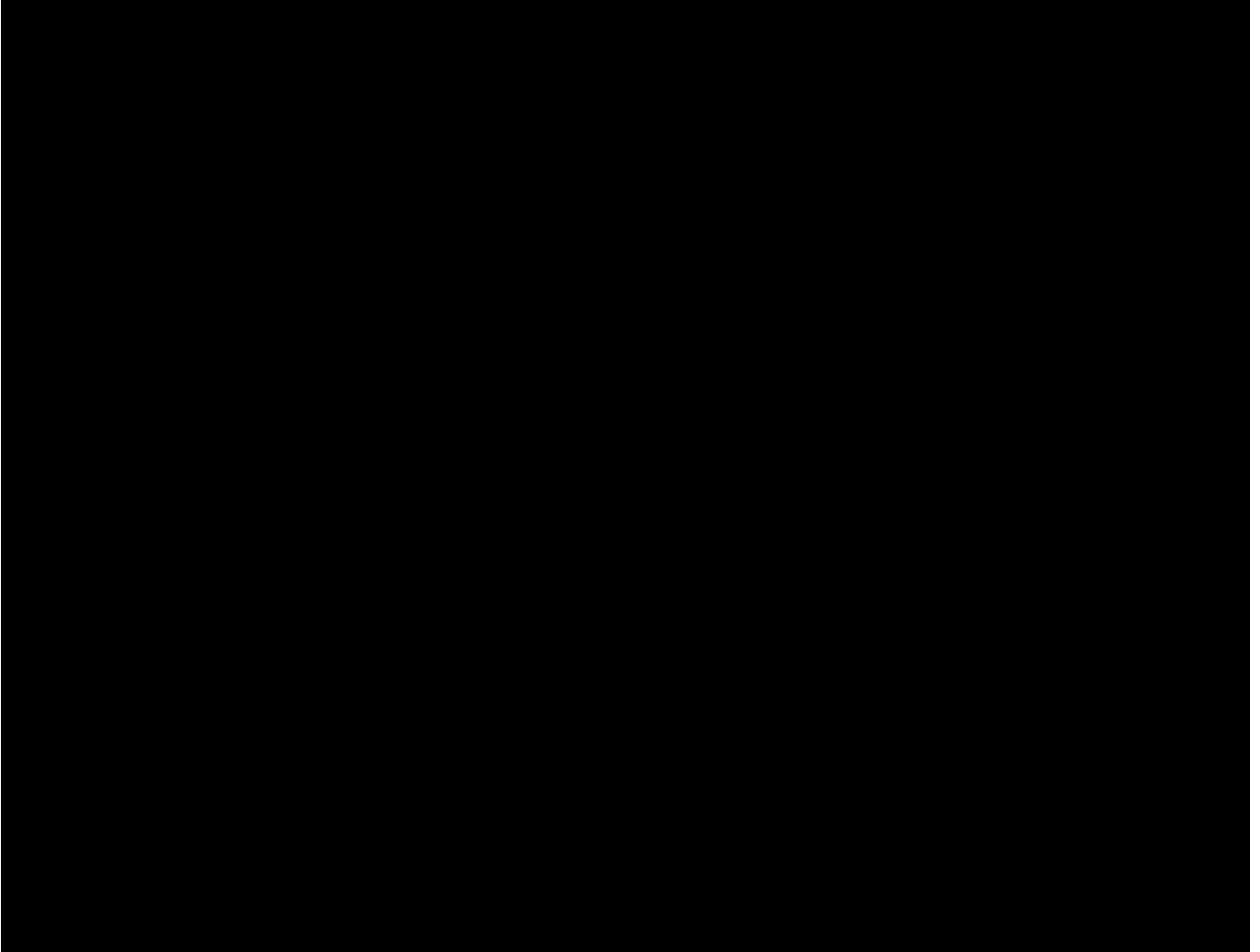


Higher Education and Businesses: Together building the talent pipeline for high level skills in the transport industry

Dr Deirdre Hughes OBE
and Greg Wade, Universities UK
22nd June 2017

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Introduction

This paper, commissioned by members of the Strategic Transport Apprenticeship Taskforce (STAT), sets out current trends in the higher education landscape, alongside business challenges and opportunities in supporting the delivery of the Transport Infrastructure Skills Strategy (TISS).¹ It draws on evidence provided by higher education (HE) and business leaders on key developments, challenges and opportunities that lie ahead to strengthen the talent pipeline within and across the UK transport industry.

The TISS signals the importance of skills to the industry through a future vision that supports all areas of transport from road to rail, maritime and aviation. It sets out an ambition to: upskill the workforce; stretching ambitions for the creation of new apprentice starts; improving diversity and recognising the need for greater collaboration on promoting transport as a career to young people and adults, including a requirement for 30,000 new apprenticeships for the sector. Simultaneously, there has been a significant commitment to supporting wider skills reforms, marked with developments such as government supporting specialist national colleges, and training academies for the sector in England, alongside active steps to significantly boost the take up of apprenticeships.

The content is designed to stimulate further discussion and collective action, drawing upon key contributions from differing stakeholders such as: Crossrail, Education and Employers, Heathrow Airport Ltd, Highways England, High Speed 2 Ltd (HS2 Ltd), Jaguar Land Rover, National Careers Service (Cornwall & the Scilly Isles), People 1st, National Skills Academy Rail Ltd, oneTRANSPORT, The Midland Metro Alliance,

The Work Foundation, Transport for London, TRL, UKCITE, University of Exeter, University of Warwick, Warsash Maritime Academy and Women In Science and Engineering (WISE). This paper is complemented by an independent report commissioned by STAT, undertaken by The Work Foundation², which examined skills infrastructure issues in the Further Education (FE) sector.

Acknowledgments

The authors wish to thank the Rt Hon John Hayes CBE MP Minister of State for Transport Department for Transport (DfT) and STAT members for their support. We also wish to thank Catherine De Marco (DfT), Miriam Lea (DfT) and Heidi Catlin (DfT) for their ongoing support. We are particularly indebted to those higher education and industry partners who contributed their invaluable ideas and offered case studies as part of the consultation process. Clearly, higher education, businesses and government are working together to strengthen the talent pipeline within and across the UK transport industry. Finally, the contributions within this report demonstrate a strong appetite and willingness for all parties to do more.

1 Department for Transport (2016) Transport Infrastructure Skills Strategy: building sustainable skills. Moving Britain Ahead. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/495900/transport-infrastructure-strategy-building-sustainable-skills.pdf.

2 The Work Foundation (2017) Is the FE sector ready to deliver the future skills the transport industry needs? London: The Work Foundation, June 2017

The policy landscape

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1. The policy landscape

In 2015, Patrick McLoughlin MP, then Secretary of State for Transport, appointed Terry Morgan, Chairman of Crossrail, to develop the TISS as an important strategic venture between government and the transport industry. As indicated, the UK's transport businesses, including roads and rail, maritime and ports and aviation, need the right skills systems to achieve high growth. They require the right balance of skills, a supply of high quality talent from schools, further and higher education, the right mix of innovations in research and development and access to capital. The skills requirements cover both core and distinct skills requirements of the industry and sub-sectors. In core skills this covers areas such as: engineering and related technical areas, client and project leadership, construction management, and skilled trades, as well as plant operatives and labourers.³ But there are clearly quite distinct requirements to specific sub-sectors too which must also be considered, ranging from specialist drivers in rail and road, to pilots, air traffic controllers and cabin crew, to harbour masters, and marine mariners in the maritime sector.

Effective collaborative working links between higher education, businesses and government are central to meeting the transport industry skills needs. A major imperative is to ensure a competitive advantage for the UK as it rebalances its economic growth and rises to the national productivity challenge. The end-goal is to make Britain the global go-to nation for scientists, innovators and technology investors. Recent transport industry developments include, for example, the creation of a major national infrastructure plan; enhancing investment levels nationally and locally in areas such as rail, road, air through separate and integrated strategies

including major new infrastructure projects such as: HS2 Ltd, Crossrail and the expansion at Heathrow; and the establishment of the National Infrastructure Commission⁴ to support the government in delivering national infrastructure projects and meeting its long term infrastructure challenges and needs across the UK.

Globalisation has transformed the places and spaces where individuals live and migrate to apply their knowledge and skills. The UK labour market is becoming more diverse, with greater numbers of women, older workers and people from different ethnic backgrounds working side by side. It is important therefore that the transport sector also reflects this diversity and becomes more inclusive. It needs to attract a wider range of individuals, reflective of local communities and the broader labour market composition. By doing so, this will ensure the industry fully optimises the readily available talent pool. As such, diversity targets (including for attracting more women and black, Asian and minority ethnic (BAME) individuals) need to remain very high on the industries' radar.

In a time of post-Brexit uncertainty, it is vital that the transport industry has a clear sense of its strategic direction and economic and skills priorities so it can decisively shape its own future – working effectively with HE and other national, regional and local partners. The ambitious policy reforms in areas such as skills and employment, backed up by a strong programme of devolution, will place even greater emphasis and responsibility on how such policies are delivered locally. This offers new opportunities for those in the transport industry and HE providers to jointly shape and create new forms of provision that drives UK plc.

The government's Industrial Strategy

³ National Infrastructure Plan for Skills, pp. 37-48. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/464354/NIP_for_skills_final_web.pdf

⁴ National Infrastructure Commission – Retrieved from: <https://www.nic.org.uk/>

(HMG, 2016)⁵ offers a strong foundation for businesses and educationalists to jointly explore innovative ways in which the supply of science, technology, engineering and mathematics (STEM) skills can be increased and improved across the UK. The Industrial Strategy includes plans to improve in education and skills provision (education and vocational training) supported by careers provision for people of all ages. The Department for Education (DfE) 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.

Employment and skills, including innovation and research, are very high on the government's agenda. The Chancellor's Budget (March 2017)⁶ set out major proposals that will inevitably impact on higher education. Overall, there is a clear intention to support universities across England on innovation, the commercialisation of research, and work with business. The government also signals in the Industrial Strategy its support to create new Institutes of Technology (IoT) with a £170m allocated for capital funding (op. cit). 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 commitment is to ensure that an IoT is available in all areas based on local education and business partnerships. 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.

As part of this, National Colleges⁷ and National Skills Academies perform a vital role in creating sector skills plans that facilitate the collaborative industry effort required to address the challenges of an ageing workforce, the drive towards higher level skills and the need to increase diversity in the transport industry. For example, Highways England are currently focusing on the implementation of a Skills Accreditation System within its major construction project. This requires suppliers to commit to a number of obligations including: the recruitment of new staff, training of new and existing staff and community engagement with local schools to promote the career opportunities that exist within construction. This programme and accreditation system is called the National Skills Academy for Construction (NSAfC). There is a proposal to the Highways England board to implement this across all relevant projects and contracts. The creation of a newly formed DfE (2016) bringing together higher education, further education, including apprenticeships and pre-16 education, provides new and exciting opportunities to develop and strengthen the technical, further and higher education system through effective national, regional and local partnerships.

5 HMG (2016) Industrial Strategy, London. Retrieved from: <https://www.gov.uk/government/policies/industrial-strategy>

6 Chancellor's Budget (March 2017), London. Retrieved from: <https://www.gov.uk/government/topical-events/spring-budget-2017> For example, driving up 3 million 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% of the latter will be in STEM disciplines and 40% will directly help strengthen collaboration between business and academia through industrial partnerships. An extra £4.7 billion of additional investment in research and development (R&D) is anticipated by the end of this Parliament. This includes £100 million to incentivise university collaboration in technology transfer and in working with business over the period 2020-21

7 National Colleges have two main roles: teaching students at the highest levels, using teachers with up-to-date understanding of the industry and in environments which accurately simulate the workplace; and awarding qualifications in their specialist area and setting standards which other colleges across the country could use. National Colleges will focus on addressing higher-level skills gaps (predominately levels 4 and 5) but may also look to deliver education and training up to level 6, including degree apprenticeships, and therefore seek to hold specialist-degree awarding powers where employers have identified a particular skills gap at this level.

The government's Post-16 Skills Plan (BIS/DfE, 2016)⁸ sets out a range of reforms to the higher education and research system. In both the academic and the technical options, these key principles are made explicit: improving the quality of education and student choice; and greater diversity among universities, colleges and other training providers. Alongside a new Institute for Apprenticeships (IfA)⁹ and its role in technical qualifications, the new and forthcoming Office for Students (OfS)¹⁰, which is being introduced through the Higher Education and Research Bill, will determine which academic qualifications at levels 4 and 5 are part of a wider programme of study leading to a full bachelor's degree. The OfS and the IfA will both have a role in level 6 degree apprenticeships. It will remain the responsibility of higher education providers, under the regulation of the OfS, to determine the degree content of the apprenticeship (equivalent to an undergraduate degree) under their formal degree-awarding powers, thus ensuring academic rigour. The Institute will not regulate the degree qualification, but it will need to approve the apprenticeship standard (which sets out the knowledge, skills and behaviour that the apprentice will need to demonstrate) and the associated assessment plan before any apprentice can start on the programme. But higher education in England (and other parts of the UK) also offers so much more.

8 BIS and DfE (2016) Post-16 Skills Plan, London: Department for Business, Innovation and Skills and Department for Education, July 2016. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/536043/Post-16_Skills_Plan.pdf

9 Only level 4 and 5 qualifications which meet national standards and are entered onto the Institute's register of approved technical education qualifications will be eligible for public subsidy (via government-backed loans) as technical qualifications.

10 The OfS will be a consumer focused market regulator with new statutory powers and an extended remit to regulate all registered HE providers; a Non-Departmental Public Body at arms' length from Government. It will determine which academic qualifications at levels 4 and 5 are part of a wider programme of study leading to a full bachelor's degree, and which are hence eligible for student support on that basis.

Higher Education in England

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2. Higher Education in England

The HE sector in England (and in other home nations) has a global reputation for excellence in research, teaching and knowledge exchange. It makes a significant contribution to the UK economy and society. The Higher Education Funding Council for England (HEFCE) register of higher education providers¹¹ shows 108 providers with a university/university college title; 139 providers that can award degrees; 115 alternative providers with specific course designation; and 237 further education/6th form colleges that deliver higher education. These Higher Education Institutions (HEIs) perform a significant role in driving social mobility. Universities recognise that they must meet the challenge of creating STEM graduates with general and specific business skills, but also with the interdisciplinary abilities needed in transport businesses, and the creativity to adjust to rapidly changing environments. The National Centre for Universities and Business (NCUB)¹² plays a key role in supporting enhanced university/business activity.

With the completion of the Lords Committee stage of the Higher Education and Research Bill, plans are now well advanced to reform the higher education system. Subject to Parliamentary approval, a new Office for Students (OfS)¹³ and UK Research and Innovation (UKRI)¹⁴ will be established in April 2018. The creation of these two bodies creates a funding and regulatory architecture for HE which places student choice, competition and

quality at the heart of the system and provides the basis to build on the excellence of the UK's world class research base.

The Higher Education Innovation Funding (HEIF), currently managed by HEFCE, supports effective university-business engagement and Knowledge Exchange. In future, UKRI will engage with the OfS to ensure joint discussion of strategic objectives and the criteria for HEIF funding that reflect the teaching elements of knowledge exchange. HEFCE will continue to pursue a robust outcome-based funding approach and build on this in order to encourage and reward greater university and business collaboration.

Research Excellence Framework (REF)

The excellence of the UK's research base is internationally recognised and is crucial in supporting sustainable economic growth and enhanced productivity. The government has reaffirmed its commitment to the Dual Support system, which has delivered an increasing share of the world's best research, and Quality Related (QR) research funding remains important to the UK's research success within this system. Lord Stern's Review of the Research Excellence Framework (REF 2021) has triggered ongoing consultations both within and across HEIs on the practical arrangements for implementing his recommendations

¹¹ HEFCE Register of Providers. Retrieved from: <http://www.hefce.ac.uk/reg/register/search/Overview>

¹² The National Centre for Universities and Business (NCUB) is an independent and not-for-profit membership organisation that promotes, develops and supports university-business collaboration across the UK. Retrieved from: <http://www.ncub.co.uk/who-we-are/who-we-are.html>

¹³ The recent announcement to combine the Higher Education Funding Council for England (HEFCE) and the Office for Fair Access (OFFA) resources and expertise into an Office for Students (OfS) to further tackle widening participation should increase the impact of work in this area.

¹⁴ This is the creation of a new public body in place of the seven Research Councils, Innovate UK, and the research and knowledge exchange functions of the Higher Education Funding Council for England. In alphabetical order, the seven Research Councils are: the Arts and Humanities Research Council (AHRC); the Biotechnology and Biological Sciences Research Council (BBSRC); the Engineering and Physical Sciences Research Council (EPSRC); the Economic and Social Research Council (ESRC); the Medical Research Council (MRC); the Natural Environment Research Council (NERC); and the Science and Technology Facilities Council (STFC) - Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/527803/bis-16-291-ukri-case-for-creation.pdf

and key principles. The HEFCE consultation on the REF 2021 is the third in a series of consultations, following the HE Green Paper (6th November 2015) and the Stern Review (July 2016).¹⁵ There are some key questions yet to be resolved, for example, if Lord Stern's recommendations on 'Outputs' are adopted, some research-intensive HEIs are likely to submit only one-half of the total number of papers that they did in REF 2014; whereas some post-1992 institutions may need to submit eight times as many papers to REF 2021, when compared to REF 2014. Nonetheless, universities are currently focused on 'Impact Case Studies' to feed into the REF 2021 which will include examples of innovative research and development in transport industries. Clearly, there are many examples of universities and business links, see Annex 1: case studies.

The Newton Fund and from the Global Challenges Research Fund supports the investment in cutting-edge research that addresses the challenges of economic development and wellbeing faced by developing countries. This is also a priority, as set out in the grant letter 2017 -2018 from the Minister for Higher Education to the HEFCE.¹⁶

Teaching Excellence Framework (TEF)

Raising the quality of teaching and learning, through implementation of the Teaching Excellence Framework (TEF), is a top priority area for universities and government to

meet the timetable set out in the White Paper (2016).¹⁷ The TEF aims to (i) ensure all students receive an excellent teaching experience that encourages original thinking, drives up engagement and prepares them for the world of work; (ii) build a culture where teaching has equal status with research, with great teachers enjoying the same professional recognition and opportunities for career and pay progression as great researchers; (iii) provide students with the information they need to judge teaching quality; (iv) recognise institutions that do the most to welcome students from a range of backgrounds and support their retention and progression; and (v) include a clear set of outcome-focused criteria and metrics. The DfE led a 'Year Two Lessons Learned' exercise and has developed new metrics for the future years of TEF. HEFCE is charged to deliver 'subject level pilots' for TEF, which will take place on a similar timescale to the delivery of Year Three and in preparation for transition to the OfS.

A series of 'Learning Gain' pilots¹⁸ have now completed their first year, and in November 2016 the National Mixed Methodology Learning Gain Project was launched by HEFCE.¹⁹ Approximately, 27,000 students are invited to take part in this new longitudinal study involving 10 English universities.

Some key challenges for HE

- Data from the Higher Education Students Early Statistics Survey (HESES) for the 2016-17 academic²⁰ year indicate a 0.6 per cent decrease in the number

15 Lord Stern's Independent Report to Government 'Building on Success and Learning from Experience: An Independent Review of the Research Excellence Framework' – Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/541338/ind-16-9-ref-stern-review.pdf

16 <http://www.hefce.ac.uk/news/newsarchive/2017/Name.112915.en.html>

17 DBIS (2016) Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice, London. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/523546/bis-16-265-success-as-a-knowledge-economy-web.pdf

18 HEFCE is supporting 13 collaborative institutional projects to test and evaluate different ways of measuring learning gain. Over 70 universities and colleges, reflecting student and sector diversity, are involved.

19 The project forms a key element of HEFCE's wider programme of work on learning gain, which aims to understand how students' knowledge and skills develop during the course of their degree – Retrieved from: <http://www.hefce.ac.uk/news/newsarchive/2016/Name.110708.en.html>

20 Retrieved from: <http://www.hefce.ac.uk/pubs/year/2017/201702/>

of undergraduate entrants (Home, EU and non-EU). However, this masks considerable variation across the sector, with an average decline of 7 per cent for those 58 institutions where recruitment has reduced compared with the previous year 2016-17.

- Higher Education Students Early Statistics (HESES) data²¹ also indicate a continuing decline in part-time undergraduate entrants. For the 2017-18 cycle the latest UCAS application data highlights a 5 per cent decline in UK applications and a 7 per cent decline in EU applications, relative to the same point in the previous year.
- In terms of overseas recruitment data, early student numbers for 2016-17 show no increase in overseas undergraduate entrants compared with 2015-16. Although this pattern only relates to a small proportion of overseas applications, it is echoed by UCAS application data for 2017-18 entry, which indicate that overseas applications remain at the same level as at the same point in the previous year's cycle. In July 2016 the sector forecast an increase in overseas students (expressed as full-time equivalents (FTEs) of 3.1 per cent between 2015-16 and 2016-17. However, the data and indicators taken together suggest an over-confidence by the sector in student number forecasts.²² (Extract from: HEFCE, Financial Health of the Higher Education Sector: 2015/2016 financial results).²²
- Whilst foundation, undergraduate, postgraduate and doctoral level studies remain at the core of HE planning and development, the introduction of new degree apprenticeships provide new and exciting challenges for HE and businesses to come together and co-create new

types of flexible provision that meets transport industry needs.

New degree apprenticeships

An apprenticeship²³ is a job, in a skilled occupation, that requires substantial and sustained training, leading to the achievement of an apprenticeship standard and the development of transferrable skills to progress careers. The focus on apprenticeships is relatively recent and their increase and rollout is taking place against an evolving policy landscape. There is strong cross party support for the government target of 3 million apprenticeships by 2020, and specific public sector targets. Apprenticeships are moving to a more employer-led system in both design and demand. The trailblazer process will set standards, with provision restricted to areas with standards, based on occupations, in place. The Apprenticeship Levy system began in April 2017.

- Currently in transition to a levy-based system and the establishment of the Institute for Apprenticeships
- Systems are still being developed and tested, communicated to employers and providers, and are yet to be fully understood, particularly by small to medium enterprises (SMEs)
- Apprenticeship standards, based on occupations, are the key enabler of provision – no provision can happen without them
- This is an employer-led system, not a provider-led system, and policies and practices need to understand this and change accordingly.

21 Retrieved from: <http://www.hefce.ac.uk/pubs/year/2016/201622/>

22 Retrieved from: <http://www.hefce.ac.uk/funding/finhealth/>

23 A degree apprenticeship is: a higher apprenticeship that includes the awarding of a degree; these are at qualification levels 4-7 and possibly level 8; a combination of work-based learning and day release (20%); typically 3-4 years; and participants are employees.

- No apprenticeship or degree apprenticeship will exist unless there is employer demand for it.

The Apprenticeships Levy is UK-wide but apprenticeships policy is not. Scotland is currently trialling graduate apprenticeships. Specific policies in Wales and NI have yet to fully unfold. There are some cross-border challenges – with employees, employers and with provision. In England, the HE sector and businesses both need to understand the specific requirements and processes involved in working with the Education & Skills Funding Agency (ESFA) on the effective planning and delivery of degree apprenticeships.

Rationale

Degree apprenticeships have been introduced because UK productivity lags behind other developed economies and employers are investing less in training.²⁴ Meanwhile, relative social mobility has stagnated or declined over recent decades.²⁵ The UK has low levels of intergenerational social mobility compared to some other developed countries²⁶. There is an acute awareness in higher education and the transport industry of the importance of technical and other non-technical skills that the UK workforce needs to have, i.e. soft skills, social behaviour, augmented/virtual reality etc., as we prepare for a digital/technology enabled future and the need for more cross-disciplinary, agile, and creative people.

Supply and demand

The HE sector has longstanding and relevant experience of co-designing and

delivering with and on behalf of businesses: part-time study programmes; work-based learning; distance learning; blended learning, professions, statutory and regulatory bodies (PSRBs); work experience; employer engagement and collaborative projects that have been quality assured. These are firm foundations for the delivery of degree apprenticeships. The Universities UK survey (2017) of its members shows that significant growth is expected over the next few years (albeit from a relatively small base).

The role of HE and process:

- Provider;
- Employer;
- Employer/Provider.

Universities could be providers, employers and employer/providers. As a provider, these are some of the processes they will have to go through:

- Register of Apprenticeship Training Providers;
- Initial procurement;
- Mechanism for growth;
- Contracting with employer;
- Recruiting apprentices;
- Support to employer and apprentice throughout programme;
- Recording achievement;
- Awarding degree;
- Successful End Point Assessment/ competency.

24 DfE Apprenticeship Funding Briefing, April 2017. Retrieved from: <http://amazingapprenticeships.com/wp-content/uploads/Apprenticeship-Funding-reform-slides-School-briefing-02.02.17-1.pdf>

25 Apprenticeship Levy Update webinar, 8th September 2016. Retrieved from: <https://s3-eu-west-1.amazonaws.com/bppassets/public/assets/pdf/levy-guide/BPP-Webinar-Apprenticeship-Levy-Updates-2016.pdf>

26 OECD (2010) A Family Affair: Intergenerational Social Mobility across OECD Countries In Economic Policy Reforms: Going for Growth, Paris: Organisation for Economic Cooperation and Development. Retrieved from: <http://www.oecd.org/centredemexico/medios/44582910.pdf>

The sector is ideally positioned to support such developments; however, universities need to ensure that all internal functions support effective planning and delivery (e.g. senior management, business engagement, legal, finance and planning, marketing and recruitment, academic quality, academic discipline, IT support).

Figure 1 below indicates universities currently expressing interest in the development

of future standards across employment sectors. Universities will be providing degree apprenticeships across almost all of the IPTE (2016) recommended 15 T-routes and approved standards²⁷. At some stage, it will be necessary for those in the transport industry and HE bodies to jointly map degree apprenticeships in line with new and emerging 'T' level qualifications, working closely with the Institute for Apprenticeships (IfA).

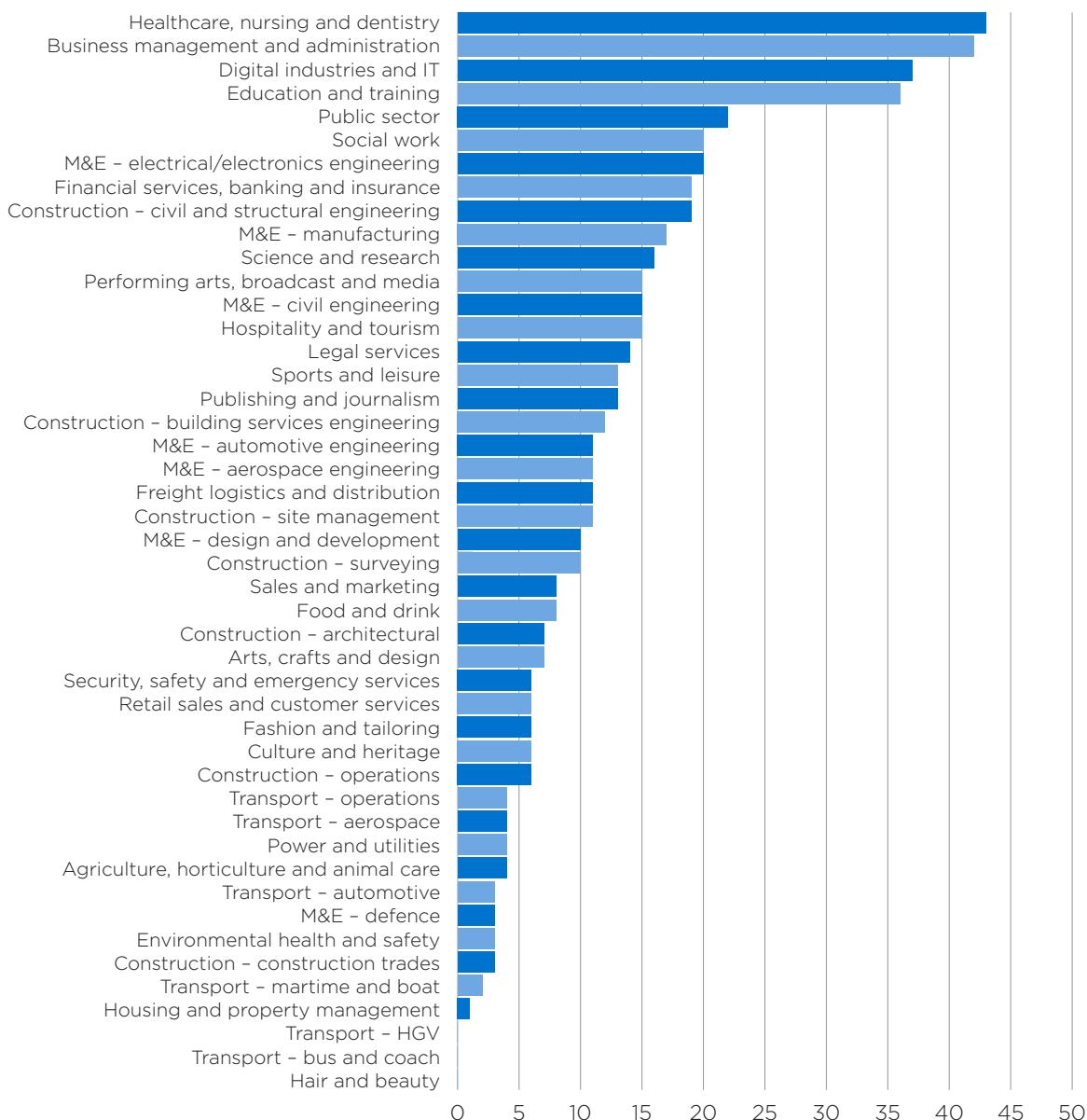


Figure 1: Universities UK Survey of degree apprenticeships development of future standards

27 IPTE (2016) Report of the Independent Panel on Technical Education, London, April 2016

Current growth is being driven by: chartered manager, digital and technology, and engineer-related degree apprenticeships.

The benefits, challenges and barriers of degree apprenticeships to student and employers are outlined in Table 1 below.

Students		Employers	
Benefits	But...	Benefits	But...
A debt free degree	It is demanding	Addresses skills shortages	Expensive compared to other routes
A paid job	Awareness and branding	Standards designed by employers to meet a specific occupation	Increases responsibility of employers (time and support)
A guaranteed future job	Needs skills for career as well as first job	Apprenticeships are delivering very early on in their employment	Concerns about cheap labour at the lower levels and progression
Technical skills	Requires tenacity and commitment to succeed	Potential to increase staff retention	Needs career pathways to be made more explicit to young people and adults
Experience of the workplace	State of readiness to adapt to working practices	Potential to grow and retain local talent	Insufficient careers education and guidance in schools and colleges
Transformative learning	Poor signalling on the medium to long term benefits	Need to spend the levy	May be hesitant and possibly resist being early adopters

Table 1: Benefits and challenges of degree apprenticeships to students and employers

Findings from a Universities UK survey (2017)²⁸ show the top 5 reported benefits of degree apprenticeships from a HE perspective are:

- Employer links;
- Meets local/regional skills needs;
- Social mobility;
- Debt free degree;
- Provision that develops the occupational skills and competencies employers require.

All benefits were rated quite highly, much higher than the barriers and the more advanced the strategy, the higher the rating of benefits.

The survey identified the top five barriers to development as:

- Uncertainty of employer demand for degree apprenticeships;
- Absence of degree apprenticeships in key occupational areas of interest to your institution;
- Uncertainty of individual demand for degree apprenticeships;
- Skills Funding Agency data return requirements for degree apprenticeships;
- Skills Funding Agency apprenticeships contractual requirements.

For those universities at the early stages of their strategies there was greater concern

28 Degree Apprenticeships: Realising Opportunities, Universities UK, March 2017

about awareness of and demand for degree apprenticeships. For those with more advanced strategies quality assurance processes and funding rules and regulations were more likely to be considered barriers.

Implementation strategies

The illustration in Figure 2 below highlights recent findings from Universities UK (May 2017) when it comes to universities' strategies for implementing degree apprenticeships (DAs). This shows the level and breadth of university engagement in the development of degree apprenticeships.

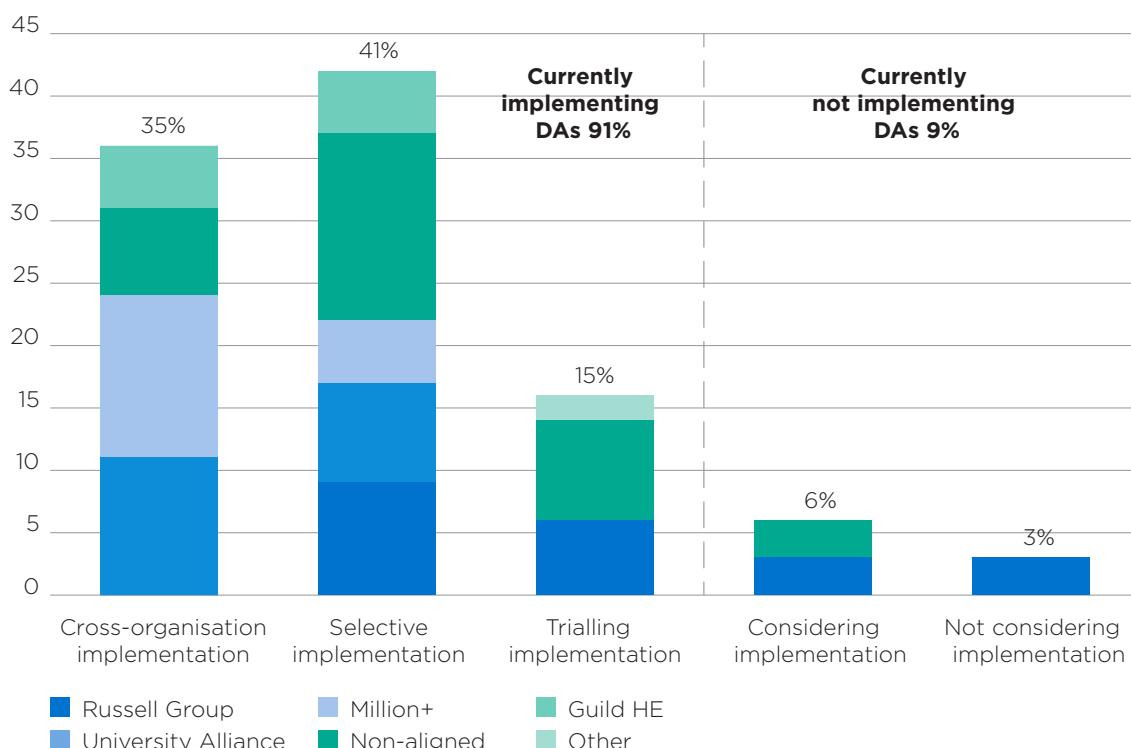


Figure 2: Universities UK survey of degree apprenticeships – University strategies

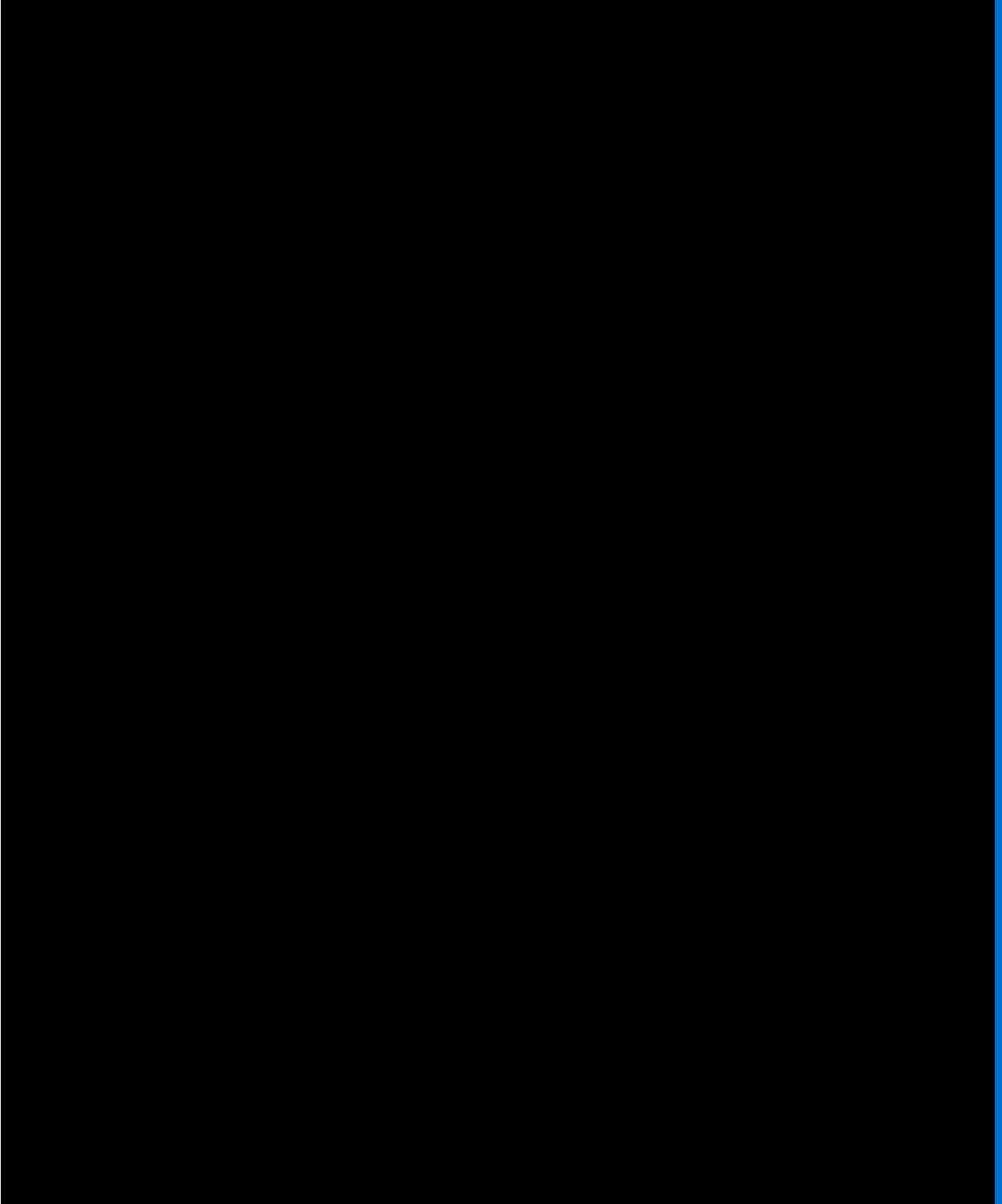
Note: There is a broad spread of engagement by type of institution. Responses from 66 institutions and the survey was England only

Overall, more than 7,500 apprentices are expected to be recruited between 2015-16 and 2017-18, spread across 17 standards representing a 650% growth. The DfT has already established a 'Strategic Transport Apprenticeship Taskforce' (STAT). The transport industry will need to integrate degree apprenticeships into their overall skills strategy alongside other apprenticeships, graduate and postgraduate recruitment. If existing apprenticeship standards are relevant then the sector needs to identify and work with university providers. If new standards are required then

sector-led trailblazer groups will need to be established to draft these standards. A trailblazer group is more successful when a range of employers in the sector are engaged, there is some central support and co-ordination with the sector and early discussions are held with potential providers. The development of standards can be a slow process and if new standards are required, the establishment of a trailblazer group/groups should be a priority.

Businesses and skills

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3. Businesses and skills shortages

There are major skills shortages to address, given an anticipated shortage of 55,000 workers in Transport Infrastructure (construction and construction engineering) industries is predicted by 2020.²⁹ Tackling this will require:

"A proactive approach to changing perceptions of working in transport and engineering, broadening the diversity of our workforce and upskilling existing workers to equip them to deal with the new technological challenges they face. There are concerns about the lack of representation of women, minority communities, as well as limited opportunities for those with disabilities to work and thrive in transport careers." (Transport Infrastructure Skills Strategy, p.6)

Evidence from latest labour force projections

Evidence from the latest labour force projections from Working Futures (2014-2024)³⁰ predict annual growth in total employment of 0.5% for the UK. Skills shortages are particularly acute in construction, but also across the science and engineering, ICT and manufacturing sectors impacting of transport industries. Overall, 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.³¹

- **Science** – 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).³² 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 2025.³³
- **Technology** – 1.2m technical and digitally skilled people are needed by 2022 to satisfy future skills needs of the UK – therefore there is an urgent need to improve the skills pipeline for digital and technology, particularly at level 6 and 7. This has been raised in recent reports such as 'The Shadbolt Review'³⁴ and the 'Forging Futures' report by Universities UK.³⁵ 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

29 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/495900/transport-infrastructure-strategy-building-sustainable-skills.pdf

30 UKCES (2016) Working Futures 2014-2024, Evidence Report 100, April 2016, Sheffield: Wath-Upon-Dearne

31 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). Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/513801/Working_Futures_final_evidence_report.pdf

32 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).

33 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

34 <https://www.gov.uk/government/publications/computer-science-degree-accreditation-and-graduate-employability-shadbolt-review-terms-of-reference>

35 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/356749/FF_FinalReport_Digital_190914.pdf

economy (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).³⁶ 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 potential job losses in manufacturing more broadly owing to automation technology and global competitive pressures (PWC 2016).³⁷

- **Engineering** – 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).

- **Mathematics** – The Mathematical sciences make a substantial contribution to the UK employment and economy – 2.8 million people in 2010 (Deloitte 2012).³⁸ The number of people employed in jobs where a mathematical science 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).³⁹ 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).⁴⁰ 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).

36 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

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

38 Deloitte (2012) Measuring the economic benefits of mathematical sciences research in the UK. <https://www.epsrc.ac.uk/news/events/pubs/deloitte-measuring-the-economic-benefits-of-mathematical-science-research-in-the-uk/>

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

40 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>

An ageing and diverse workforce

Across the transport sector, there exists an ageing workforce and historically low staff turnover, and an insufficiently diverse workforce resulting in too narrow a skills pipeline to tap into. For example:

"We will need high calibre engineers and operatives building and maintaining our future transport and infrastructure. We will need our supply chain to work with us to ensure we maximise our productivity returns through high quality apprenticeships, and finally we want to see transport become the career of choice for school children and their parents." (Transport Infrastructure Skills Strategy, p.8)

Females 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)⁴¹, 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).⁴² Evidence from King's College London (2015)⁴³ 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 – at secondary school – is likely to be too little, too late.' Fundamentally, they argue 'STEM capital' is needed to support aspirations to STEM careers, including work with parents and teachers. A lack of role models and images in society further accentuates the problem. Only 7% of girls leave the UK education system with a qualification at degree or level 4 equivalent to work in engineering or technology, compared to 24% males.⁴⁴ The government could potentially fill skills shortages by facilitating re-training opportunities for adult women. Some businesses have done so and have been overwhelmed by demand e.g. 'Get into tech scheme'.⁴⁵ Many women who currently work in STEM came into the sector by chance after starting down a different career path. There is scope to do more in this regard using apprenticeships as a lever for success.

Some key challenges for the transport industry

Over the coming years, 42% of businesses expect to have more jobs requiring intermediate level skills, and 74% expect to demand more higher level (advanced) skills.⁴⁶ The road and rail infrastructure projects and programmes within the transport sector have a current labour demand of 160,000 in construction alone – people with a blend of skills from construction and engineering (Transport Infrastructure Skills Strategy, p.13). For example:

- Many employers, particularly SMEs, need more people to specialise in STEM subjects. But SME's will need greater support and encouragement to engage with education than their larger

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

42 WISE 2016, London

43 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>

44 Source: Women in Science and Engineering (June 2016) See: - <https://www.wisecampaign.org.uk/resources/2016/11/from-classroom-to-boardroom-the-stem-pipeline>

45 Retrieved from: - <http://getintotech.sky.com/>

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

counterparts. Large employers can perform a key role in communicating STEM priorities and nurturing SME engagement in this regard.

- There is an urgent imperative to fundamentally improve the status, value and understanding of technical education skills generally, including STEM specific skills, as a rewarding route to work. DfT has set an ambition for at least 20% of new entrants to engineering and technical apprenticeships in the transport sector to be women by 2020 and to achieve parity with the working population at the latest by 2030 (op.cit p.10). The traditional HNC and HND routes in employment and training have been gradually eroded, yet business understand and, in many cases, still demand these study pathways. There is a need to re-invigorate these level 4, 5 and 6 routes in consultations between HE and businesses.
- Finding ways of using government open source data effectively in local communities, particularly in schools, is a key challenge that needs to be overcome. In addition, working via the Transport and Infrastructure Education Partnership (TIEP), transport suppliers, Engineering UK and the professional institutions, DfT plans to develop a joined-up national approach to education activity to promote careers in transport, particularly technical and professional education routes via apprenticeships, to parents, teachers and all young people. This will include groups that are currently under-represented such as women and BAME communities (ibid. pp. 10-11).

- The Maritime Growth Study report⁴⁷ set out a vision for the UK to be the world's foremost maritime centre with recommendations directed at government and industry. The report concluded that there is a strong skills base in the UK and high-level training offered to those wishing to join the sector. While some parts of the sector do not report difficulties with recruitment and retention of staff, others report a growing shortage of skilled individuals particularly in areas such as engineering. This is attributed to an ageing workforce, a lack of diversity, UK personnel being drawn to more lucrative jobs elsewhere and a lack of interest from young people considering career options (Transport Infrastructure Skills Strategy, p.14).
- There is a need to equip Britain's already-employed people to engage and upskill in science, technology, engineering and mathematics (STEM)⁴⁸ recognising that learning and training occurs throughout the life-course (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. The aviation industry requires a broad range of skills and roles in a variety of areas including construction, maintenance, operations and services. Many of these roles, such as air traffic control, are highly skilled and lead to international careers (Transport Infrastructure Skills Strategy, p.15).
- Employers value the quality of graduates, but there are concerns that many lack general skills in communication, team working, entrepreneurship and leadership. This problem can be ameliorated by a

47 Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/460861/maritime-growth-study-keeping-UK-competitive.pdf

48 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' UKCES (2013) The Supply and Demand of High-Level STEM Skills, Evidence Report 77, November 2013 - Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/302973/evidence-report-77-high-level-stem-skills_1.pdf

deeper engagement between universities, careers professionals and transport industry businesses. There is significant scope to collaborate more closely on programmes that enable students to experience the world of work through placements, internships, entrepreneurship programmes, and a range of differing ‘touch points’.

- With a dramatic decline in UK applicants for computer science degrees, it will be a challenge for businesses to find the best talent in order to compete globally. Part of this problem lies with the current school system that fails to prepare children for making effective transitions from schooling to work. The university sector is gearing itself up at postgraduate level with the development of several doctoral training centres (DTC).

Ensuring supply meets demand: engagement in skilling, upskilling and re-skilling

Latest policy initiatives have encouraged the development of expert training centres, with a renewed focus on enhancing technical and specialist education, especially in intermediate and higher skill levels. Latest policy initiatives have encouraged the development of expert training centres and Institutions of Technology (IoT). There is a recognition that these centres might provide leadership and focus in meeting more specialist areas and filling such skills gaps. As these continue to unfold, it is important that consideration is given to the co-ordination of skills and employment activities and how they come together as a series of networks to serve the interests of the transport industry as a whole.

The transport industry has been working to develop different Training Alliances e.g. core publicly funded infrastructure trainers including: Network Rail, NCHSR, TfL, NTAR,

and Alstom. The maritime sector also provides a highly innovative example of having established a network of 24 specialist colleges serving its sub-sector needs. The aviation sector has a new apprenticeship standard for commercial airline pilots⁴⁹ being developed by a specialist sub-group of the Aviation Industry Skills Board. This will be chaired by TUI UK & Ireland, managed by People 1st, and is set to increase opportunities in the aviation industry. The commercial airline pilot standard, approved for development by the Department for Education, is also supported by other leading aviation employers, including, Monarch Group, British Airways and FlyBe, and has the backing of the British Airline Pilots Association (BALPA), the Honourable Company of Air Pilots and the Civil Aviation Authority. Looking across a range of private and publicly-funded regional training centres and HE providers e.g. the National College of High Speed Rail, Crossrail Tunnelling and Underground Construction Academy (TUCA), and Network Rail, there is scope to enhance what the training facilities, serving the needs of different parts of its sector in rail, road, maritime and air, can provide together.

Within the context of higher education and business links there are significant opportunities for the transport industry to ‘piggy back’ on major developments in some or all of the following policies, programmes and/or projects. **This merits more detailed discussion, prioritisation and development of case studies to fill obvious gaps, where necessary.** For example:

- HEIs supporting schools and raising attainment**, including where some institutions sponsor schools i.e. there may be opportunities to directly showcase good/interesting transport policies, programmes and/or practices.
- Opportunity Areas** can support shared understanding of the nature of HE

49 Retrieved from: <http://www.people1st.co.uk/news/new-apprenticeship-standard-announced-for-commercial/>

provision and participation in those areas and links with businesses and skills needs.

- **LMI for All**, an online data portal (owned by government), connects and standardises existing sources of high quality, reliable labour market information (LMI) with the aim of informing career decisions. These data are made freely available via an Application Programming Interface (API) for use in websites and applications within differing educational contexts.
- **Outcomes from the Schools That Work For Everyone Consultation** (ended December 2016) and some HEIs are considering how they could further encourage and support innovative forms of engagement – such as sponsorship – between higher education institutions and schools. Transport industries engaged in such developments.
- **Degree Apprenticeship Development Fund** has already helped create many more opportunities in degree apprenticeships. There is further scope to connect with local government, local enterprise partnerships (LEPs) and HE providers as they become apprenticeship providers.
- An '**Institute of Coding**' was launched through a new competitive fund (managed by HEFCE) of £20m designed to increase the quality of digital skill provision through innovative teaching models. Collaboration between universities and industry is a key requirement and the involvement of Transport Industries has yet to be fully determined.
- **The QAA-regulated 'Access to Higher Education' Diploma** makes a valuable contribution to widening participation in higher education. The potential importance of the Diploma in taking forward Transport Industries' widening participation objectives, could optimise the take-up of the Diploma, to most effectively assist in the achievement of social mobility goals.
- **Credit Accumulation** promotes the transfer of students between courses and institutions. Student transfer offers students more flexibility to choose the type of study most suitable for them and contributes to ensuring that all those who could benefit from higher education are able to do so.
- **The UK Research Partnership Investment Fund (UKRPIF)** has proved highly effective in developing collaborative research programmes at scale between universities and the private sector. A total of £900m is allocated via UKRPIF through to 2021.
- **Inspiring the Future** is working with a number of universities and their professional bodies, Universities UK and University Alliance to support their staff and alumni as school governors and volunteer to inspire young people about jobs and educational routes.
- **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. For example, TfL support the development of internal employees through our Rail Signalling Foundation/ BEng degree programme which could potentially work under the Lifelong Learning Pilots.
- **Return to work support** – The government plans to 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 has confirmed the terms of maintenance loans for part-time undergraduates, previously announced in the 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.
- **National Collaborative Outreach Programme (NCOP)**, provides funding for disabled students and support offered through the Student Premium with Access Agreements.

Finding ways to reduce the gaps

Ways to reduce gaps in provision to optimise the transport industry skills talent pipeline include further ideas for discussion:

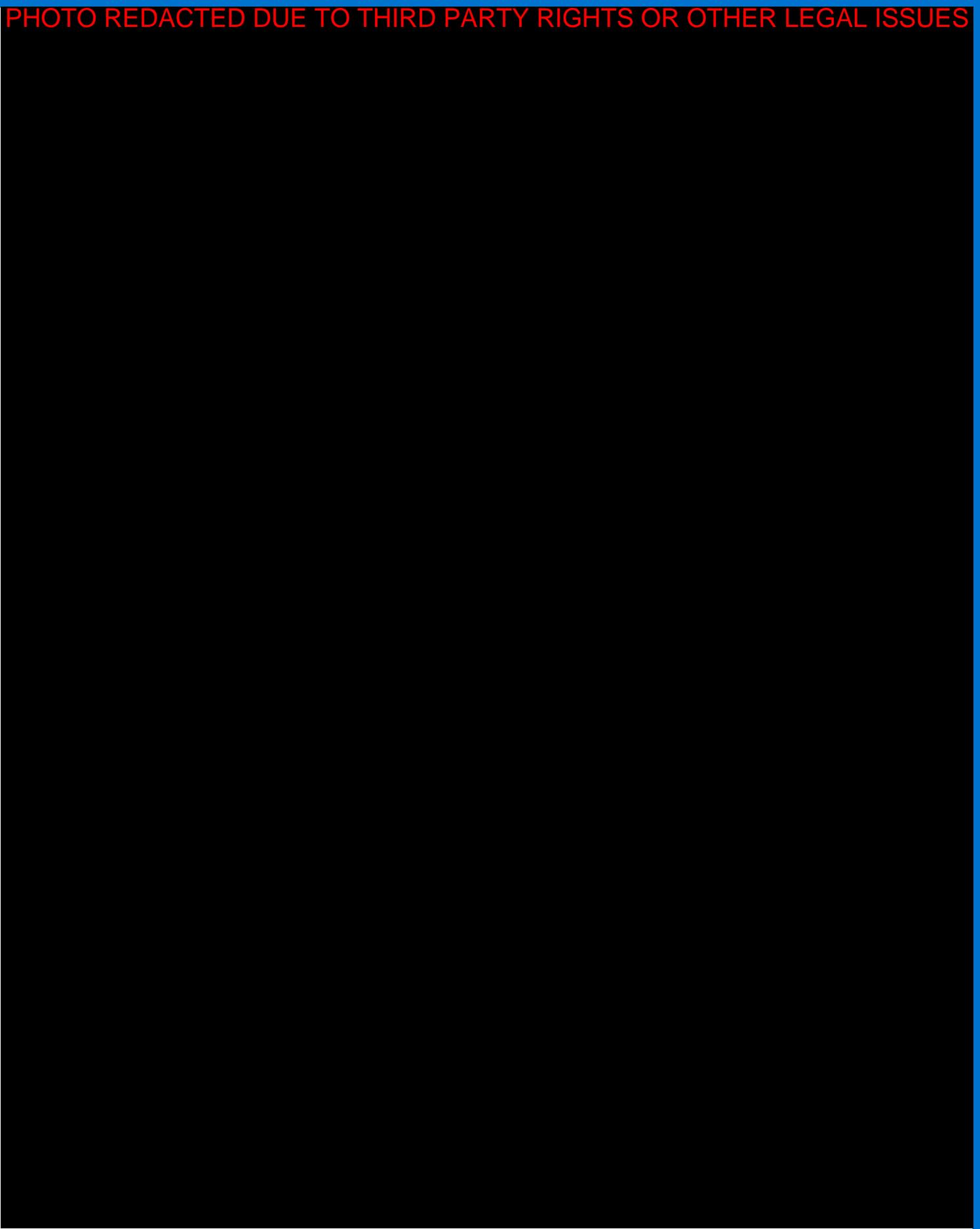
- 1 Higher education providers sharing and building on existing local initiatives that promote specific transport industries such as: joint competitions or themed weeks, including open days, and taster projects that are open to adults and not just promoted to young people in schools and colleges.
- 2 Findings ways to incentivise individuals by giving them improved access to up-to-date and personalised labour market intelligence/information (LMI) linked to transport industry occupations, salaries and openings. This could build on exemplars of best practice including the use of open source data through ‘LMI for All’ made available on apps, tablets and websites.
- 3 Businesses 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 transport industry workplaces 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.

- 4 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.
- 5 Showcase employers who have successfully enabled vulnerable and/or under-represented individuals into transport industries.
- 6 Facilitate the take up of STEM degree apprenticeships by women (and others with caring responsibilities) with part-time, online and other flexible training options made available. Government investment into the HE sector to develop online provision, via UKRI, is a possible way forward.

Moving forward

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4. Moving forward

The transport industry has done much already to understand and begin to address the pressing skills needs it is facing and to enhance the breadth and quality of HE provision. Employer ownership of the skills agenda is now becoming a reality as new government policies unfold. There is a strong appetite to do more with HE and government. In doing so, the transport industry may wish to consider three key factors to generate skills demand and nurture its supply chain:

- How can the industry improve its attractiveness to, and recruitment of graduates?
- How can the industry further engage with the development of degree and higher-level apprenticeships?
- What more can the industry do to enhance postgraduate provision and recruitment?

As a minimum, industry growth expectations with actions need to be clearly articulated to stimulate demand within and across the

sector and to make better use of individual's talents and skills. This should in turn inspire a supply-side response, with high-quality, higher-level skills development providing the future skilled workforce the transport industry needs.

Describing and promoting transport industry opportunities

The routes and pathways in the transport industry are changing fast. Therefore, finding a way of easily describing these and promoting the opportunities available is essential for young people and adults both within and outside of the workforce. The HE application process is well rehearsed in schools and colleges; this is in contrast to FE and apprenticeships. In schools and colleges, although most young people are willing to access information online, there is strong preference for face-to-face help and support with course choice and decision-making. A key objective should be to efficiently reach every school and college give a consistent high quality message on the transport sector and opportunities.

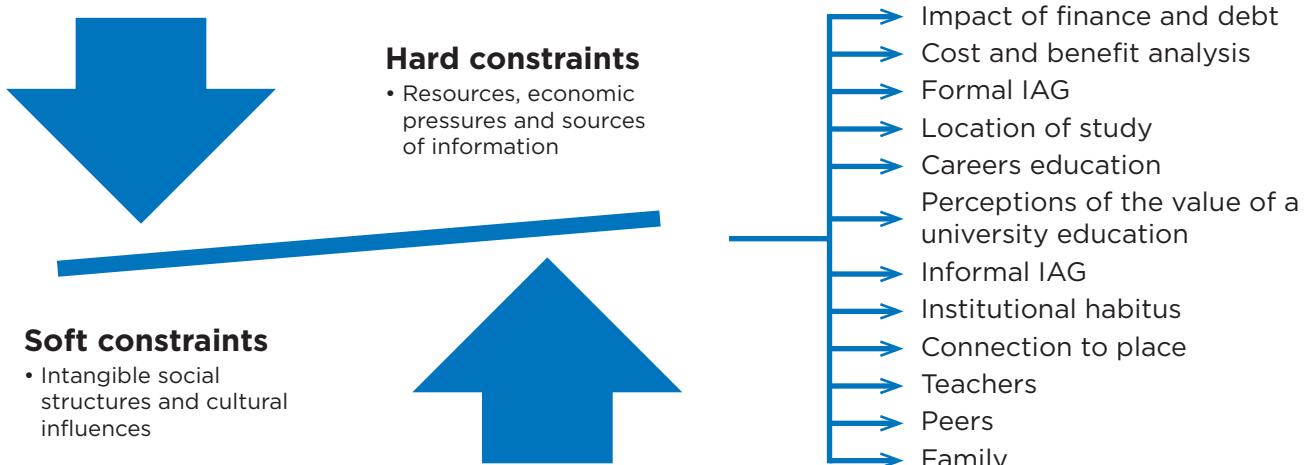


Figure 3 – Relationship between soft and hard sociological and institutional influences
 (Source: CFE Research (2015) Understanding progression into higher education for disadvantaged and under-represented groups. BIS Research Paper Number 229)

Widening participation and lifelong learning

More needs to be done to widen participation and to raise awareness amongst young people and adults, particularly to encourage those from lower socio-economic groups to engage in skills, upskilling and reskilling on a lifelong basis. Attracting more women and BAME in business is vital for individuals and the local economy. There is ‘a moment in time opportunity’ for HE and business to shape government policies at a central, regional and local level, particularly through new devolution arrangements, that respond to post-Brexit skills needs. Communication, co-operation and collaboration between HE and business is essential to develop specific HE provision that addresses current and future skills needs, widens participation, and encourages social mobility.

Forecasting labour market skills

Some sub sectors within the transport industry are currently undertaking updates to labour market and skills forecasting work and are also requiring ‘bottom up’ forecasts from their supply chain e.g. NSAR, HS2 Ltd, Highways England. There is potential connect with the DfE sponsored “LMI for All” open source data platform. Key decisions will have to be taken regarding how transport industry data will be presented and used. This could be really helpful to ensure that students are following HE and transport industry pathways with real and exciting prospects at the end. Also, businesses and HE will have to monitor progress towards meeting forecasted needs and the attainment of KPIs.

HE qualifications and/or equivalents

Employers in the sector have a longstanding tradition of recruiting through the HNC and HND, degree and doctoral education pathways. With new qualifications on the immediate horizon and new methods of teaching and learning in HE and business, there are opportunities to co-design and shape qualifications and standards based on a dynamic curriculum that meets current and future skills needs.

Next steps

The Transport Industry needs to:

- Ensure it has clear descriptors of the new lattice of provision. Including pathways and routes to career progression and that these are made readily available online and offline in school and college engagement plans and in local community settings.
- Articulate the relationship between degree apprenticeships and the new ‘T levels’ so that this becomes well understood by young people, adults and employers/employees. This means connecting effectively with the Institute for Apprenticeships and to those involved in the expert panels for the new 15 routes. As the new standards and training solutions are created and delivered by business this will inevitably impact on HE providers.
- Consider the co-ordination of high technical and professional level skills and employment activities and how these come together as a series of networks to serve the interests of the transport industry as a whole. This could be linked to joint competitions or themed weeks, open days and taster projects that are targeted at adults and not just promoted to young people in schools and colleges.

- Identify and form partnerships with HE providers to review and where appropriate rapidly expand courses in high demand.
- Co-develop with HE providers online formative and summative assessment tools that inspire individuals to take action to join the transport industry.

HE providers needs to:

- Ensure there are sufficient ambassadors and role models to connect with young people and adults in local communities to inspire them to explore transport industry and allied career pathways and opportunities on a lifelong basis.
- Engage fully with new and evolving devolution arrangements that have policies and act as potential vehicles for HE providers to link with business in engagement activities aimed at skilling, upskilling, and reskilling individuals on a lifelong basis.
- Work with expert training centres and Institutes of Technology (IoTs) to support and strengthen local and national centres of excellence, including degree apprenticeships, HNC/HND, graduate, post-graduate and doctoral routes linked to industry requirements.
- Show leadership in working closely with business to drive the delivery of the transport industry skills and investment plans for the supply chain, particularly SMEs.
- Develop success metrics that help bring alive the HE opportunities afforded by transport industry and jointly monitor the outcomes with businesses.

Government needs to:

- Publish its national careers strategy to bring greater coherence and coordination to the fragmented CIAG environment. There are plans underway within the DfE to work towards this end-goal.
- Find ways of optimising competitions, projects and facilities that work in the interest of attracting more people and for HE and business to work closely driving forward the transport industry skills agenda.
- Invest in closely monitoring the skills shortages and skills supply routes in the transport industry as Britain moves towards post-Brexit.
- Support the sharing of good practice across different parts of the delivery system so that this supports better partnership working amongst business and provider communities.

Case studies

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5. Case studies

Case study 1: Use of Government Open Source Data – LMI for All

LMI for All is an online data portal, originally developed by the UK Commission for Employment and Skills, which brings together existing national sources of high quality labour market information (LMI), including transport industries data. This is designed to inform people's choices about their careers. LMI for All is currently managed by DfE working closely with the University of Warwick, Institute for Employment Research (IER) and its technical development partner Pontydysgu.

LMI for All includes information from two key products from the Office for National Statistics: the Labour Force Survey and the Annual Survey of Hours and Earnings; plus data from two products from the UK Commission for Employment and Skills: the Employer Skills Survey and Working Futures. It also includes vacancy data from Universal JobMatch, and data on skills, interests and abilities from the US O*NET database. The data available from LMI for All are organised around the Standard Occupational Classification. This system classifies all jobs into 369 detailed categories, according to the tasks that are undertaken and the level and nature of the skills and qualifications required to do the job. The data within LMI for All are all available under an open government license. This means that individuals and organisations can use the data for any purpose, including commercial use. LMI for All data can be used to power apps and websites. Organisations such as iCould, Skills Match, London, U-explore, Kareer Hub, RCU and Active Informatics currently use LMI for All data in their websites. A popular 'Careerometer' widget version one was released a year ago, and makes it simple to embed a widget in any web site. The first version gave access to pay rates in different jobs. The new version provides extra information. As well as

providing hourly, weekly and annual pay figures for each occupation the widget gives details of present numbers employed in the UK and projected future growth or reduction in numbers employed. It also provides prediction of replacement demand – an important measure showing how many new employees are likely to be needed based on those leaving an occupation or retiring. It provides examples of different industries where those in that occupation are likely to be employed as well as a brief description of the occupation itself. It is easy to compare different occupations to UK average wages. The widget can be configured to provide a card for providing information on one occupation at a time, or two or three cards for comparing more occupations. Another simple configuration allows organisations to preset the occupation the widget displays, instead of leaving it up to the user to search. At a technical level, the Careerometer widget has been designed to be as simple as possible to install even for those with little technical knowledge – visit: <http://www.lmiforall.org.uk/about-lmi-for-all/>

Case study 2: Use of Open Source Data – Transport information published by data producers

oneTRANSPORT is a revolutionary smart city initiative focused on addressing the challenges in transportation systems with Internet of Things (IoT) technology. Comprising academic, industrial and public partners, and with sponsoring from Innovate UK, oneTRANSPORT is laying the basis for smarter multi-modal, multi-region and multi-system transport networks in the UK. This is currently implemented in 4 counties in the UK as explained in the description plus in Birmingham. More punctual use cases are traffic management for silverstone races, Watford football stadium and Park & Ride in Oxford.

Today's world urgently needs innovative transport solutions to reduce pollution, running costs and to deliver a fully-integrated transport experience to citizens. And while this is widely recognised as a global market opportunity, the intelligent transport services (ITS) industry is stalled in a similar way that the telecoms market was in the early 1990s, when multiple national systems and proprietary technology offerings impeding the delivery of cellular roaming. A similar problem was also seen with Smart City activities growing in isolation. As a result, citizens travelling across this disconnected scenario see a variable experience, application developers see sub-critical markets, transport authorities see a confusing meleé of expensive non-standard ITS products, and equipment manufacturers and software providers see highly fragmented, and hence small, markets.

oneTRANSPORT is an integrated transport initiative that aims to transform the travel experience on a truly nationwide and global basis. It is a two-year, commercially-focused trial proposed by a consortium of 11 partners: Arup; Buckinghamshire County Council (CC), Clearview Intelligence; Hertfordshire CC; Highways England; Imperial College London; Northamptonshire CC; Oxfordshire CC; Traak Systems; Worldsensing; and InterDigital Europe.

It is a solution based on the open international standard oneM2M™ that can enable a transport industry revolution that mirrors the revolution that the telecoms industry has experienced over the past two decades. It represents a scalable, exportable marketplace for transport data, enabling SMEs, academia, incumbent suppliers and new players to deliver enhanced services, facilitate new business models, service innovation and new investment into the transport marketplace.

oneTRANSPORT enables transport information to be published by data producers (e.g. transport authorities and third parties), then discovered and accessed in an open marketplace by authorities, application developers and others. This allows delivery of a superior travel experience as well as generation of new revenues, in-journey travel optimisation and added value services that the real system 'user' – the traveller – desires and finds beneficial. It represents the next stage in industry evolution enabled by the opening up of currently-closed data assets.

By fulfilling latent user needs – as digital mobile phones did for telecoms – oneTRANSPORT promises to unlock new investment into the ITS industry, create economies of scale, new markets and new business models. An underpinning principle is that the end user customer base is in the millions, rather than the isolated transport authority customer base, which is in the hundreds. oneTRANSPORT can be envisaged as the 'transport' component that provides improved mobility within the 'smart cities' agenda, based upon standardised technology that integrates existing systems with future 'smart city' solutions – visit: <http://onetransport.uk.net/>

Case studies 3a -3c: Innovation and Intelligent vehicles⁵⁰

WMG is working on a number of projects within the area of 'Intelligent Mobility' contributing to shared understanding of the subject of the technologies and their gradual adoption. For example,

50 Tuesday 11th April 2017: Business Secretary Greg Clark and Transport Minister John Hayes have announced a range of research funding which included total of £4.25 million split between a battery research project and an Autonomous Vehicle research project at WMG at the University of Warwick.

3a. Innovative Testing of Autonomous Control Techniques (INTACT)

Partner: RDM

RDM, the UK's only designer and manufacturer of driverless Pods, and University of Warwick are working together to enable the broader uptake of Pods, help inform the legislative framework for the UK and eventual certification of autonomous vehicles, and show the UK as a leader of research into autonomous vehicles. Urban mobility vehicles, or driverless Pods, will reduce congestion and accidents on our roads and give more people travel independence. However, they require trust from users – they must be safe, secure and robust. This requires extensive testing and validation of the Autonomous Control System, or ACS, which is the brains of the Pod responsible for detecting objects and controlling the vehicle. Reducing the cost and optimising this ACS is essential in facilitating the large scale manufacture and sale of commercially viable Pods in the near term. However testing on public roads and in real-world driving situations would be very expensive, unrepeatable and potentially dangerous. Hence this project proposes the use of a novel simulator concept, to enable the evaluation of an optimised ACS in a safe, repeatable and scientifically rigorous environment.

3b. Research for Advanced Concept Development: of smart and autonomous vehicles (RACeD)

Partner: Jaguar Land Rover

The project is working on advanced concept development for connected and autonomous vehicles in four strategic areas: self learning car, connected car, next generation HMI and software development. These strategic areas are closely aligned with JLR's mega research projects and will undercut the introduction of future autonomous technology to JLR.

The RACeD program with Jaguar Land Rover is a group of five Engineering

Doctorates undertaking research on a collection of specific JLR challenges and which will collectively advance JLR's pathway to building up autonomous technology capability. The individual projects are: On-Board and Off-Board data platforms, Advancing Intelligent Feature Development, Exploring the user experience of autonomous vehicles, Evaluating the self-learning car in the simulated and real-world.

3c. UK Connected Intelligent Transport Environment (UKCITE)

Partners: Visteon Engineering Services Limited, Jaguar Land Rover, Coventry City Council, Coventry University, Highways England Company Ltd, HORIBA MIRA, Huawei Technologies (UK) Co Ltd, Siemens, Vodafone Group Services Ltd and WMG at University of Warwick.

The UKCITE project will create one of the world's most advanced environments for testing connected and autonomous vehicles. It involves equipping over 40 miles of urban roads, dual-carriageways and motorways with combinations of three 'talking car technologies', and testing for a fourth, known as LTE-V. The project will establish how these technologies can improve journeys, reduce traffic congestion, and provide entertainment and safety services through better connectivity. It will enable automotive, infrastructure and service companies to trial connected vehicle technology, infrastructure and services in real-life conditions on 40 miles of roads within Coventry and Warwickshire. The project will establish how technology can improve journeys, reduce traffic congestion and provide in-vehicle entertainment and safety services through better connectivity. WMG are leading two major packages of work on the UKCITE projects. The first relating to the cyber-security challenges of the infrastructure implementation, and the second looking at new and evolving business models that could emerge from the new technology – visit: <https://www.ukcite.co.uk/>

Case studies 4a – 4b: Technical upskilling Jaguar Land Rover Technical Accreditation Scheme

4a. The Automotive Industry's leading MSc upskilling and Continuing Professional Development programme

Jaguar Land Rover requires the best talent and skills to deliver future sustainable growth. By uniquely integrating a number of individual universities to deliver the “best courses from the best sources” employees can gain qualifications as part of company sponsored training. Jaguar Land Rover launched this unique and innovative programme in September 2010, bringing together ten top universities: Aston, Bradford, Cambridge, Coventry, Cranfield, Loughborough, Southampton, UCL, Warwick and York universities to deliver masters level and accredited modules in specific technical disciplines.

The programme forms part of the Jaguar Land Rover Academy and includes more than 80 modules covering key competency areas, such as software design, electrification and energy storage, problem solving tools and project management. The modules can all be taken separately or combined to create a qualification up to and including an MSc or EngD with one of the partner universities.

This collaborative partnership is key to developing the new skills and knowledge to support the delivery of future product strategy and low-carbon technologies. To date well in excess of 1.3m hours have been committed by Jaguar Land Rover engineers, mostly in their own time, to complete masters degree level modules from the scheme. Currently 70% of the 10,000 engineers are studying at least one module.

The scheme and modules are also available for employees of suppliers and other automotive manufacturers and university engineering students, which will help create the pipeline of skills and graduates needed by Jaguar Land Rover and other advanced manufacturing businesses in the region.

The scheme is endorsed by the Royal Academy of Engineering and accredited by the Institution of Mechanical Engineers, the Institution of Engineering and Technology and the Institute of Materials, Minerals and Mining. The scheme also supports the UK Automotive Council's skills strategy.

Jaguar Land Rover's Adult Auto-Upskilling Programme

4b. A programme to create adult apprentices for skilled vehicle maintenance technician roles to support Jaguar Land Rover growth

Jaguar Land Rover has a shortage of appropriately qualified and experienced candidates to take up roles as vehicle maintenance technicians within their Product Creation team. The maintenance technician provides critical support for the engineering test and development teams, which ensures that vehicle programmes are kept to target and engineers have the tools needed to validate customer requirements.

The programme targets adults operating in the consumer vehicle maintenance industry and equips them with the knowledge and skills required to become Jaguar Land Rover vehicle maintenance technicians. Previously, recruits were drawn from Jaguar Land Rover dealerships, but due to business, there is a need to source candidates from a wider pool.

They carried out a business needs assessment with Warwickshire College Group which led to a modular apprenticeship programme, delivered in partnership by the college and Jaguar Land Rover Dealership Academy. Apprentices receive a training needs analysis to identify skills gaps and each receives a personalised programme of training to help them reach the required standard. The end point is a level 3 Advanced Apprenticeship in Automotive Maintenance incorporating both electrical and mechanical skills. 24 apprentices have been recruited into the pilot cohort so far since the scheme was launched in 2016.

Case study 5: Railway transport skills partnerships

The Midland Metro Alliance is a team of planning, design and construction specialists collaborating to build a number of new tram extensions over the coming decade on behalf of the West Midlands Combined Authority (WMCA).

The alliance consists of the WMCA, which owns the Midland Metro; a consortium of design experts from Egis, Tony Gee and Pell Frischmann; and rail construction specialists Colas Rail – with Colas' sub-alliance partners Colas Limited, Barhale, Bouygues UK and Auctus Management Group. The Midland Metro Alliance is committed to creating a legacy of a trained, enthusiastic and committed workforce over the next 10 years to meet its skilled and semi-skilled labour resource plans. It has engaged with local colleges, the Department for Work and Pensions (DWP), councils and other funding bodies to deliver a bespoke six week Sector Based Work Academy (SBWA) in Light Rail giving unemployed candidates aged 18 and over throughout the West Midlands region the opportunity to achieve accredited qualifications, develop personal skills and gain practical experience in key competencies required to kick start a career in the light rail sector.

The programme is offender friendly and are actively targeting women, 18-29 and BAME groups to promote opportunities within the sector. The alliance are aware that there is an aging workforce (average age 45 in construction and rail) which needs redressing. The programme has been designed to include transferable skills to encourage candidates to consider career progression in construction, civils, engineering and rail. These options may not have necessarily been promoted or accessible to these candidates through traditional routes in education. The participating colleges are:

- Dudley College (Dudley and the Black Country)
- City of Wolverhampton College (Wolverhampton)

Birmingham Metropolitan College (Birmingham North, Central, West) · Solihull College (Birmingham South, East) Group. Information Sessions and Initial Assessments were delivered to unemployed people in each geographical area referred by DWP work coaches after initial 1-2-1 consultations. Following which, candidates, selected by DWP work coaches and colleges, took a rail sector approved drug and alcohol test and medical. Successful candidates who pass the drug and alcohol test and medical (15-20 candidates in each area) will then attend the SBWA at their local college and be ready for interview during May/June 2017 by Midland Metro Alliance partners. The partners will then select suitable candidates for apprenticeships, permanent and temporary contracts. DWP, councils and colleges will help signpost unsuccessful candidates towards other suitable employers in the West Midlands.

The forthcoming works for High Speed 2 will have an impact on the availability of skilled and semi-skilled labour so regional investment in this particular SBWA is vital to equip unemployed candidates with the relevant skill set to build a long term career and, importantly, give them choices for employment.

The first group of candidates in Wolverhampton commenced the programme on 20 March 2017 and are showing early signs of success (as indicated in a recent press release from City of Wolverhampton College). Birmingham Metropolitan College and Dudley College groups will begin on 24 April 2017 and their colleagues at Solihull College on 2 May 2017. In addition to the SBWA programme the Midland Metro Alliance is committed to developing and retaining a local talent bank and is currently recruiting for ten graduate placement opportunities to "grow our own" – acknowledging skills shortages within the construction, engineering and civils sectors across the UK.

Case study 6: Inspiring role models from higher education

The charity Education and Employers is working with a number of universities and their professional bodies, Universities UK and University Alliance, helping them to efficiently and effectively support their staff and alumni as school governors and volunteer to inspire young people about jobs and educational routes to these including, of course, attending university. Inspiring Governance is a national school governance recruitment and support service being taken forward by the charity Education and Employers and funded by the Department for Education. The service uses online Inspiring the Future Technology to recruit and train volunteers as well as match volunteers to schools with vacancies - visit: www.educationandemployers.org

Case study 7: Careers in logistics – National Careers Service

The National Careers Service in Cornwall and the Isles of Scilly have produced Talking Heads films featuring Somerset employer, Nagel Langdons who are championing careers in logistics.⁵¹ This is complemented by a range of Employer Spotlights featuring South West Highways, Highways England, Gregory's Distribution, Airbus & First Group⁵². Printed and distributed posters featuring LMI information on different sectors are made available in local communities. The National Careers Service recently held a STEM event at Flybe's Training Academy in Exeter. Flybe hosted the event free of charge and jointly promoted careers in STEM including engineering related careers linked to transportation e.g. air transport.

The Service has previously promoted the Love the Lorry campaign via our Inspiration Bulletin and we have brokered for local employers South West Highways, Great

Western Railway and Gregory Distribution to attend School careers events. Great Western Railway were also represented in a special Apprenticeship Bus tour to promote Apprenticeships within their company. With regards to Hinkley, the Service is involved in meetings with EDF/Hinkley Education Inspire Operation Group – visit: <https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/inspire>

Case study 8: Maritime - Warsash Maritime Academy

Warsash Maritime Academy has provided first class education, training, consultancy and research services to the international shipping, commercial yacht, and offshore oil and gas industries for over 70 years. As part of Southampton Solent University's School of Maritime Science and Engineering, the Academy benefits from a strong organisational and quality assurance infrastructure to maintain exceptional standards of teaching and service delivery. They are the world's premier maritime education and training provider and part of a prestigious innovation hub, which includes other schools and services within Solent University, with reputable training and business services partners. Southampton Solent University's maritime strategy has reached an exciting new phase, starting with the relocation of officer cadet provision to new premises in Southampton city centre from September 2017. The University's new maritime centre for the tuition of first certification of officer cadets will be located in a dedicated building at St Mary's campus, within the grounds of City College.

The move forms part of Solent's ambitious plans to bring its professional and higher level maritime education programmes from the Warsash campus to the city centre by 2018. Teaching for the fire school, maritime safety and offshore, first aid and medical, and seamanship courses will remain at the

51 see: <http://www.careerpilot.org.uk/for-advisers/national-career-service-south-we/talking-heads-industry-insights/>

52 <http://www.careerpilot.org.uk/for-advisers/national-career-service-south-we/employer-spotlights/>

waterside, lower site of the Warsash campus, with investment plans for new and improved facilities. Visit: <http://www.warsashacademy.co.uk/about/welcome-to-warsash/future-for-warsash-maritime-academy.aspx>

Case study 9: Commute Exeter

The University of Exeter is working in a Consortium with Devon and Exeter Councils and commercial partners Ntt Data, Vaisala, Black Swan and Dynniq, in a ground-breaking, two year (from Nov 2015) intelligent transport project for the area, funded by Innovate UK/NERC. Through this outcome-focused project, the group aims to identify solutions that will alleviate traffic congestion in and around Exeter, with research by the University an important validation for product commercialisation.

The Engaged Smart Transport project integrates real-time sensor data regarding traffic and weather conditions and public services performance with insights into behavioural decision-making, travel mode shift and engagement in smart technologies, and will co-create innovative interventions with public participation. The research is based on the principles of socio-psychology, statistical modelling and social influence, and literature from sustainable transport, smart technologies, travel behaviour, mobilities and social marketing.

The project provides an exciting opportunity to influence travel behaviour bespoke to the Exeter region, and the potential to effect change further afield. Visit: <http://www.commute-exeter.com/>

Case study 10: Targeting Female Returners to Fill Skills Gaps

WISE is 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.

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 – visit: <https://www.wisecampaign.org.uk/>

Case study 11: Transport organisations working closely with schools – TRL

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. TRL is relying more and more on European and overseas skills for the STEM subjects than growing its own at home' (60-70% of applicants are from overseas).

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:

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.

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>