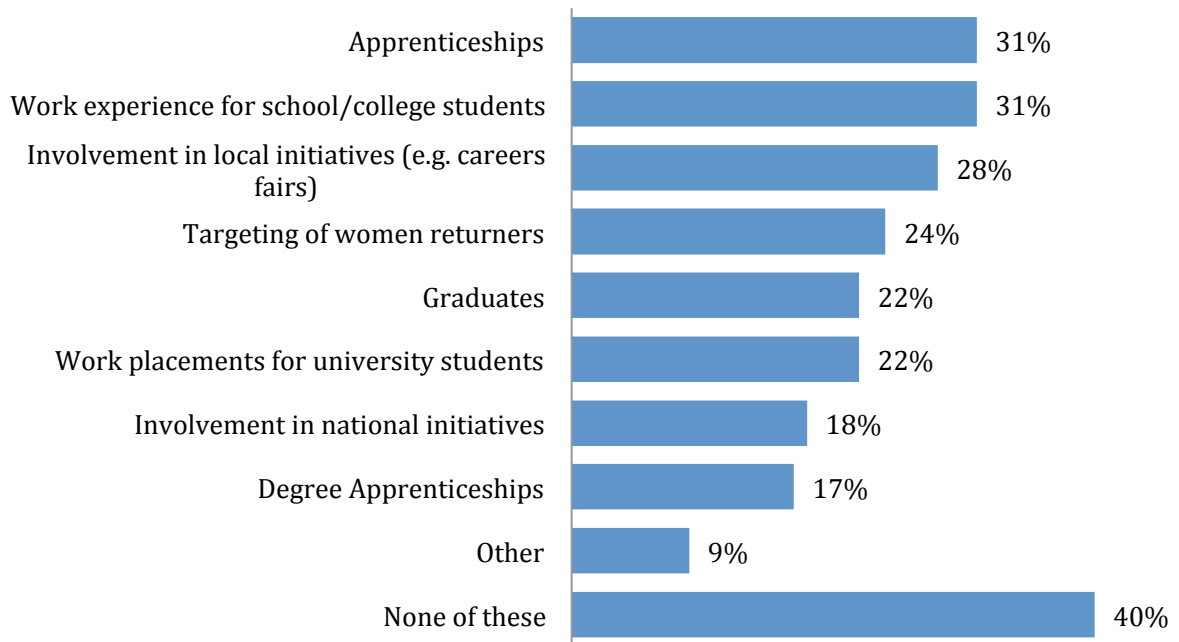
Unweighted sample base = 130

When asked if they would recommend the recruitment channels to other employers, all of those that have used graduates or degree apprenticeships would recommend them; all but one of the respondents that have used apprenticeships, work placements for university students, targeting of women returners and involvement in national or local initiatives would recommend them and all but two of those that have used work experience for school/college students would recommend them.

Nearly a third of employers that employ any staff in STEM roles (31%) feel it is getting harder to recruit into STEM occupations. Far fewer (9%) feel it is getting easier and these are spread across sectors but concentrated in Slough. Building a CEO-Led STEM Network, possibly linked to the 'Scale Up CEOs Club' and 'Biz Utd' to leverage the unique capacities of the private, public and third sectors could ensure partners promote at the highest level access to more high quality STEM apprenticeships.

But further work is needed to ensure that STEM apprenticeships are promoted with employers through the National Apprenticeship Service, STEMNET, Adviza, the Careers and Enterprise Company and local partnership i.e. Local Chambers of Commerce, National Careers Service, Education Business Partnerships, Professional bodies and Royal Academy links.

Key issues that require attention during STEM event consultations include: (i) the attractiveness of STEM Apprenticeship/Traineeship programmes to individuals; (ii) equality issues and barriers to STEM participation, including innovative approaches to support disadvantaged groups (e.g. ethnic groups, women returners, prisoner rehabilitation); (iv) improving individuals' participation in Apprenticeship opportunities; and assessing the impact of loans (and other financing issues) on STEM participation levels.

CASE STUDY 5
TRL: IT'S TIME TO GROW OUR OWN
TRL was established in 1933 by the British Government as the UK's Transport Research Laboratory and was subsequently privatised in 1996. Today, TRL has more than 1,000 clients across 145 countries and provides organisations with the evidence-base to enable future innovation in transport. Its portfolio is diverse, with core areas of expertise including transport safety; vehicle engineering and simulation; investigations and major incident forensics; human factors and behavioural science; intelligent transport systems; infrastructure asset management; and sustainability and climate change. Those recruited include civil and mechanical engineers, electronic engineers, automotive and other engineering disciplines, psychologists (human factors specialists and ergonomic specialists), mathematicians, statisticians, risk specialists, computer scientists, data analysts, some material scientists and physicists. Around 250/330 staff have a science background (some at a lower level who have gone through an apprenticeship). The organisation is planning to increase its visibility in the UK – a challenge has always been to recruit world-class experts from the local Thames Valley region.

The skills gap – getting young people interested: the key is 'finding better ways of demonstrating to them what they can do with a STEM subject…to make it sexy and exciting for them'. Students need to understand that there are lots of organisations where STEM is valued, 'raising the awareness of where subjects can take them'.

Some gaps in apprenticeship provision and design: Last year TRL looked for a technician working in the lab to examine road and rail design 'and there were no suitable apprenticeship courses out there at all within the local area…if you do not have a programme that's designed in a specific way – it's got to match up directly against the apprenticeship' (e.g., laboratory content was the particular problem).

Lack of girls in certain STEM subjects: '…we're still seeing a lack of females, particularly in the hard engineering areas…and this starts at a very early age'. More encouragement needed well before GCSEs: 'the younger the better'. Girls at Key Stage 3 are often interested in Science but by Key Stage 4 this disappears – problems with the 'branding' of STEM, particularly for girls.

Poaching from other sectors: Some specialist roles can take 6-9 months to fill, e.g., for statisticians 'we are butting up against pharmaceuticals, oil companies, banks and retail.' In one case, retail companies were offering about 40% more in terms of salary: 'high level maths and data skills, those are really valuable to big multinational retail chains' so 'luring people away with money'. 'Law firms are also now targeting STEM students' (STEM is 'such a transferable skill').

What is the impact?
'A problem recruiting people from this area and country…we're relying more and more on European and overseas skills for the STEM subjects than growing our own at home' (60-70% of applicants are from overseas). Recruiting from overseas costs a lot more and takes a lot longer.
What do we do about it?
- **Apprenticeships and growing your own**: Reference to the Trailblazer Apprenticeship scheme: 'we wouldn't be big enough to do it on our own, but if we got together with other organisations, you can develop an apprenticeship standard to do that sort of thing'. This is currently being discussed as a potential plan for the future. Many organisations are reluctant to bring in young people at lower levels such as apprentices: 'not plucking them out of university…we've got to start finding ways to invest and better funding would help with this'.
- **Organisations working better with schools**: There is also 'a lot of talking about things but not actually doing anything…the best thing is to hook up with local schools, get out there and try and make this happen from the ground up because it's been an issue for many years and the hole isn't getting any smaller in terms of the skills deficit. With Brexit, it might potentially get worse'. Teachers are already very squeezed with the current curriculum and many 'are not aware of a lot of things that are going on and they're not experts in that area, not qualified to be giving careers advice.'
- **Getting girls interested**: Go out into girls' schools and give practical examples; 'make it hands-on, exciting and engaging, not someone doing a talk…with girls, it is just about getting the message across that they can do whatever they want'.
- **Embedding careers into the curriculum:** Build work into the STEM curriculum, e.g., a requirement to come into an organisation as part of the course, although often a mis-match between timings of offers from organisations and what schools can accommodate. As soon as [students] know they have to do a subject, a lot…switch off from it…what's the point of maths? I don't want to be an accountant. They need to see what the point is.
**Visit:** https://trl.co.uk/about-us

Further Education Colleges

Five further education (FEd) colleges in Berkshire contributed to the research. All had recently taken part in a formal independent Area Review[54], covering general further education and sixth-form colleges. The conclusions from this indicate a clear focus on the development of progression routes from entry level through to higher education. There are proposals by the colleges to develop specialisms, particularly at levels 4 and 5, which will provide learners and employers with improved access to training, and address skills gaps and skills shortages in key sectors.

Stakeholder interviews revealed FE and employer concerns about gaining access into schools to promote STEM opportunities and the poor level of essential and soft skills demonstrated by young people applying for work experience and/or job opportunities.

From the Berkshire STEM employer survey, one in five employers report any links with educational establishments (21%) – see Figure 8 below. These are equally likely to be with schools (11%); FE colleges (11%) and/or universities (9%). Larger employers are more likely than average to have such links; 32% of 11-49 employers and 38% of 50+ employers do so. Employers with links to Berkshire's FE colleges are most likely to have links with East Berkshire College (40%).

Figure 8: FE colleges that employers reported having links with
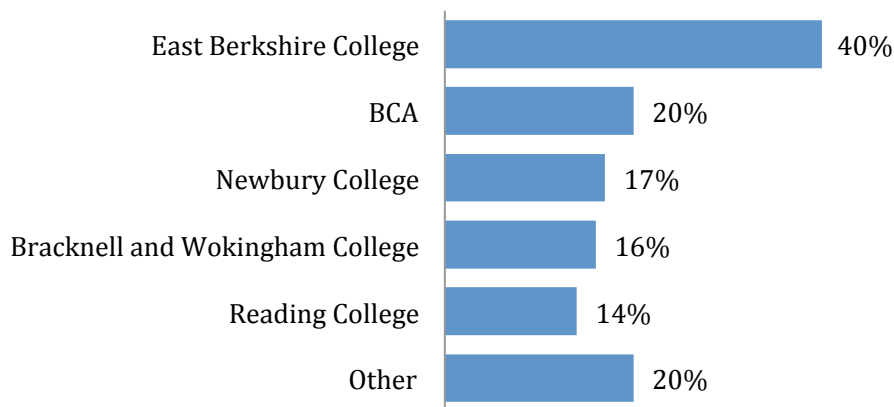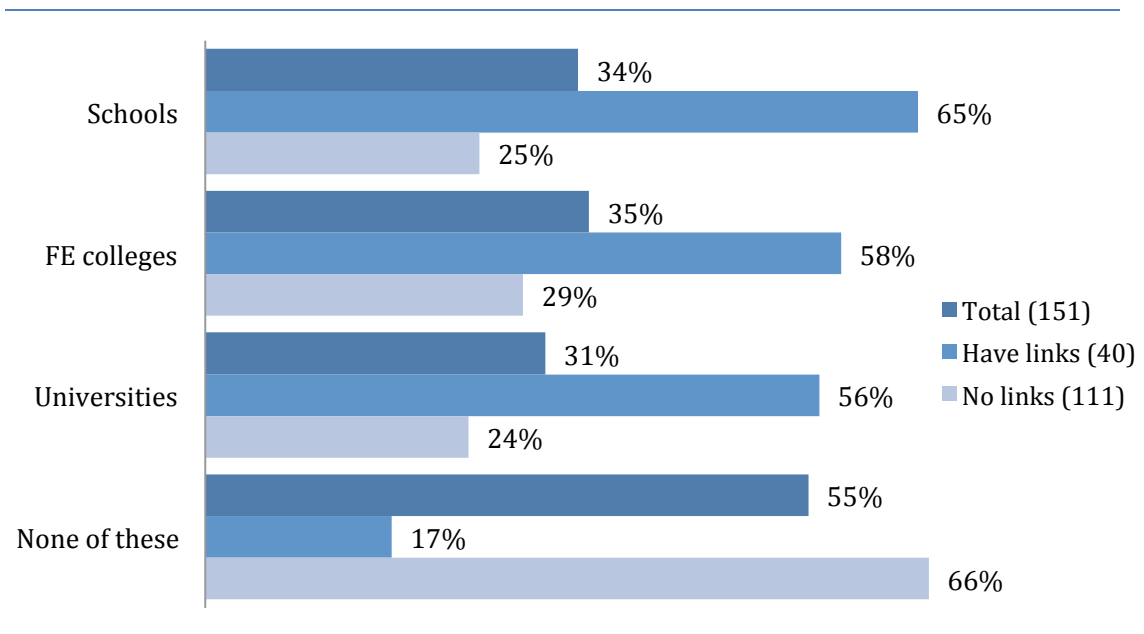

Unweighted sample base = 22

Just under half of all employers would consider further links with educational establishments (45%) and are equally likely to consider links with schools (34%), FE colleges (35%) and universities (31%) – see Figure 9 below. Comparing those who already have links with those that do not, the majority of those with links already would consider further links (83%), while 34% of those without links currently would consider them.

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[54]   Thames Valley Area Review: Final Report 2016. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/585770/Thames_Valley_15_November_2016_FINAL.pdf

Figure 9: Further links with educational establishments that employers would consider, by whether they have links currently or not (all respondents)

Schools	34% / 65% / 25%
FE colleges	35% / 58% / 29%
Universities	31% / 56% / 24%
None of these	55% / 17% / 66%

Legend: ■ Total (151) ■ Have links (40) ■ No links (111)
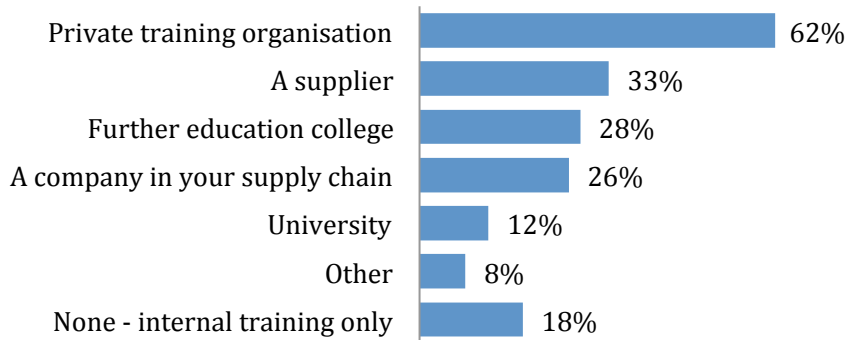
Unweighted sample bases in parentheses

Stakeholder interviews revealed FE and employer concerns about gaining access into schools to promote STEM opportunities and the poor level of essential and soft skills demonstrated by young people applying for work experience and/or job opportunities. In line with the recent Area Review findings, at lower skills levels logistics/warehousing companies are concerned at lack of basic skills (literacy and numeracy) in applicants.

Training providers

Findings from the Berkshire STEM employers show when it comes to training in the last twelve months, just over a third of employers with staff in STEM occupations (36%) have arranged or funded on or off-the-job training or development in the last 12 months. Propensity to have funded or arranged training increases with business size to 65% of those with 50 or more employees at the site. By sector, training is most likely to be funded or arranged within information and communication (51%) and least likely to be funded or arranged within construction (24%).
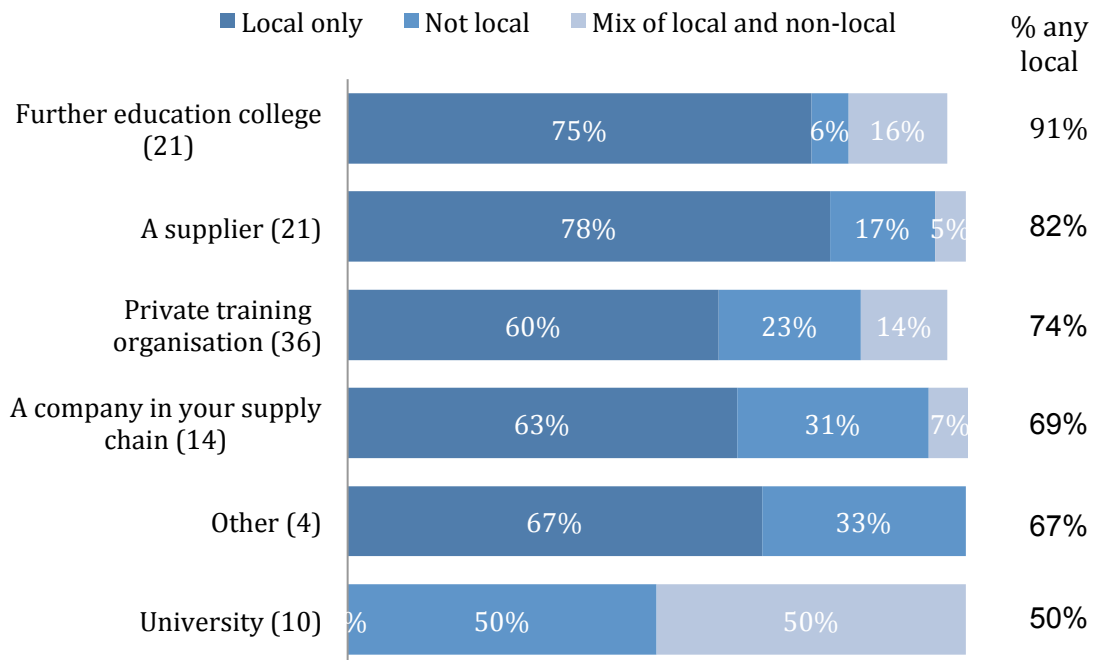
Four-fifths of employers that have funded or arranged training (82%) have used a private training organisation to deliver training (see: Figure 10 below). Thirty per cent of those that have funded or arranged training have found it difficult to source the training provision required locally. Sample bases are too small to rely on within sub-sample, but the data indicates that the proportion is higher amongst manufacturers (51%) and construction businesses (40%) and within Windsor and Maidenhead (76%) and West Berkshire (41%).

Figure 10: Training organisations used to deliver training

Category	Percentage
Private training organisation	62%
A supplier	33%
Further education college	28%
A company in your supply chain	26%
University	12%
Other	8%
None - internal training only	18%

In terms of using local resources, respondents were most likely to report having used locally-based further education colleges (91%), while least likely to report having used a local university to deliver training (50%).
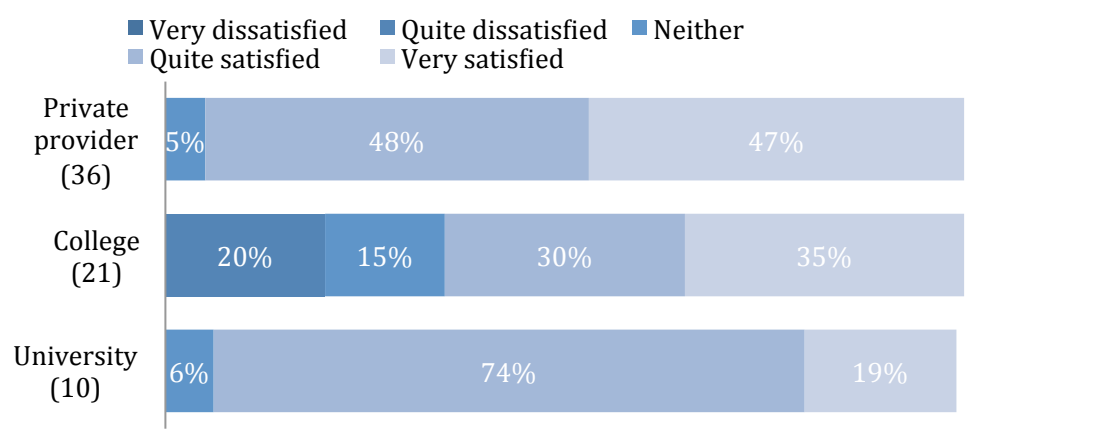
Figure 11: Whether training organisation used as locally based or not

Organisation	Local only	Not local	Mix of local and non-local	% any local
Further education college (21)	75%	6%	16%	91%
A supplier (21)	78%	17%	5%	82%
Private training organisation (36)	60%	23%	14%	74%
A company in your supply chain (14)	63%	31%	7%	69%
Other (4)	67%	33%		67%
University (10)	%	50%	50%	50%

Unweighted sample bases in parentheses

Satisfaction levels with regard to private providers and universities are high, but lower with regard to colleges used for training (see Figure 12 below). Most are satisfied with private providers and universities with regard to the training they have delivered (95% and 94% respectively), but one in five that have used colleges (20%) have been (quite) dissatisfied with the training provided overall.

Figure 12: Satisfaction with training provided overall

Legend: ■ Very dissatisfied ■ Quite dissatisfied ■ Neither ■ Quite satisfied ■ Very satisfied

- Private provider (36): 5%, 48%, 47%
- College (21): 20%, 15%, 30%, 35%
- University (10): 6%, 74%, 19%

Unweighted sample bases in parentheses

While satisfaction with the training delivered by universities is high, the majority are quite satisfied rather than very satisfied (74%; 19%), while satisfaction levels with regard to private providers are evenly split between quite and very satisfied (48%; 47%).

Thirty per cent of those that have funded or arranged training have found it difficult to source the training provision required locally. Sample bases are too small to rely on within sub-sample, but the data indicates that the proportion is higher amongst manufacturers (51%) and construction businesses (40%) and within Windsor and Maidenhead (76%) and West Berkshire (41%).

Findings from the Berkshire STEM employers show when it comes to training in the last twelve months, just over a third of employers with staff in STEM occupations (36%) have arranged or funded on or off-the-job training or development in the last 12 months. Propensity to have funded or arranged training increases with business size to 65% of those with 50 or more employees at the site.

By sector, training is most likely to be funded or arranged within information and communication (51%) and least likely to be funded or arranged within construction (24%). Four-fifths of employers that have funded or arranged training (82%) have used a private training organisation to deliver training. Thirty per cent of those that have funded or arranged training have found it difficult to source the training provision required locally. Sample bases are too small to rely on within sub-sample, but the data indicates that the proportion is higher amongst manufacturers (51%) and construction businesses (40%) and within Windsor and Maidenhead (76%) and West Berkshire (41%). In terms of using local resources, respondents were most likely to report having used locally-based further education colleges (91%), while least likely to report having used a local university to deliver training (50%).

In January 2017, the Skills Funding Agency released a new 'Register of Training Organisations' and 'Higher Education Institutions approved to compete for Higher Apprenticeships only'. The training provider landscape is changing which further necessitates the promotion of, and engagement in, the STEM Skills Strategy and Action Plan with new and existing providers across Berkshire.

Higher Education
The Higher Education White Paper, 'Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice' (DfE, 2016)[55] focuses on ensuring all students are prepared well for the world of work. New Degree Level Apprenticeships, Student Internships in industry, and specialist Masters Level courses are prominent.

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[55]   BIS (2016) Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice, London: Department for Business Innovation & Skills https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/523396/bis-16-265-success-as-a-knowledge-economy.pdf

> *"This bill will give us the chance to introduce new and flexible ways of learning…students are crying out for more flexible course, modes of study which they can fit around work…"* (Universities UK, 2017).

> *"Predictions that degree apprenticeships are going to 'grow significantly'. The University is 'mindful' of this growth and is exploring a targeted offering, such as Chartered Manager degree apprenticeships from Henley Business School, Health, Food and Nutrition, and potentially in the areas of Teaching through the Institute of Education."* (University of Reading)

In most cases, there was a strong appetite to focus more on creating high quality higher-level technical routes in STEM skills shortage and skill gap areas. Universities UK (2016)[56] reports universities are engaging with employers and local organisations, such as Local Enterprise Partnerships (LEPs) and local authorities, to help them implement degree apprenticeships. In particular, institutions work closely with small and medium-sized enterprises (SMEs) and national employers, employer groups and other delivery providers, especially further education colleges.

Findings from the 151 Berkshire STEM survey interviews with employers revealed 30% of employers with links to universities (45 in total) have links with the University of Reading. The nature of these links are diverse with employers mentioning: collaborative research; input into course content; staff speaking to students; work placements and graduate recruitment. Clearly, there are new possibilities on the horizon to address STEM skills shortages and gaps through more flexible STEM routes and pathways that can benefit more businesses, young people and adults.

The University of Reading highlighted the need to address the pipeline out, as well as in:

> *"Gap being created at the postgraduate levels…'and this is a pipeline that this region needs' (Level 7 and 8: 'higher science, technical'). 'How do you actually fund local people, and regional people, to take that next step on?' Food industry ATP developed at level 7 and level 8, so could the same happen in Technology to fund a flexible Master's or professional doctorates for people in the workplace? Could a local consortium fund some of the higher-level students or offer support for professional doctorates and/or industry projects? Who are the 'next generation of academics?' Most Post Graduate Teacher and Post Graduate Research applicants are from overseas who then return to their own countries so of no benefit to the UK labour market: one strategy would be to have a 'right to work' for a number of years for people who have qualified with a PhD in the UK."* (University of Reading)

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[56] Universities UK (2017) *Degree apprenticeships: realising opportunities,* London. http://www.universitiesuk.ac.uk/policy-and-analysis/reports/Documents/2017/degree-apprenticeships-realising-opportunities.pdf#search=apprenticeships

CASE STUDY 6
UNIVERSITY OF READING: CAPITALISE ON PARTNERSHIPS AND COMMUNICATE
The case study was undertaken with the Interim Director of Careers and Employability and the Teaching and Learning Dean. The University of Reading (UoR) was founded in 1926, has around 17,000 students from over 150 countries and is ranked in the top 1% of universities worldwide. UoR is very focused on its relationships with industry and has gone a long way to forge enduring links. For example, the Thames Valley Science Park, owned by the University, operates across two locations: the Science & Technology Centre and Reading Enterprise Centre. The Science Park is home to over 70 companies covering a broad range of technologies and business sectors.

The skills gap: '…definitely around the Tech skills…there's a major gap in terms of the skills, the supply and demand'. Supply issues are accentuated due to the large number of Tech companies in the area: 'we have a significant number of enquiries from employers…for placements for graduates and to meet those skill gaps.'
Apprenticeships: Predictions that degree apprenticeships are going to 'grow significantly'.
UoR is 'mindful' of this growth and proposes a targeted offering, such as Chartered Manager degree apprenticeships and health-related subjects for Royal Berkshire Hospital (with Henley Business School), Food and Nutrition, and Teaching.

What do we do about it?
Work with industry to address STEM gaps: e.g., a particular gap in STEM was in Construction Management and Engineering, and particularly Architecture. UoR worked with industry to develop a School of Architecture, launched in 2016. Other identified gaps in Medicine and Health-related STEM subjects: UoR worked with local NHS Trusts to develop a postgraduate programme in Physician Associate: 'very much aimed at people who have had a Biological Sciences or Life Sciences degree but to get them working in the clinical setting'; other 'upskilling' courses. **Offer SME Internships:** Reading Internship Scheme provides UoR funding to recruit students to work with local SMEs or charities for 6-12 week projects over the summer.
Offer more flexible delivery: e.g., a) the new health postgraduate courses are 'a flexible offering for people already in the workplace'; b) degree apprenticeships: 'they will need us to be more flexible' because of the requirements for 20% off-the-job training; c) online delivery such as MOOCs are important at UoR, especially in Life Sciences, and could extend this flexible learning technology for STEM returners, coupled with blended learning. **Create better partnerships:**
1. **With schools:** e.g., the University of Monsters ('science and big-bang things'); the Reading Scholars Programme with a focus on STEM, working with particular schools; a national Chemistry for All project, co-funded with the Royal Society of Chemistry. Need to provide 'a coordinated offering' for schools: every HEI is doing a lot of outreach: 'how does that fit in with what schools need?'
2. **With colleges**: UoR knows that FE colleges have the capacity to offer degree apprenticeships but need to integrate offers, not necessarily compete, e.g., FE colleges offer a 2-year foundation programme and then students move to UoR to do the BA/Bed for a year.
3. **With employers**: build on existing relationships to show that 'we as a university are listening and how can we put measures in place as a responsible organisation to what are the demands out in the labour market?' Also UoR is partnered with the UTC: 'a huge success' and 'literally on our doorstep'. 'That has managed to engage top employers to give credibility'.

Work with students and career changers: a) '…say to current students 'can you look beyond your subject?'' (e.g., an English graduate may not consider a finance-related job); how do you start that career journey?' One way the University can help is to encourage internships and placements; b) Important to address the career-changers, the returners, those looking for more flexible working: a 'gender pipeline issue', particularly acute in the NHS.

Identify what STEM learners want: identify what were 'the key things that swung it' for STEM returners and how can providers facilitate that? **Re-brand 'STEM'**: 'People just see it

as maths, engineering and science and they don't see it as health or innovation or communication…' Gender stereotypes are also important here.

Identify best practice from other areas and employers: Learn from other regions which have done it well: 'it's something that every LEP, every region is trying to grapple with'. Identify organisations' existing strategies and the existing gaps: local employers that University of Reading deals with are generally 'global players' who will already have their own schemes or will have developed them with other institutions: what are they for and what are their priorities?

Expand Industrial Advisory Boards across the university: at a more strategic, senior level within the university, where 'key decision-makers can help to shape and design our courses…a stake in terms of what goes on in the department, what skills are students not using, what skills can they be developing'.

Importance of location and win-wins: Science and Technology Centre (good for interns) and the Enterprise Centre housing 50-60 companies of different sizes, both on campus. Close to a broad range of students doing different subjects at university: 'as you grow at speed, you need staff'…advantage of accessing students quickly. The new Thames Valley Science Park is set 'to rival some of the Cambridge/Oxford initiatives': close to Heathrow and M4.

Taster courses: Residential weekend courses for lower-sixth students to give them a taster of STEM-related courses (i.e. gives a taster before making university choices).
Mentoring schemes: Alumni mentors and mentees undergo a 'matching process' – particularly important for the WP students who have lower social capital. New 'transition in' mentoring scheme developed 'to get students over the hump of coming in'.
Encouraging women into STEM: Some discussion of making 'aspirational offers' to increase gender and diversity balance on their intake which seems to be working – 'levelling off the differences'. '
Visit: http://www.reading.ac.uk/

The problem with insufficient careers advice in schools was cited regularly as a barrier to progression into appropriate courses. For example:

> *"When I decide to go to university there were careers advisers who came into school and offered impartial information and support. My children are overloaded with information and they really need someone trained and skilled to help guide them on suitable pathways and opportunities to connect the things they like to the world of work – it isn't easy nowadays for young people and adults who want to change jobs – where do you go for help?"* (Employer, Environmental Services).

Findings from the Berkshire employer survey revealed 30% of employers with links to universities (45 in total) have links with the University of Reading. The nature of existing links are diverse with employers mentioning: collaborative research; input into course content; staff speaking to students; work placements and graduate recruitment. Reading University and other surrounding universities in Oxfordshire work closely with partner colleges to enhance the delivery of higher-level technical knowledge and skills, including higher level programmes including HNC, HND and Foundation degrees. There were calls from further education specialists for universities to open their doors to more teachers and to offer them 'free' or 'in-kind' STEM professional development days working in innovative and growth industry areas.

'Gearing Up for STEM' Skills Strategy and Action Plan
The 'Gearing Up for STEM' Skills Strategy and Action Plan (2017 -2018) is designed to encourage key stakeholders to work together to influence and shape STEM provision in each of the six differing geographical areas of Berkshire. This is not a 'one-size fits all approach' – instead, the Action Plan provides a framework for dialogue, customization, and action at both a local and regional level.

Action Plan

Strategic Objectives	Strategic Actions	Timescale	Supported by	Outputs
1. Align STEM provision to strengthen and create capacity in key areas of economic growth (in particular with SMEs) and explore potential models for a new Institute of Technology	1.1 Capitalise on employer engagement in apprenticeships and the apprenticeship levy to drive STEM provision	Short – Medium term (mid- 2017 to early 2018 and then review)	TVB LEP and key SEE group partners	Case studies to feed into local areas, as well as the Institute for Apprenticeships and Technical Education 27% of all Apprenticeship starts to be in STEM subjects (to align with the local economy
	1.2 Capture a wide range of diverse STEM delivery routes and options for continuous improvement	Medium – Long term (late 2017 to July 2018	A Berkshire programme of STEM consultation events	12 Large Events – 2 per LA per year – min 500 people – employers and IAG stakeholders. Increase in STEM learning by 2018. 36 small events – 6 per LA, 3 per year – min 100 people. Practical opportunities to understand and learn about STEM skills, job roles and working in STEM sector, including taster activities. Work with STEM employers to provide 300 graduate placements. Enable graduates to gain industry relevant experience.
	1.3 Capture quantitative and qualitative data on the supply and demand for STEM skills	Medium – Long term (late 2017 to early July 2018	TVB LEP	TVB LEP Skills Priority Statement updated and further STEM research, where necessary
	1.4 Raise the profile of level 2	Short – Medium term (mid- 2017 to	STEM Advisory Group, including	Careers and training

	traineeships and jobs as a potential stepping stone into higher level learning and work.	early 2018 and then review)	education and training providers and employer partnerships	providers across Berkshire disseminate STEM marketing materials and promotional opportunities.
	1.5 Establish the remit of the Institute of Technology (IoT)	Short Term (Spring/Summer 2017)	TVB LEP and key partners	A Thames Valley proposal submitted to Government
	1.6 Explore the feasibility (or otherwise) of the four models (IoT) emerging from the STEM skills strategy research	Short – Medium term (mid- 2017 to early 2018 and then review)	TVB LEP and key partners	
2. How to improve the STEM talent pipeline, including reducing gaps in provision and addressing STEM skills shortages and skills mismatch	2.1 Incentivise individuals through improved access to innovative and personalised labour market intelligence/information (LMI) e.g. jobs, salaries, openings	Short-Medium – Long-term (August 2017 onwards)	Adviza, TVB LEP and STEM partners	Promotion of LMI products and services, including increased take up by Berkshire schools of LMI resources At least 250 Youtube views per year of the TVB LEP's LMI resource
	2.2 Develop a compelling careers offer for young people (and adults)	Short-Medium – Long- term (August 2017 onwards)	Employer & education leaders with careers, enterprise, education business partners, DWP, other key agencies	Agreement on a shared vision and joint statement

	2.3 Build on existing initiatives for promoting specific STEM industries across Berkshire	Short – Long-term (2017-July 2018)	STEM learning providers in association with Berkshire's employers	A directory of STEM initiatives aimed at young people and adults across Berkshire
	2.4 Develop and share examples of successful practices in widening recruitment and retaining STEM employees	Medium – Long term (2017 -	SEE group partners	Case studies to feed into local area reports
	2.5 Encourage STEM Careers Clusters for the exchange of good and interesting policies and practices	Medium – Long term (December 2017 – July 2018	Careers and enterprise advisers working with STEM specialists	Initial pilots in Berkshire schools and colleges, drawing on key lessons learned from other areas, to be incorporated within a careers and enterprise strategy.
3. Maximise opportunities for collaborative working to further optimise STEM skills across the region, including identifying and responding to emerging needs and building greater awareness of opportunities across the community.	3.1 Leverage the TVB LEP SEE group to drive greater focus on STEM skills gaps	Short – Long-term (July 2017-July 2018)	SEE group representatives	Operational plans linked to STEM Skills Strategy and Action Plan and the TVB LEP Skills priority Statement
	3.2 Build a CEO-Led STEM Network to leverage the unique capacities of public, private and third sectors	Medium – Long term (December 2017 – July 2018)	SEE group and trade and professional bodies with key partners	STEM employers on SEE group report back on progress being made with trade and professional bodies, where appropriate
	3,3 Showcase STEM ambassadors to inspire more people to follow STEM subjects and work opportunities	Short – Long-term (July 2017 – July 2018)	Adviza with key partners e.g. STEMNET	Provide 250 STEM role models and champions (employed within STEM sectors) to demonstrate and promote the benefits of a STEM career in schools and colleges

	3.4 Promote STEM pathways from an early age	Short – Long-term (April 2017-July 2018)	Adviza, Learning to Work, CBEBP Berkshire primary schools	Closer linkage with the National Association of Headteachers 'Primary Futures' initiative
	3.5 Further leverage funds to promote STEM opportunities, particularly to under-represented groups in STEM industries within targeted areas	Medium – Long term (September 2017 – July 2018)	Education, careers and enterprise providers with key partners	Production of STEM careers education resources aimed at specific target groups within and outside of schools and colleges
	3.6 Establish mechanisms, such as a shared digital community, for capturing emerging needs including e.g. a "Have your say" platform.	Short – Long-term (April 2017 – July 2018)	TVB LEP and Adviza	Launch digital platform for WOOP, including webpage that capture views and monitors progress Captured feedback on STEM Skills Strategy and Action Plan using Have Your Say platform
	3.7 Develop and measure the impact of a Gearing up for STEM marketing campaign ("Worlds of Opportunity")	Short – Long-term (April 2017 – July 2018)	Adviza 'Gearing Up for STEM' Skills Strategy group	Surveys at minimum 75% of large events, at least one follow up survey of employers, at least one survey of schools or colleges
	3.8 Establish pre and post assessment measures and publish findings.	Short – Long-term (April 2017 – July 2018)	Adviza, TVB LEP 'Gearing Up for STEM' Skills Strategy group	Publish impact and progress report on completion of the 'Gearing Up for STEM' Skills Strategy and Action Plan and publicise.

Annex 1 - ACKNOWLEDGEMENTS: CONTRIBUTORS TO THE RESEARCH

Details of companies who were interviewed either as a Case Study or Stakeholder:

CASE STUDIES

ORGANISATION	CONTACT	POSITION
Fairsail	Adam Hale	CEO
Redwood Technologies	Sean Taylor	Managing Director
Transport Research Laboratory (TRL)	Rob Brown Naomi Barringer Caroline Green	Head of Talent Management HR Director L&D Advisor
University of Reading	Orla Kennedy Jon Bainbridge	Director of Careers and Employability Business Development and Employer Engagement Manager
UTC Reading	Joanne Harper Stephanie Mitchell Michael Halliday	Principal Director of Industry Relations Business Relations Manager
WISE	Helen Wollaston	CEO

STAKEHOLDERS

ORGANISATION	CONTACT	POSITION
Activate Learning, Reading College	Jon Adams	Faculty Executive Director
Berkshire College of Agriculture	Gillian May Amanda GeE	Principal Commercial Director
Bracknell and Wokingham College	Campbell Christie CBE	Principal
CEng MIMechE	Judith Packer	Senior Engineer
ConnectTVT	Louize Clarke	Co-Founder
Contax	Glenn Turner	Company owner
East Berkshire College	Kate Webb	Principal
Health Education Thames Valley	Zoe Scullard	Health Dean
J Rayner & Sons Ltd	Colin Rayner	Director
Learning To Work	Rachel Burt	Managing Director
Lichfields.UK	Dan Lampard	Director, Head of Thames Valley Office
London & South East at STEM Learning UK	Ajay Sharman	Regional STEM Ambassador Liaison Lead
Maidenhead and District Chamber of Commerce	Olu Odeniyi	President and CEO
Newbury College	Anne Murdoch Fadia Clarke	Principal Deputy Principal
QA	Ben Pike	Director
Quantel Holdings	Marion Lynch	HR Manager
Science Oxford	Karen Bell	STEM Projects Manager
SECBE	Julian Carter	Head of Commercial Services
Tomorrow's Engineers Employer Support	Bronagh Liddicoat	Employer Support Manager
TVB Growth Hub	Susan Elliott	CEO

Xtrac	Jane Gilham	Head of HR

GEARING UP FOR STEM – ADVIZA PARTNERS CONSULTED AS PART OF THE STRATEGY AND ACTION PLAN DEVELOPMENT ACTIVITIES

NAME	TITLE	ORGANISATION
Fiona Jones	Chief Executive	East Berks College
Andrew Willis	Head of Department	Bracknell & Wokingham College
Debbie Owen-Mann	Joint Managing Director	Central Berks Education Business Partner
Rachael Burt	Managing Director	Learning to Work
Jo Houghton	Workplace Learning Manager	Newbury College
Neil Edwards	Group Director	Activate Learning

Annex 2 - SOME GOOD OR INTERESTING STEM POLICIES OR PRACTICES WITHIN AND OUTSIDE OF THAMES VALLEY BERKSHIRE

Within Berkshire	Outside of Berkshire
'People Like Me' This is an innovative WISE approach to engaging girls with careers in STEM. 'People Like Me' uses the natural tendency of girls to articulate their self-identity using adjectives, to show them that people like them are happy and successful working in careers in STEM. https://www.wisecampaign.org.uk/about-us/wise-projects/people-like-me	**Challenge gender and racial stereotypes:** start with drawing on the available evidence-base to inform local policies and practice, including STEM resources. For example, research on why girls from Black Minority Ethnic (BME) backgrounds often turn away from STEM e.g. **Let Toys Be Toys:** http://www.lettoysbetoys.org.uk/ten-ways-to-challenge-gender-stereotypes-in-the-classroom/ **Stemettes**: run public events, more then mentoring programme and an app supporting ages 5 and upwards http://stemettes.org/
Royal Academy of Engineering 'Industry-Led Ten Steps' aimed at companies who want to improve the retention and progression of women in STEM - https://www.wisecampaign.org.uk/consultancy/industry-led-ten-steps This focuses on sectors where women are still very much in a minority. It has been signed by the leaders of science, technology, engineering and manufacturing businesses with a significant workforce in the UK. Some companies in Berkshire will already be doing some of what is on the list. The actions have all been identified for their potential to drive company performance; they are more than simply 'good management practice'. Commitment from those at the top is critical. Having high profile companies on board is a great start – WISE is looking for others to follow their lead.	**The National STEM Centre** based in York hosts the UK's largest collection of STEM teaching and learning resources. The centre provides teachers of STEM subjects with access a range of high-quality support materials. It also facilitates networking between employers, professional bodies, schools and colleges in order to promote collaboration and improved STEM careers awareness. **The 5% Club**: regular meetings and discussions about the apprenticeship levy, sharing best practice, etc: aim for 5% of overall headcount to be on a committed graduate or apprenticeship programme which could be extended http://www.5percentclub.org.uk/
Inspiring Governance: the national online matchmaking service which connects skilled volunteers interested in serving as governors and trustees with schools and colleges http://inspiringgovernance.org/	**Inspiring Tomorrow's Engineers:** A collaborative partnership between EDF Energy (Hartlepool Power Station), Tomorrow's Engineers and Tees Valley Combined Authority, the 'Girls Powering the Nation' events are designed to inform girls about engineering careers with EDF Energy, change their perceptions of the sector and inspire them to get involved.
Primary Futures: Helping primary school children make the connections between their learning and their futures	**Future Morph** – career opportunities from science and maths with rich and high quality resources aimed at young

http://www.inspiringthefuture.org/primary-futures/ See also: #redrawthebalance	people aged 11 upwards, parents/carers, teachers, parents, governors and employers http://www.futuremorph.org/
Inspiring Women: The national **Inspiring Women campaign** launched October 2013 and already has 24,000 amazing women ready to talk with girls in state schools about the 'job they do' and route they took. http://www.inspiringthefuture.org/inspiring-women/	**Teen Tech** runs lively one-day events, with a year-round supporting awards scheme, to help young teenagers see the wide range of career possibilities in Science, Engineering and Technologies. http://www.teentech.com/tag/maggie-philbin/
Arkwright Scholarships Trust: TRL subscribes to this and sponsors a couple of 'A' level students who then get a link with a local organisation and some do relevant work experience; the alumni then come back and talk at awards ceremonies about their career progression and this included one senior woman who worked in nuclear energy – good role modelling, especially for some girls from more disadvantaged backgrounds: http://www.arkwright.org.uk/	**Future learn**: Massive Open Online Courses (MOOCs) for STEM and other teachers https://www.futurelearn.com/courses/differentiating-for-learning-stem
Future First Alumni: Helps connects schools to their alumni: http://futurefirst.org.uk/	**Worker's Educational Association, part of the Institutes for Adult Learning** attract funding for adult STEM learning opportunities https://www.wea.org.uk/about-us
One participant joined the **Intelligent Transport Systems Group** to help identify ways of encouraging more people into the field. One of the difficulties is to try and explain what this means in simple 'layman's speak' (lots of different acronyms, etc.) and how to translate this into something that young people understand and latch onto?	**Learn Direct** offers distance learning for adults to improve their STEM skills at work http://www.learndirect.com/
Engineering UK – Tomorrow's Engineers SE Employer Network: Consultancy advice provided to employers in support of their engagement with future workforce, whether under a CSR agenda or in search of skills. Full use is made of the Employer toolkit and time is spent with employers, when required, in support of their development of a STEM outreach strategy to match their objectives and needs. Regional Forum meetings are based around a current topic of interest and offer short presentations by TE Network members, followed by chaired discussion. STEM teachers are invited to the Women in Engineering Forum http://www.tomorrowsengineers.org.uk/	**Young Enterprise** – STEM challenges and resources to support enterprise in primary and secondary schools https://www.young-enterprise.org.uk/
Core Maths Support programme: Core Maths is a new DfE and UCAS approved Level 3 qualification for students who achieved a Grade 4 (formerly Grade C) at	**Maths Teaching Ideas** – ideas and resources for a broad audience of potential users

GCSE Maths and wish to develop their practical maths skills for the real world, be it in work, study or life. Local data is captured when Berkshire students are entered for CMSP exams in 2017. http://www.core-maths.org/	http://www.teachingideas.co.uk/news **National Centre for Excellence in the Teaching of Mathematics** –The aims of the National Centre for Excellence in the Teaching of Mathematics (NCETM) are to raise levels of achievement in maths, and to increase appreciation of the power and wonder of maths, across the school, sixth form college and further education system. https://www.ncetm.org.uk/
Buddying schemes: to support and mentor people new to the industry from under-represented groups e.g. Careers and Enterprise Company (CEC), Adviza, Education and Business Partnerships (EBPs) http://thamesvalleyberkshire.co.uk/Project-Details/ArtMID/531/ArticleID/3335/CAREERS-ENTERPRISE-COMPANY-ENTERPRISE-ADVISER-NETWORK http://www.adviza.org.uk/services/services-to-communities/lucky-break-mentoring	**Mentoring and Befriending Foundation (MBF)** - a national charity that works to support, develop and grow mentoring and befriending programmes throughout England. http://www.mandbf.org/wp-content/uploads/2011/03/Peer_Mentoring_in_Schools1.pdf
Find School Workshops in Berkshire STEM: An online platform for uploading STEM workshop opportunities in primary and secondary schools http://www.findschoolworkshops.co.uk/loc/Berkshire/Primary/STEM/	**STEMM Disability Advisory Committee**:The Royal Society of Biology a grouping of learned societies and academies with a commitment to improving policies, practices and provision for disabled people in STEMM disciplines http://www.stemdisability.org.uk/about-us/about-us/
STEM Ambassadors Network, Berkshire: STEM Ambassadors come from a wide range of careers and professions, including environmental scientists, civil engineers, marine biologists, medical physicists, pharmacists, energy analysts, architects and games developers to name but a few. http://www.stemnet.org.uk/	**Business in the Community (BiTC)** – a wide range of STEM resources and BiTC mentors from business working in schools and colleges http://awards.bitc.org.uk/

Note: This listing is *indicative only* with due acknowledgment that all Further Education Colleges, Education Business Partnerships and the University of Reading in Berkshire offer exemplars of good/interesting STEM activities. This list above will be further extended during 2017-2018.

Annex 3 – WHAT MAKES THAMES VALLEY BERKSHIRE SO SPECIAL?

The South East is the third largest region of England, covering 19,100 square kilometres and constituting 8 per cent of the total area of the UK. Lying to the south and west of London, the region's population of 8.7 million at mid-2012 was the largest of all the regions of England and countries of the UK, making up almost 14 per cent of the total UK population. In mid-2012, population density in the South East was 458 people per sq km, higher than the population density for England (411 people per sq km) and the third highest of all the regions.[57]

Within the South East, the Thames Valley has been described as the "Silicon Valley of Europe".[58] At the same time as having a highly dynamic local economy, almost half the region is made up of areas of outstanding natural beauty.[59] The Thames Valley Berkshire area lies at the heart of the Thames Valley/M4 corridor as a whole. It is made up of six Berkshire unitary authority localities: Slough, Windsor & Maidenhead, Bracknell Forest, Wokingham, Reading and West Berkshire. The area has strong attractions for businesses including its national and international connectivity – with proximity to London and to Heathrow Airport – and accessibility to the national motorway and rail network. Crossrail and improvements to the M4 motorway) over next few years will further reduce travel times to London and Heathrow.[60]

So what is special about the Thames Valley Berkshire (TVB) area?

Thames Valley Berkshire as an economy

- Berkshire (together with Buckinghamshire and Oxfordshire) was among the top five localities in terms of gross value added (GVA) per head in 2014, with a GVA per head of more than £34,000 a year – some 39% above the UK average and more than 4% up on the previous year.[61]
- The TVB area generated total tax revenue equivalent to more than £23,000 per job in 2013-14, compared with an average of less than £20,000 across the country as a whole. Public spending in the area in the same period averaged just over £9,000 per resident, below the national average of £10,627.[62]
- There were around 42,000 businesses operating in the TVB area in 2012, an increase of some 5,000 businesses (13.5%) over the levels of 2004.[63]

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[57] ONS (2013) T*he 2013 ONS regional characteristics analysis for the South East*, London: Office for National Statistics, October 2013. http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/regional-trends/region-and-country-profiles/region-and-country-profiles---key-statistics-and-profiles--october-2013/key-statistics-and-profiles---south-east--october-2013.html

[58] http://www.thamesvalley.co.uk/

[59] http://www.thamesvalley.co.uk/lifestyle-environment/

[60] *Thames Valley Berkshire*, UK Property Forums, 2014. http://www.ukpropertyforums.com/wp-content/uploads/2014/10/MIPIMUK-stand_brochure_2014-spreads.pdf

[61] *Regional gross value added (income approach)*, ONS, December 2015. http://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedincomeapproach/december2015#sub-regional-nuts2-gva-estimates

[62] *Tax and spend factsheet: Thames Valley Berkshire LEP*, Centre for Cities, 2015. http://www.centreforcities.org/wp-content/uploads/2015/07/15-07-06-Thames-Valley-Berkshire-LEP-Factsheet.pdf

[63] *Thames Valley Berkshire: Delivering national growth, locally, Strategic Economic Plan, 2015/16 – 2020/21*, *Evidence base*, Thames Valley Berkshire LEP. http://thamesvalleyberkshire.co.uk/Portals/0/FileStore/StrategicEconomicPlan/TVB%20SEP%20-%20Evidence%20Base.pdf

- The vast majority of these businesses (84%) employ fewer than ten people, ranging from 80% in Slough to 87% in Wokingham. Businesses with ten to 49 employees account for 12%, while medium businesses (50 to 249 employees) make up 3% and larger businesses just 1%.[64]
- New businesses in the area have a relatively good survival rate: among those set up in 2007 in the TVB area, some 48.2% were still operating five years later compared with 44.4% for England as a whole.[65]
- Thames Valley Berkshire has the second highest business start-up rate outside London and the fifth highest rate of patents per resident of all Local Enterprise Partnership areas.[66]
- Business activity in the TVB area is weighted towards scientific and technical sectors: firms engaged in professional, scientific & technical activities make up 18.7% of businesses in the area, while information and communication businesses account for 14.1% (these are higher than the national average proportions of 14.8% and 6.9% respectively).[67]
- The TVB area has very strong international business links: foreign-owned businesses accounted for more than a fifth of employment (22.3%) in 2009, compared with 12.6% nationally. Moreover, foreign-owned businesses contribute more than half of the TVB area's gross output (51.4%).[68]

Thames Valley Berkshire as a population centre

- The population of the TVB area amounted to some 891,000 in 2015, about 10% of all those living in the South East region. The TVB population has risen by 9.7% over the past decade compared with a rise of 7.8% nationally.[69]
- Nearly two thirds of the population are of working age, with 63.9% aged 16 to 64 compared with 63.3% nationally. Only 13.6% of TVB residents of working age describe themselves as retired compared with 15.3% across the South East as a whole.[70]
- The area has relatively low but varying proportions of workless households, ranging in 2015 from 7.3% in Windsor & Maidenhead to 13.8% in Reading (compared with a UK average of 15.5%)[71]
- The proportion of TVB residents with no qualifications stands at 4.9%, almost half the all-Britain average of 8.6%. Close to half (45.2%) are qualified to at least degree level or equivalent compared with 37.1% across Britain as a whole.[72]
- Between November 2008 and February 2012 approximately 10,000 non-EEA migrant workers were employed in the TVB area (with IT and software professionals making

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[64] Op cit.

[65] Op cit.

[66] *Thames Valley Berkshire*, UK Property Forums, 2014. http://www.ukpropertyforums.com/wp-content/uploads/2014/10/MIPIMUK-stand_brochure_2014-spreads.pdf

[67] Op cit.

[68] Op cit.

[69] *Labour Market Profile - Thames Valley Berkshire,* ONS/NOMIS. https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx

[70] https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx

[71] *Rankings of percentages of workless households for counties and unitary authority areas in Great Britain*, ONS, 2016. https://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/datasets/rankingsofpercentagesofworklesshouseholdsforcountiesandunitaryauthorityareasingreatbritaintablee

[72] https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx

up the largest group). This represents an annual average of about 3,000 migrants and equates to 0.7% of the economically active population in the area – more than double the 0.3% average across the greater South East.[73]

- Including those from the EU, an estimated 52,000 migrants of all ages entered the area between mid-2006 and mid-2010, with those from India (18%) and Poland (16%) forming the largest groups.

Thames Valley Berkshire as a labour market

- The TVB area has high levels of employment, with 79.2% of people aged 16 to 64 in work in the year to June 2016, above the UK average of 73.8%.[74]
- Unemployment in the area at 3.7% is substantially lower than the British average of 5.1%.[75] In the year to June 2016 it ranged from just 2.9% in West Berkshire to 5% in Reading.[76]
- Levels of economic inactivity in the TVB area are relatively low (at 17.8% compared with 22.1% for the country as a whole).[77]
- The TVB area has a high level of 'job density': the ratio of total jobs relative to the working age population stood at 0.96 in 2014 compared with a ratio of 0.85 for the South East as a whole and 0.82 for Great Britain.[78]
- More than half the TVB area's working population are in managerial and professional jobs, well above the proportion across Britain as a whole. In 2015/16, 54.7% of employees in the TVB area worked in the three highest occupational groups compared with 44.9% across Britain. In contrast, just 13.2% worked in the two least skilled groups compared with 17.2% for the country as a whole.[79]
- A quarter of the TVB workforce are employed by just two sectors: information & communications (13%) and professional, scientific and technical services (12%). They are followed by retail and healthcare, each accounting for 9% of the workforce.[80]
- Employers in the area report a major shortage of workers with appropriate science, technology, engineering and mathematics (STEM) skills both now, and based upon available forecasts, in the future.[81]
- People working in the TVB are relatively high earners: Reading has the fourth highest average weekly wage in the UK.[82] Using the measure of gross disposable household

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[73] *Migrant labour in the Thames Valley Berkshire Local Enterprise Partnership area*, 2012. http://www.secouncils.gov.uk/wp-content/uploads/2012/04/Thames-Valley-Berkshire-V3.pdf

[74] *Regional labour market, July 2016* Statistical Bulletin, ONS, July 2016, http://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/regionallabourmarket/july2016

[75] https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx

[76] *Regional labour market: Modelled unemployment for local and unitary authorities*, ONS, October 2016. http://www.ons.gov.uk/employmentandlabourmarket/peoplenotinwork/unemployment/datasets/modelledunemploymentforlocalandunitaryauthoritiesm01

[77] https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx

[78] https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx

[79] https://www.nomisweb.co.uk/reports/lmp/lep/1925185564/report.aspx

[80] *Thames Valley Berkshire: Delivering national growth, locally, Strategic Economic Plan, 2015/16 – 2020/21*, *Evidence base*, Thames Valley Berkshire LEP. http://thamesvalleyberkshire.co.uk/Portals/0/FileStore/StrategicEconomicPlan/TVB%20SEP%20-%20Evidence%20Base.pdf

[81] Op cit.

[82] http://livingreading.co.uk/invest/key-facts

income (GDHI) per person, TVB residents averaged £20,886 in 2014 compared with an average of £18,315 for England as a whole.[83]

- Across the South East as a whole some 10.7% of young people aged 16 to 24 were not in education, employment or training (NEET) in the three months to September 2016 compared with 13.9% across England as a whole.[84]

- In Berkshire approximately 9,000 16-24 year olds were unemployed in 2014, of whom approximately 1,200 (13%) were claiming Job Seekers Allowance. Unemployment among 16-24 year olds in the TVB area has not declined in recent years in step with adult unemployment, suggesting that the TVB labour market isn't as accessible for young people as it is for those aged over 24.[85]

Thames Valley Berkshire as an education centre

- In January 2016 there were some 264 state-funded primary schools and 63 secondary schools in TVB area. The total school population of young people (including independent schools) was around 160,000.[86]

- Pressure on school places is intense: in Slough and in Windsor & Maidenhead it has been estimated the number of primary school places needs to increase by at least 20% to ensure every child gets a place.[87]

- Schools in Berkshire perform well when measured on the basis of the DfE statistics used in the preparation of the school league tables: they rank number five amongst the 46 counties.[88]

- In terms of GCSE results, in 2016 Reading ranked in the top five local authority areas in England, Windsor & Maidenhead in the top ten and Slough in the top 20.[89]

- Despite the overall exam results, more than 90% of employers in the area report expecting the skills of young labour market entrants in numeracy and literacy to be very strong or good but only just over 50% of employers describe the actual competency of new recruits as reaching that level.[90]

- The TVB area is served by a variety of further and higher education colleges, including Reading College, East Berkshire College, Bracknell & Wokingham College and the Berkshire College of Agriculture.[91]

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[83] *Gross disposable household income (GDHI) for local enterprise partnerships: 1997 to 2014*, ONS, 2016.
https://www.ons.gov.uk/economy/regionalaccounts/grossdisposablehouseholdincome/articles/regionaleconomicanalysis/1997to2014#gdhi-per-head

[84] *NEET: Young people not in education, employment or training*, House of Commons Library Briefing Paper 06705, 30 November 2016,
http://researchbriefings.files.parliament.uk/documents/SN06705/SN06705.pdf

[85] Thames Valley Berkshire labour market update – October 2014, Thames Valley Berkshire LEP.
http://thamesvalleyberkshire.co.uk/LinkClick.aspx?fileticket=628GPZDcy-g%3D&portalid=0

[86] *Schools, pupils and their characteristics: January 2016*, Department for Education,
https://www.gov.uk/government/statistics/schools-pupils-and-their-characteristics-january-2016

[87] https://www.channel4.com/news/education-schools-baby-boom-gove-classrooms-teachers

[88] http://www.educationquizzes.com/education-maps/berkshire/secondary-schools/

[89] http://www.getreading.co.uk/news/reading-berkshire-news/readings-gcse-results-among-top-11787474

[90] *Thames Valley Berkshire: Delivering national growth, locally, Strategic Economic Plan, 2015/16 – 2020/21*, *Evidence base*, Thames Valley Berkshire LEP.
http://thamesvalleyberkshire.co.uk/Portals/0/FileStore/StrategicEconomicPlan/TVB%20SEP%20-%20Evidence%20Base.pdf

[91] *Choosing a course, university or college in Berkshire*, Brighton University, 2010. http://learning-opportunities.org.uk/resources/LO-Choosing%20a%20course-Berks.pdf

- Reading University ranks among the top 1% of universities world-wide and has some 17,000 students from more than 150 countries.[92] Over a fifth of all University of Reading graduates stay in the local area after graduation.[93]

[92] http://www.reading.ac.uk/about/
[93] http://livingreading.co.uk/invest/key-facts

Annex 4 – STEM LEARNING PROVIDERs, BERKSHIRE[94]

Primary schools - 264 state-funded primary schools
Secondary schools - 63 secondary schools, including Free Schools, Academies, University Technical Colleges
Further Colleges
1. East Berkshire College
2. Berkshire College of Agriculture
3. Newbury College
4. Reading College
5. Bracknell and Wokingham College
6. UTC Reading

Higher Education
7. University of Reading

STEM charities and other allied organisations
8. STEM Ambassador network – STEMnet
9. STEM Learning Network
10. WISE (Women in Science and Engineering)
11. Engineering UK
12. ADVIZA
13. Inspiring the Future – Primary Futures, Inspiring Women, Inspiring Governors
14. Future First (Alumni)

Training Providers
15. Health Education Thames Valley
16. Winchester Science Centre and Planetarium
17. ATG Training Apprenticeships
18. Reading Scientific Services Ltd (RSSL)
19. SGS United Kingdom Ltd – Training Courses for Biopharmaceutical Characterisation
20. Inspired Pharma Training Ltd
21. Wokingham IT Training Centre
22. PTR Associates – IT training provider, Wokingham

Royal Societies and Professional Bodies
23. Chartered Institute of Professional Development
24. Institute of Mechanical Engineers
25. Institute of Civil Engineers
26. Science Innovation Partnership (SIP)
27. UK Careers Development Institute
28. CIPD
28. CIMS
29. GoConstruct
30. Engineering Industry Training Board
31. Institute of Mathematics and Its Applications (IMA)
32. See also: https://www.gov.uk/government/publications/professional-bodies-approved-for-tax-relief-list-3/approved-professional-organisations-and-learned-societies#a

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[94] Between April 2017 – July 2018 further details will be collated by Adviza with its key partners on the full range of STEM Learning Providers in the TVB LEP area, including examples of good and interesting policies and practices.

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