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TECHNICAL APPRENTICESHIPS

Research into the need for and capacity to deliver STEM related Apprenticeship Provision in England

MARCH 2014

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The views expressed in this report are the authors' and do not necessarily reflect those of the Department for Business, Innovation and Skills.

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Executive Summary

The Study...

The aim of the study was to undertake an assessment of current Apprenticeship provision supporting key growth sectors in England which have substantial science, technology, engineering, or mathematics (STEM) content (for sake of brevity these have been referred to as Technical Apprenticeships in the current study). The study reports on the Apprenticeship system's capacity to meet the demands of employers in these sectors both now and in the future. This assessment incorporates an analysis of the key drivers for change and the various constraints on provision.

The research is based on a review of previous studies and various surveys, alongside interviews with key stakeholders, training providers, and employers. The interviews with employers in selected local labour markets, and with training providers and organisations in their supply chain, together with inputs from local labour market stakeholders, provide local area case studies of the supply of, and demand for, Technical Apprenticeships. As well as exploring employers' rationales for recruiting Technical Apprentices, the study also addresses how employer participation in Technical Apprenticeships may be facilitated.

... and its Main Conclusions

The overall conclusion from the data analysis suggests that employers in sectors which have a substantial demand for STEM skills are slightly more likely to report difficulties filling vacancies for those jobs which would typically require an individual to have completed a Technical Apprenticeship or its equivalent. On the other hand, those employers which participated in the study – many of which were recurrent recruiters of Technical Apprentices – reported that they were able to satisfy their demand for suitably qualified people to take up Technical Apprenticeships. This was despite an increase in the number of employers providing such Apprenticeships. Some concerns were expressed by employers about the academic preparedness of young people looking to undertake the rigours of Technical Apprenticeships, but nearly all employers interviewed had been able to recruit the Apprentices they wanted.

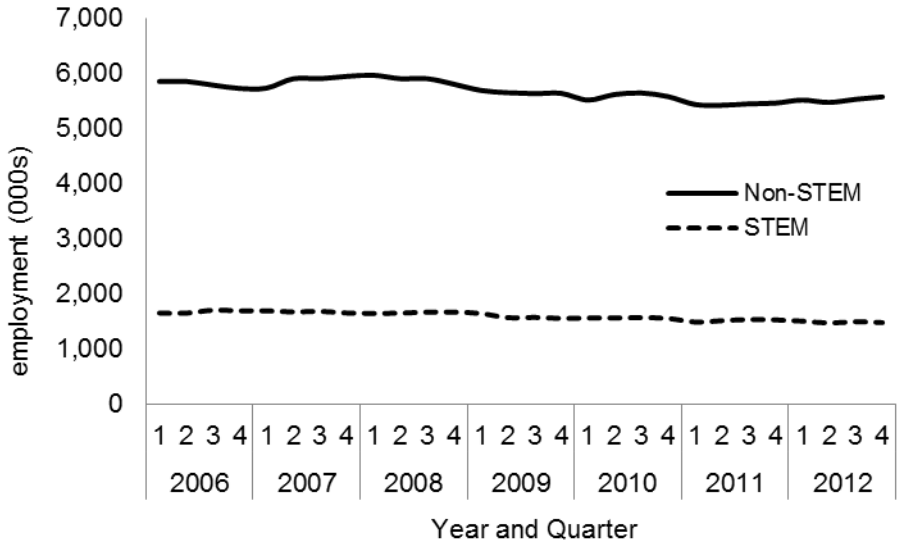
It may be suggested, tentatively, that the current stock of people qualified to a Technical Apprenticeship level is slightly too low, but that employers have been able to increase the flow of entrants into this form of training. At present, supply and demand are finely balanced with concerns expressed by employers that any marked increase in demand, which may arise as a consequence of the economy recovering and major infrastructure projects being commissioned, may result in skills shortages emerging.

Employers were keen to balance the risk between ensuring that they had sufficient skills supply to meet future demand and avoiding training in excess of that demand given the relatively high costs they encountered in training Technical Apprentices.

Trends in the Demand for, and Supply of, Technical Apprenticeships

The evidence suggests that the number of people employed in occupations which require people to have an intermediate level qualification in a STEM subject has been more or less stable over recent years (see Figure A).

Figure A: Employment in STEM and non-STEM occupations at an intermediate level, 2006 to 2012



Note: Intermediate level occupations are those in 1-digit SOC groups 3, 5 and 8. Figures include employees only

Source: Labour Force Survey, quarterly data 2006 Q1 to 2012 Q4

The number of people who report that they have completed an Apprenticeship in those industries with a relatively high concentration of people with skills related to science, engineering and technology, has steadily fallen in percentage terms over time (see Table A). In other words, employers' skill needs in these sectors have been increasingly filled by means other than Apprenticeships.

Table A: Percentage of people in STEM industries reporting completion of an Apprenticeship

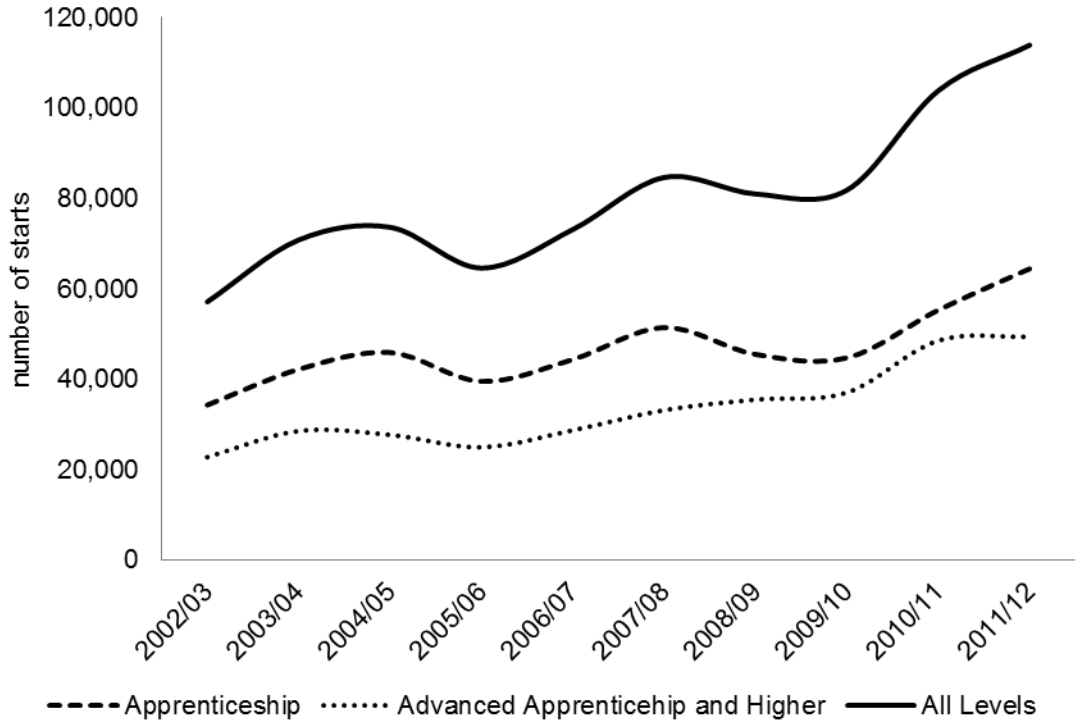
	Non-STEM Industries	STEM Industries	All Industries
2006	8%	23%	11%
2007	7%	22%	11%
2008	7%	21%	10%
2009	6%	22%	10%
2010	6%	21%	9%
2011	6%	20%	9%
2012	6%	20%	9%

Source: Labour Force Survey 2006 - 2012

Looking to the future, the evidence suggests that the demand for people who have completed a Technical Apprenticeship – or its equivalent – looks set to increase. This is likely to result from future replacement demands in those occupations where a Technical Apprenticeship is a common means of entry where demand is projected to be substantial over the period to 2020 as a consequence of the expected number of retirements.

To date the number of Technical Apprenticeship starts has responded to the signals relating to increasing future demands. Figure B shows the increase in the number of Technical Apprenticeship starts over recent years. It should be noted that the number of Technical Apprenticeship starts as a share of all Apprenticeship starts has been in decline.

Figure B: Number of Technical Apprenticeship Starts



Source: Statistical First Release

The critical question is whether demand is keeping pace with supply. The interviews with employers suggested that for them this supply was keeping pace with their demand. But there is prima facie evidence that employers in those sectors with a substantial demand for science, engineering and technical skills are more likely to report hard-to-fill vacancies for skilled trades workers. That is, an excess demand for those workers who would have completed a Technical Apprenticeship or its equivalent.

How the pattern of future demand and supply plays out is also dependent upon how employers decide to meet their future skill needs. For instance, by substituting higher education graduates for Apprentices or vice versa. Employers have a degree of strategic choice regarding how they satisfy their skill needs. These are considered next.

Case Study Evidence on Employer Demand for Technical Apprenticeships

The in-depth interviews with employers revealed that many had established Apprenticeship programmes with well-developed links to training providers. Their view was that Technical Apprenticeships had successfully met their skill needs in the past and they expected they would continue to do so in the future.

Apprenticeships were typically at Level 3, though some led solely to Level 2. There were mixed views about Level 4 Apprenticeships. Some employers – typically those

with established Apprenticeship and graduate entry programmes in the engineering sector - were unsure what role Level 4 Apprentices could play in the organisation given that the Level 3 ones currently met their needs for technicians, and their graduate programmes met their higher level needs relating to managerial and professional roles. Other employers saw a Level 4 Technical Apprenticeship as filling job roles which fell between technician and professional ones (i.e. a higher level technician). The establishment of Higher Apprenticeships could affect the number of graduates required over the long term, but this would not be confirmed for some years to come.

In companies outside the engineering sector, there was considered to be greater scope for graduates to substitute for Technical Apprentices and vice versa. There were examples where employers had switched provision from one to the other over recent years. Level 4 Apprenticeships were potentially seen as facilitating this development though it may not result in a direct substitution. Level 4 Technical Apprenticeships may lead to individuals filling a higher technician role – a role which was not yet fully developed within all organisations – which, in turn, may result in a demand for fewer graduates. But, as yet, this was supposition.

Employers who had recently started to engage with Technical Apprenticeships – for example in the creative and media sector – had found that Apprenticeships had met their demand for people with industry-relevant IT skills. They anticipated continuing to recruit Technical Apprentices in the future.

Smaller employers were keen to become involved in Apprenticeships but were concerned about the risks of doing so. They could see Apprentices supplying the key skills required in the business and, as a secondary benefit, felt that their involvement would contribute a social good to the local community. They very much valued having an organisation to guide them, and their Apprentices, through the training programme and, where necessary, liaise with training providers and assessors on their behalf.

There was relatively little evidence that companies at the head of the supply chain required employers in their supply chains to engage in Apprenticeships, though there was an expectation that their suppliers would possess the skills required to fulfil their obligations.

Case Study Evidence on the Supply of Apprentices

In general, employers reported little difficulty in either recruiting or retaining Technical Apprentices. This was true in even the tightest of labour markets such as in the south east of England. Employers typically required their recruits to have five GCSEs at grades A to C, with maths, English, and a science typically required (for entry to Level 3 Apprenticeship). They also required their Apprentices to reveal an interest in the industry they were joining and aptitude for the work, and to have at least some type of hands-on experience (no matter how informal).

The debates around changing the curriculum often focused on getting employers more engaged with schools. Most large firms that employ Technical Apprenticeships engage in outreach in schools' activities to counter what many feel to be poor information, advice and guidance in relation to Apprenticeships in general, and Technical Apprenticeships in particular. There was support from some of our interviewees for the idea of raising the profile of STEM careers through more use of STEM ambassadors to counter the perception that particular STEM areas do not present attractive career opportunities.

Even though the employers wanted people who typically had the qualifications which would allow them to study for A-levels and then enter university, they usually had applications substantially in excess of the number of places they had available. This was less true of the smaller employers which were newer to Apprenticeships but even here employers were able to recruit the people they wanted. Supply-chain SMEs and those which used the same providers as the larger employers often found that the larger firms had first pick of the better qualified Apprentices.

In general, employers and providers reported that retention was not a problem because of the amount of effort expended on getting a good fit between the individual and the organisation at the recruitment stage. The largest employers tended to delegate the initial sifting of applications to their training provider. Smaller organisations also tended to depend upon their providers to help with the recruitment process. Such approaches were seen as means of minimising the risk of recruiting an unsuitable candidate.

Training providers tended to report that the main problem they faced was finding sufficient employers to take on Apprentices. For them the problem was dealing with the over-supply of young people looking for a Technical Apprenticeship

Evidence of Mismatch / Sub-Optimal Supply in the Case Studies

In general, employers trained to meet their current needs. They did not train beyond what was required to meet expected demand in the workplace. In part this was because they recognised that they would only recoup the cost of training Technical Apprentices by retaining them in the business for some years after completion of their Apprenticeship.

Employers recognised that there was considerable expense involved in training their Apprentices. Examples of some of the larger employers becoming quasi-group training associations in their own right were noted. At least one large employer reported that they had trained Apprentices for other companies in the vicinity (for a price). This service was not necessarily limited to supply-chain companies.

Some training providers pointed out that large national infrastructure projects – such as the Olympics and Terminal 5 at Heathrow – could attract skilled technician labour because of the wages they offered. This could result in skill shortages elsewhere occurring by upsetting the finely poised balance between the demand for, and supply

of, skilled labour in a local labour market. Whilst the attraction of well-paid jobs at a distance had little impact on Apprenticeship training directly, it meant that the local employers could be faced with skill shortages where: (a) they lost existing staff to these projects; or (b) they were looking to recruit skilled workers from the external labour market to replace either exiting employees or meet increased demand. Such shortages have a disproportionate impact on SMEs and micro firms in localised labour markets unable to compete with salaries offered by national recruiters. This suggests that the current supply of Apprentices could well be insufficient to meet any market upturn in the demand for skilled labour which results from a growth in the economy and/or increased investment in major infrastructure projects, although such projects are signalled well-enough in advance for remedial action to take place.

Employers which had considered taking on Apprentices but had, in the end, decided not to do so, mentioned that the main reason for this was the associated cost. Some were unable to access suitable training in their locality, or were unaware of the training opportunities that existed. Often, they felt that the job roles in the organisation did not justify Apprenticeship training. Some employers cited health and safety regulations as one reason for not recruiting Apprentices as it precluded young people between the ages of 16 and 18 years from working on site (e.g. on nuclear decommissioning plants, or working offshore).

Developing New Models of supply

The typical types of training provision that employers are engaged with in the UK include:

- employer/provider direct relationships which have evolved organically according to need;
- employers-as-providers (where employers have established their own training academy, sometimes in conjunction with supply-chain companies);
- shared Apprenticeship models;
- various models of group training (including Group Training Associations (GTAs) and Apprentice Training Associations, (ATAs)); and
- the more recent Employer Ownership Schemes (EOS).

The Shared Apprenticeship model - whereby large companies and some of their supply chain sub-contractors share Apprentices as and when required - is reportedly becoming an increasingly popular model of delivery and is found in the Construction industry where short-contracts mean that otherwise Apprentices may be left 'high and dry' if they remained with one employer.

Employer Ownership Schemes, whereby companies are directly funded by Skills Funding Agency to provide training, are becoming more common, particularly in industries with a higher proportion of SMEs, such as Construction. They fit most directly

with the policy agenda of making Apprenticeships more responsive to employers' needs.

Group Training Associations (GTAs) emerged in the 1960s as groups of training providers working under one umbrella to avoid overlap of provision and offer economies of scale by sector and/or region. ATAs are also mostly led by training providers. They recruit Apprentices who are then hired out as a flexible workforce to other employers, known as ‘host companies’ for the work-based element of their Apprenticeship. This model appears to be more common in the Life Sciences sector where the sharing of opportunities for Apprentices to access resources and equipment with employers is highly valued, and are largely used by larger employers as SMEs often don't have the range of work to offer experience to Apprentices.

As noted above, some of the larger employers we spoke to were becoming their own training providers. They were taking on Apprentices from other companies and training them – at a price – in their training schools and academies. The larger employers had the expertise in-house to navigate the processes required to deliver a high quality Technical Apprenticeship. The training of Apprentices from other companies was not limited to supply-chain companies. In fact it was often local companies which tended to supply Apprentices to the Technical Apprenticeship programmes of the larger companies. The benefit to local companies – and the local market more generally – was that of Apprentices having access to training which was highly regarded in the external training market even if the Apprentices did not work for the company with which that training programme was associated.

Smaller employers wanted to minimise their exposure to the business risks of delivering a Technical Apprenticeship. One model was where the apprentice was effectively managed by the provider. In many respects the problem the novice Apprentice employer faced was that of not being sure of what they were getting into or the level of mentoring support for Apprentices in the workplace. They recognised that Apprenticeships could fill a skill demand in their organisation but were not at all sure what would be required of them in delivering the Apprenticeship.

Group Training Associations (GTA) were believed by some employer respondents and stakeholders to be an effective but declining model for delivery. Where they are demand led, responding to what employers need, GTAs were thought to be successful, but one difficulty noted by stakeholders is around getting competing employers to work together and provide something beyond that required for their own specific needs. Employers often need to be willing to share new technology with competitors for the training to be optimised, but evidence suggests that this may not always happen.

Other Points

The take up of Technical Apprenticeships among young women remains low. Employers and providers were keenly aware of this issue, which is largely about

persuading more women to apply for Technical Apprenticeships. Outreach activities can be a partial solution to this and most of the larger companies and providers undertook such activities, though some noted that schools sometimes turn down the opportunity to engage with them.

Several employers and providers noted that more applicants with A-levels were applying for Technical Apprenticeships which they thought was a result of the recent increase in Higher Education tuition fees. This has implications for the content and structure of the Apprenticeships given the existing stock of knowledge the A-level student possesses (e.g. it may be possible to reduce the period of training leading to completion or to reduce time off-the-job for some modules).

While many employers were looking to take on Apprentices in the 16 to 19 year old age group, some employers noted that the withdrawal of funding for those aged 25 years and over had potentially limited their supply of candidates to those who are eligible for subsidised training. Other employers were prepared to recruit those aged over 25 years as they were well suited to the Apprenticeship on offer.

Local Enterprise Partnerships (LEPs) recognised the importance of promoting the take up of Technical Apprenticeships in the areas they represented. At the time the study was conducted many LEPs were still in the process of scoping how they would promote their local economies and how they might influence the supply of Technical Apprenticeships and initial vocational training and education more generally.

Conclusions and Policy Implications

Employers in the range of sectors included in this study placed a high value on the contribution Technical Apprenticeships made to their business. It was also apparent that Technical Apprenticeships have been able to penetrate sectors outside the traditional heartland of engineering, such as the creative and media sector. Employers in these sectors recognised the value this form of training would continue to make to their businesses over the medium-term.

Employers were keenly aware of potential uncertainties facing the future demand for their products. They were generally unwilling to provide training over and above that required to meet projected demand over the short- to medium-term. In relation to some Level 2 training, employers reported that the productive contribution of the Apprentice over the training period could cover training costs, but most Technical Apprenticeships were at Level 3 and these were regarded as costly.

It was also apparent that an increase in the demand for skilled labour resulting from, say, the start of a major infrastructure development, could quickly result in skill shortages in local labour markets. This suggests that there is a lean system of skills supply in place for technician-type skills. This presents the risk of current supply being unable to keep pace with demand if there is a pick-up in the demand side especially

when set within the context of expected future levels of replacement demand for people to work in associate professional and skilled trades occupations.

One possible way of increasing the supply of Technical Apprenticeships is to use the existing training capacity that is already in place. There is evidence of employers becoming quasi-group training providers for their industries by taking on Apprentices from other local companies. They are willing to do so provided that they can cover their costs and they benefit from economies of scale. Potentially this approach may lead to increased supply at the local level if more employers can be persuaded to work together in this way.

There is also evidence that a more traditional approach to group training can prove beneficial to smaller employers, or those new to Technical Apprenticeships and which are a little uncertain about their capacity to deliver the Apprenticeship in a way which benefits their business. This is not to say that this is the only model which can be applied to this group and there may be other ways of finding a means of minimising the risks smaller businesses, or companies new to Apprenticeships, face in supporting a Technical Apprenticeship.

1. A Study of Technical Apprenticeships in England

1.1 The Study

Supporting key sectors is a major strand of the Government's industrial strategy (BIS, 2010). Part of that support is ensuring that the initial vocational education and training system provides the skills which industry needs. In many of the relatively high value-added growth sectors such as advanced engineering, life sciences, digital and creative, amongst others, the emphasis is upon the supply of science, technology, engineering, and mathematics (STEM) skills. Given the importance of STEM skills to the future of these sectors there have been a large number of studies which have sought to assess whether the supply of graduate level STEM skills has kept pace with demand. Many of these studies concentrate on graduate level skills (e.g. Bosworth et al., 2013). Increasingly there has been interest in the role that intermediate level skills supply can play in supporting key sectors. For instance, several studies reveal that technician roles - para-professional ones which lie between the traditional craft worker and the professional engineer – have re-emerged in sectors such as aerospace (e.g. Lewis, 2010a; 2010b). And other studies have drawn attention to relatively high levels of replacement demand for skilled trades workers in industries such as manufacturing, as a result of impending retirements over the next decade (Wilson and Hogarth, 2013). All point to increased importance being attached to the quantity and quality of supply of intermediate level STEM skills. The research on which this report is based, which considers the role of Apprenticeship in meeting current and future demand for STEM skills, is therefore timely.

The aim of the study – conducted during 2013 - was to undertake assessment of the current Apprenticeship provision supporting key growth sectors, which have substantial (STEM) content in England, and report on the programme's capacity to meet the demands of employers in these sectors in the future. For sake of brevity, Apprenticeships with substantial STEM content are referred to as Technical Apprenticeships throughout the report.

1.2 Aims and Objectives

The research addressed several inter-related questions as set out below.

- **Identify Employer Need for Technical Apprenticeship Provision**

  Does the employer base require more of the specified technical skills and is there a shortfall in provision?

  - What are the major civil projects and identified areas for growth which will require more skills?

    - What are the views of Small and Medium Enterprises (SMEs) and large employers?
    - What role do employers have and want in the development of provision and have they been able to effectively engage with the providers of Apprenticeships?

- **Capacity to Expand Specified Provision:**

  Is there currently, and in the foreseeable future, sufficient capacity in the system to meet demand?

    - Identify where gaps in provision exist.
    - Identify the capacity for existing providers to grow their provision in the related sectors.
    - Identify capacity for new entrant providers to deliver such provision – where this may come from and how it can be encouraged.

- **Barriers:**

  Identify any barriers preventing growth in identified provision, for instance:

    - Local economy restrictions.
    - Skills in the provider base.
    - Expertise and knowledge of opportunities.
    - Barriers specific to SMEs.

- **Satisfaction with provision**

  To what extent are each of the models of provision fit for purpose?

    - Private training providers.
    - Colleges.
    - Shared Apprenticeship models.
    - Group Training Associations.
    - Other models including employer-as-provider and Employer Ownership Schemes.

1.3. Method

To address the questions set out above the study was divided into four stages:

Stage 1: data analysis

The first stage of the study was concerned with identifying the scale of the phenomenon to be observed. Using a range of national data sets - including the Individual Leaner Record (ILR), the Labour Force Survey (LFS); Evaluation of Apprenticeships; Employer Survey (2011); the Employers Skills Survey

(ESS2011); and the Employer Perspectives Survey 2012 (EPS2012) - the study assessed current levels of supply of, and demand for, Technical Apprenticeships. It also provided an indication of any mismatch between supply and demand. In looking to the future the study drew on the Working Futures projections of future skill demand to 2020 in England.

Stage 2: stakeholder consultations

In order to fully understand the context in which employers and training providers were operating a number of interviews were carried out with key stakeholders. Stakeholder consultation was undertaken through telephone interviews and the informants included policy makers responsible for particular sectors or for devising skills policy relevant to those sectors. It also included interviews with various representative bodies responsible for skills supply to various sectors and / or occupations. The study had a sectoral focus so the emphasis was very much upon obtaining the views of informants with reference to the following sectors: advanced manufacturing (especially automotive and pharmaceuticals); energy supply (including renewable and nuclear); information and communication technologies (especially in the digital creative and media sector).

Stage 3: case studies

The main element of the study was collecting data from semi-structured interviews with employers. These employers formed the core of the fifteen case studies which were conducted. In addition to the interviews with the principal employer in a case study, interviews were also conducted, where feasible, with the case study employer's training providers and companies in its supply chain, together with the main training providers in the case study employer's locality relevant to its sector, and the local LEP representatives. In this way it was possible to construct 15 mainly local area case studies based around a single employer. The 15 case studies typically contained interviews with between three and five key informants. Twelve case studies were focused on a region / local area with a high level of activity in one key STEM-related sector; and three more case studies were based around national public infrastructure projects likely to stimulate demand for Apprenticeship provision across STEM-related and other sectors. The table below shows a breakdown of the case studies by sector (see Table 1.1).

Stage 4: workshop

A workshop with participants drawn from employers, training providers, and policy makers to reflect on the initial findings from the research and highlight some of the factors which may be driving the observed findings and how policy, in future, could be adapted to ensure that the supply of Technical Apprenticeships meet the needs of employers and, more generally, the needs and aspirations of local and regional economies.

Table 1.1: Case studies by sector

Case Study No.	Sector	Regional/National
1	ICT	Regional
2	Advanced Manufacturing	Regional
3	Green and Energy	Regional
4	National Infrastructure	National
5	Advanced Manufacturing	Regional
6	National Infrastructure/ICT	National
7	ICT	Regional
8	ICT	Regional
9	Manufacturing	Regional
10	Manufacturing	Regional
11	Manufacturing	Regional
12	Manufacturing	Regional
13	Life Sciences	Regional
14	Life Sciences (Pharmaceutical)	Regional
15	Green and Energy	National

In the chapters which report on the qualitative aspects of the study, interviewees are identified by the following key outlined in the table below (see Table 1.2).

Table 1.2: Interviewee codes

Interviewee type	Code
Employer with Apprentice(s)	EA
Employer without Apprentice(s)	EAW
Training provider	TP
Local Enterprise Partnerships/City Regions	L
Group Training Association as TP	GTA-TP
Case Studies	CS

The codes are followed by a number (e.g. EA16; CS10) and an indication of sector. Some thematic case study examples are presented in panels which provide contextual information about the case study.

In order to garner a wider view of provision and issues than that identified in the case studies, a total of 36 telephone interviews were also carried out with a sample of employers and providers. This also included a sub-sample of employers which had considered taking on Apprentices in the past, but did currently had not done so (as identified in the Employer Perspectives Survey 2012). There were 21 telephone interviews with employers with Apprentices, 10 with employers without Apprentices, and six with training providers, a breakdown of the telephone interview sample is outlined below (see Table 1.3).

Table 1.3: Telephone Interviewees by sector, size and region

Interview no.	Sector	No. employees	Region
EA1	Advanced Manufacturing	9	EM
EA6	Advanced Manufacturing	42	SE
EA11	Advanced Manufacturing	120	EE
EA9	Advanced Manufacturing	3280	SW
EA16	Advanced Manufacturing	80	SE
EA3	Automotive	3500	NW
EA5	Automotive	1000	National
EA14	ICT	9	EM
EA2	ICT	30	SE
EA17	ICT	450	NW
EA29	ICT	80	Y&H
EA12	Green Agenda/Energy Supply	6000	EE
EA4	Green Agenda/Energy Supply	16	NE
EA13	Green Agenda/Energy Supply	200	EM
EA25	Green Agenda/Energy Supply	300	NE
EA20	Green Agenda/Energy Supply	35	National
EA36	Green Agenda/Energy Supply	1000	EM
EA19	Life Sciences	209	SW
EA7	Life Sciences	11	Y&H
EA30	Life Sciences	25	SE
EA35	Life Sciences	600	Y&H
EWA25	Advanced Manufacturing	4	SE
EWA24	Automotive	2	SW
EWA22	ICT	7	EM
EWA27	Green Agenda/Energy Supply	20	EE
EWA29	Green Agenda/Energy Supply	4	SE
EWA23	Green Agenda/Energy Supply	30	EE
EWA15	Life Sciences	73	NW
EWA26	Life Sciences	12	SW
EWA10	Life Sciences	75	Y&H
EWA34	Life Sciences	35	SE
TP33	Advanced Manufacturing	NA	SW
TP28	ICT	NA	Y&H
TP32	Automotive	NA	EM
TP31	Green Agenda/Energy Supply	NA	WM
TP35	Advanced Manufacturing	NA	EM
TP36	Life Sciences	NA	Y&H

As we were unable to secure any telephone interviews with Group Training Associations a short survey was emailed to a sample of GTAs, yielding five returns.

The interview schedules for Stage 3 can be found in Appendices 6-11. In total the research yielded responses from people in 79 different roles (see Table 1.4).

Table 1.4: All interviewees by type of organisation

Type of organisation	Number of interviews
Employer with Apprentice(s)	35
Employer without Apprentice(s)	10
Local Enterprise Partnerships/City Regions	10
Training providers (including GTAs)	24
Total	**79**

1.4 Analysis of Interview Data

Data from all 79 interviews, including face-to-face case study and telephone interviews, along with data from the five GTA email survey responses, were analysed thematically in a matrix. Responses to each of the identified key subject themes were analysed by type of interviewee (employer with apprentices, employer without apprentices, training provider, LEP/City Region) and then classified by size (of employer) and sector. Themes were then grouped in order to create the three major qualitative sections (outlined below) in order to produce this report.

1.5 Structure of report

The report begins with three sections that use quantitative data to analyse: Current Provision; Employer demand for Technical Apprenticeships; and Trends in the supply of Technical Apprenticeships. These are followed by three sections based on qualitative data: Employer rationales for recruiting Technical Apprentices; Barriers to increasing capacity; and Reported satisfaction with training provision. These are followed by a Conclusions, Policy Implications and Recommendations section. Technical information and research instruments can be found in the Appendices.

2. Current Provision and Policy Responses

2.1 Introduction

Science, Technology, Engineering and Mathematics (STEM) skills are widely regarded as having a positive impact on economic welfare through, amongst other things, their capacity to increase innovation and exports (DTI, 2006; BIS, 2010). Both the UK and the EU more generally see their capacity to create a high value, high skill economy and society as being predicated upon a strong research and development (R&D) base which is able to turn innovations into products and services. Within an international market, relatively high value activities are seen to rest more on the invention and design of new products and services and less in their manufacture and delivery. This overstates the case somewhat but it captures the essence of the issue: that there is increased competition between countries to develop a stronger R&D base. This has inevitably focused attention on the supply of graduate and postgraduate STEM skills and whether it was keeping pace with demand (DIUS, 2006; DIUS, 2009; DTI, 2006). In the mid-2000s the general view was that supply – which had increased substantially over the preceding years – was keeping pace with demand. More recent evidence hints of possible over-supply with STEM graduates working in non-graduate jobs (UKCES, 2011), although other evidence suggests that the general direction of change in the economy towards a growth in more technically demanding jobs, coupled to future high levels of replacement demands for people with STEM skills, may mean that STEM skill shortages are on the horizon (Wilson, 2009).

During the 2000s less attention was focused on the supply of STEM skills through the Apprenticeship system, though this was acknowledged as a key source of supply (DIUS, 2006). Research at the time demonstrated that employers in manufacturing continued to provide relatively high cost Apprenticeships in engineering (Hasluck et al., 2008). In many respects these Apprenticeships corresponded to the skill intensive, advanced ones which the Richard Review seeks to promote (Richard, 2012). And in common with the dual systems of continental Europe, they had a strong emphasis upon the delivery of general and theoretical education – typically provided at a local college – alongside workplace-based training and practical experience. Employers invested in these types of Apprenticeship because they regarded them as of critical importance to the medium- to long-term future of the organisation. They were not looking to recoup their training costs over a short period of time because they saw their Apprentices becoming the future cadre of technician level personnel, upon which the organisation was so dependent. Typically employers recorded a net cost, once the productive contribution of the Apprentice was deducted, of around £30,000 in getting

an Apprentice to completion. This excludes the contribution the State makes in funding Apprenticeship training.

2.2 The renaissance of the Technical Apprenticeship?

Since the early 1990s, the direction of travel has been very much focused upon increasing levels of participation in higher education. Inevitably this has resulted in many jobs which had historically been filled by those who had completed a period of study in Further Education (FE), now being filled by Higher Education (HE) graduates. This is not to say that the jobs filled by graduates were not transformed in some way as a consequence their incumbents having a higher level of educational attainment than their predecessors. Surveys of those who have recently graduated suggest that most graduates use the skills they acquired in HE in their current jobs (Purcell et al., 2012). Whether HE graduates have provided a substitute for those who would have traditionally entered their occupation through a Technical Apprenticeship is a moot point. Certainly evidence from the engineering sector indicates that many employers continue to make a distinction between their graduate and Apprenticeship intake (Hogarth et al., 2012; Hogarth et al., 2007). Graduates are taken on to fill professional and managerial jobs whereas former Apprentices are expected to fulfil craft and technician roles in the workplace. In summary, they are not seen as substitutes for one another. This is supported by the evidence collected in this study too.

Even if graduates and Apprentices have remained distinct entities for employers with a demand for technical and scientific staff, despite the increase in the HE participation rate over recent decades, in the future Apprenticeships could conceivably offer competition to the traditional route through HE for two main reasons. First, with the increase in tuition fees, there may be a degree of uncertainty over future supply from HE though the evidence suggests that the numbers entering HE have not fallen since the rise in tuition fees. Second, with the introduction of Level 4 Apprenticeships there is the potential to further open up an alternative, vocational pathway through to tertiary level education by providing a ready means of continuing on from completion of Level 3. In combination, these two developments could stimulate demand from both employers and learners for Technical Apprenticeships. But a degree of caution is required here. Although the Government has indicated a desire to increase the number of technicians in the economy – typically people qualified through an Apprenticeship under a STEM Framework, the evidence suggests that over recent decades the number of people working in science, engineering and technology occupations who would have completed a Technical Apprenticeship has declined in both percentage and absolute terms (Jagger et al., 2010; Mason, 2012). In part this reflects both changes on the supply side such that employers have been able to increasingly recruit graduates from HE, and in the nature of work carried out in sectors such as manufacturing. It is too early at this stage to say what impact Level 4 Apprenticeships will have on employers' graduate recruitment practices.

2.3 So why are so few people working towards a Technical Apprenticeship?

Historically the problem which the Apprenticeship system has faced is the relatively low number of young people who enter this form of training. In the 1970s around 7 per cent of the school leaver cohort entered this form of training (Haxby, 1989). Over recent years there has been a sharp increase in the number of Apprentices though at least some of this has been accounted for by the provision of Apprenticeships to older people many of whom were already in employment at the commencement of their Apprenticeship. In future, funding of Apprenticeships will be determined more by Level of study and whether the person being trained is filling a new job. What impact this will have upon participation levels is too early to gauge.

Increasing the number of Apprenticeships and the number of Technical related Apprenticeships in particular needs to consider what is already known about the factors, which inhibit employer participation in workplace based training. A number of barriers were identified by Hogarth et al. (2009) which are germane to Apprenticeships:

- employer product market strategies which are concentrated on serving local markets with relatively simple, low cost products tend to generate relatively little demand for any kind of training;
- firms operating in price sensitive segments of the market find it difficult to find the capital resources to fund Apprenticeship training. As noted above Technical Apprenticeships are relatively costly to the employer over the short-term;
- some firms have relatively short-term time horizons and discount the future more heavily (*i.e.* attach less importance to financial flows which are further in the future) and are, consequently, more risk averse with respect to any investment including Apprenticeships;
- some employers are sceptical about the contribution of training to their business and, accordingly, prefer to recruit fully skilled workers from the external labour market;
- imperfect information where employers may lack sufficient, reliable information about the quality and content of learning opportunities which are available to them;
- small firms may be more likely to experience more of the barriers cited above.

Identifying how to overcome these barriers is a formidable problem. As noted earlier, persuading employers to invest in Apprenticeships is a long-standing problem which stretches back to at least the 1960s and 1970s. From the 1970s onwards there was increasing recognition of market failure with the State stepping in to increasingly fund, via the then newly created Manpower Services Commission, the provision of initial vocational education and training. More recently, policy has sought to rein in the State's expenditure on Apprenticeships with an expectation that the employer will, in certain instances (e.g. where the Apprentice is aged over 24 years of age), contribute more to the overall cost of training (BIS, 2010b). This needs to be seen in the context of employers having been increasingly provided with more influence over the content, structure and delivery of Apprenticeship training.

Given that the origins of the current study lie in Professor Unwin's inquiry into Group Training Associations (Unwin, 2012), consideration is given below to way in which employers can operate through networks and associations to obtain the training they require.

2.4 The potential to use collective measures

In their review of collective measures Cox et al. (2010) and Hogarth et al. (2009) highlighted, amongst other things, the possibility of using group training programmes to support Apprenticeships provision especially to SMEs. The review also looked at occupational licences, public procurement, and the reporting of training activities in annual accounts. It also addressed how companies can collaborate through networks of various types to meet their skill needs. Bringing the debate up to date, Professor Unwin's inquiry into the role of Group Training Associations further highlights the potential of this type of activity in supporting the provision of Apprenticeship training (Unwin, 2012).

Most firms tend to operate in networks of one kind or another. These may relate to conventional supply chain networks, or through subcontracting. However, increasingly organisations are entering into partnering relationships, sometimes at a regional level, but given the power of modern communication systems they can be worldwide. At a regional level, there is evidence that a partnering approach can have an impact upon training activities. Studies are also beginning to reveal the extent to which area based initiatives can help develop an economy, as evidenced in the strategy to revitalise the Massachusetts economy in the early 1980s. Whilst the policy focus is often upon innovation there is also a skills and training dimension, insofar as individual companies benefit from the general pool of skilled labour. This has been explicitly recognised in various regions in Europe. In Erlangen-Nuremburg, Jutland, Neuchatel, Ghent and Courtrai and Eindhoven regional infrastructures have developed which facilitate the process of employers working in collaboration with one another, including the development of their workforces (Bosworth et al., 2012). There is a sense that by ensuring the region has the skills it needs to support the existing businesses, all businesses benefit. By collaborating with one another there is a transmission of knowledge and recognition that the skills base, all employers in the network needs to be of certain standard in order for the collaboration to work successfully.

With respect to initial vocational education and training, including Apprenticeships, it is likely that more formal training relationships need to be in place rather than the ones alluded to above which relate mainly to continuing vocational education and training. Group Training Associations (GTAs) and networks place more of a formal emphasis on the arrangements to deliver training. But the evidence suggests that in certain circumstances they can prove effective in raising human capital investments. Training co-operatives in the Netherlands, for example, have brought employers together to train Apprentices where it might not otherwise have taken place (Gelderblom and Collewet, 2009). Skillsnets in Ireland have also fulfilled a similar function, though they

were dependent upon State funding. In the UK, Gospel and Foreman (2006) have drawn attention to the role of Group Training Associations in facilitating Apprenticeship training though their role has declined somewhat since their heyday in the 1960s and 1970s.

Unwin (2012) draws attention to the fact that GTAs can also increase employer ownership insofar as they exist only to serve the needs of their members:

> GTAs should not, however, be regarded purely as good quality training providers. Their distinctiveness is rooted in their symbiotic relationship with employers. It is employers who drive the work of GTAs, but, at the same time, GTAs support employers through providing a holistic and highly responsive business service in which training forms a part (p.26)

What is often less clear, however, is the extent to which GTAs can develop beyond their current base, without losing their essential elements, in promoting a greater take up of Apprenticeships by employers. Cox et al. (2013) point out that existing employer networks work best where there are pre-existing relationships between participants, who presumably share common aims, which might be a barrier to their being developed further.

The Richard Review (2012) has identified the way in which the Apprenticeship programme can be adapted to better meet the needs of industry and better meet the current and future skill needs of the economy. Employer ownership is central to achieving this aim. With specific reference to small and medium sized enterprises, where there remains considerable scope to increase employer participation in Apprenticeships, but as the Holt Review (2012) identifies; particular issues inhibit SME engagement for this group of employers. In particular, there are issues of ease of access to the Apprenticeship system, having ready access to information about how to support an apprentice through their training, being able to financially support an Apprenticeship, and being sure that skills the skills eventually obtained are of benefit to the SME.

2.5 Conclusion

There is a consensus about the importance of technical and scientific skills, at all levels, to the future success of the UK economy. With regard to Apprenticeships, the principal difficulty would appear to be that of finding a means of persuading more employers to deliver this form of training which is, after all, relatively costly to both the State and the employer compared with many other types of Apprenticeship. Some form of collective measure may provide a means of stimulating supply. Before considering this issue in more detail, the next chapter considers the recent evidence on the supply for, and demand of, technical and scientific skills at Levels 2 and 3.

3. Employer Demand for Technical Apprenticeships

3.1 Drivers of employer demand for STEM skills

The demand for Apprentices will depend in large measure upon the macroeconomic performance of the economy. As the UK economy recovers there is likely to be an increased demand for training of all kinds. But in relation to Technical Apprenticeships there are a specific set of factors which are likely to affect overall levels of demand and the specific skills which employers want to derive from investing in this form of training.

The key drivers in the demand for specific types of STEM skills will be driven by the following:

- **regulation**, such as that relating to health and safety and environmental factors;
- the **green agenda** and the impact this has on the need to reduce both energy consumption and levels of waste which will affect the design of products and the way they are produced;
- current and future **infrastructure investment** which is sometimes sizeable in nature;
- changing **consumer preferences and tastes**, such as consumer environmental awareness, and the demand for instantaneous electronic communication;
- an **ageing population** and the demand for goods and services which serve the needs of older people;
- **globalisation** and the capacity to produce goods almost anywhere with geographically dispersed supply chains;
- **technical change** and the opportunities this provides to generate new products and processes.

These all provide opportunities and challenges to employers. It is apparent that the product market strategies of employers which fully capture the benefits the drivers of demand offer have depended in large measure upon possessing the technical skills to both develop new products and services and possessing the concomitant technical skills to produce those goods and services (Mason, 2011). The remainder of this chapter looks at the demand for STEM skills and Technical Apprenticeships.

3.2 Measuring the demand for Technical Apprenticeships

Below, an indication is provided of changes in the demand for Apprentices in STEM subjects at an intermediate level. Ideally, the aim is to identify the extent to which people in employment possess skills – as measured by qualification or occupation – which correspond with STEM ones. The analysis is complicated by the absence of demand side data which contains much information about the subjects a person has

studied in FE.[1] This results in it being necessary to make a number of assumptions such as: everyone who has completed an Apprenticeship in an industry, which has a relatively high demand for STEM skills, has completed a Technical Apprenticeship. This assumption will tend to over-estimate the demand for STEM skills in those industries, on the other hand it will under-estimate the total number of people with STEM skills because it does not include people with STEM skills in industries which have a low-demand for STEM skills. For example, the retail and financial sectors have a relatively strong demand for IT workers, and engineers work in a range of industries in, for instance, maintenance roles.

Using the LFS it is possible to define STEM industries based on the Standard Industrial Classification (SIC) and STEM occupations based on the Standard Occupational Classification (SOC). The definition of STEM sectors in this study is based on the specification used by Mason (2012) using SIC07 (2-digit) codes. The list of industries and codes specified as STEM can be found in Appendix 2.[2] The classification of occupations as STEM versus non-STEM was derived from previous work undertaken (see Jagger et al., 2010; Greenwood et al. 2011; and Mason, 2012). In each of these studies, the authors used SOC2000 (4-digit) to classify occupations as STEM or non-STEM. Appendix 3 displays the codes specified as STEM occupations in the present study.

3.3 Trends in employment by STEM industries

Based on the definition of STEM industrial sectors, Figure 3.1 shows the total number of people employed in STEM intensive industries. It shows that over time the number of people employed in STEM industries has declined from around 7 million in 2006 to around 6.5 million in 2012. In part this will reflect productivity growth in STEM industries and the long-run employment trend of declining employment in manufacturing sectors.

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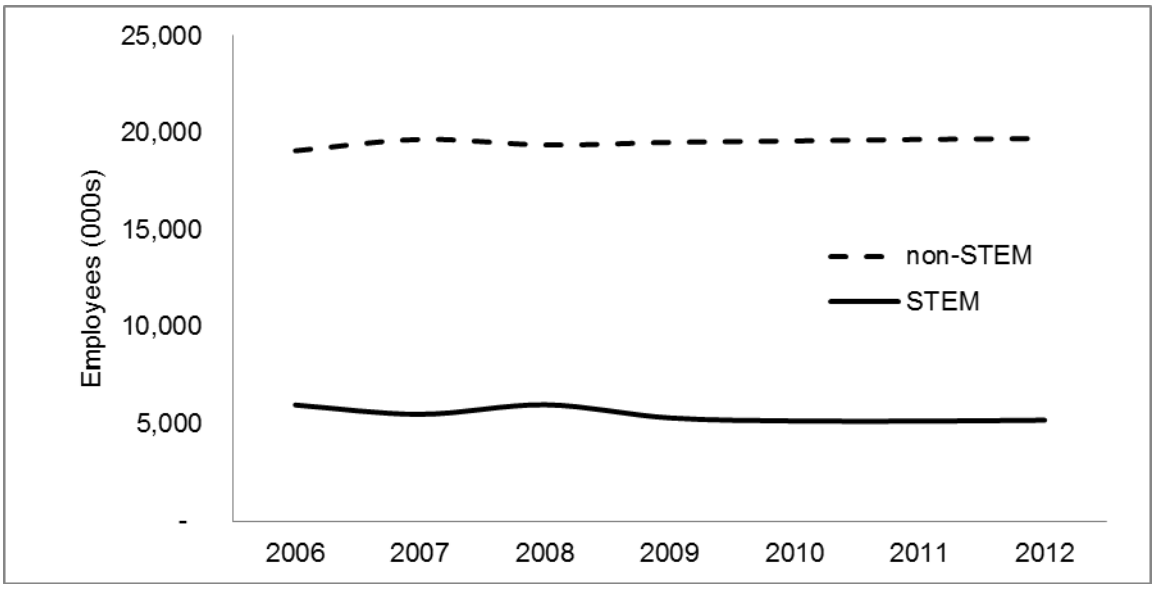
1 The situation is different with respect to HE where data sets such as the LFS contain information about the subject of degree studied.

2 STEM industries are those where there is a strong demand for STEM skills and STEM occupations are where a large part of their content is STEM related.

Figure 3.1: Employment (employees only) in STEM and non-STEM industries, 2006-2012



Source: LFS, 2006 to 2012
Notes: Annual averages; classification of STEM/non-STEM based on definition in Appendix 1; employees only

The data reveals that the workforce is comprised mainly of men who account for around 80 per cent of employment in STEM industries and this percentage has hardly changed over the period 2006 to 2012. The age structure of the workforce reveals that it is not much different from non-STEM industries, though it needs to be borne in mind that many manufacturing sub-sectors report that their skilled workforce is relatively aged which poses a number of challenges with respect to meeting future replacement demands (SEMTA, 2012; Davis et al., 2012).

Table 3.1: Characteristics of employees in STEM and non-STEM industries, 2012

	STEM	non-STEM	All
Number of employees	5,215,312	19,700,928	24,916,239
Gender (column %)			
Female	22.5	56.2	49.1
Male	77.5	43.8	50.9
Total	100	100	100
Ethnicity (column %)			
White	92.9	89.1	89.9
Mixed/multiple ethnic	0.5	1.0	0.9
Indian	2.7	2.5	2.6
Pakistani	0.7	1.1	1.0
Bangladeshi	0.1	0.5	0.4
Chinese	0.3	0.4	0.4
Other Asian backgroun	0.5	1.2	1.0
Black/African/Caribbe	1.3	2.7	2.4
Other ethnic group	1.0	1.4	1.3
Total	100	100	100
Age (column %)			
19 and under	1.9	4.4	3.9
25 to 34	31.6	34.1	33.6
35 to 54	50.8	46.2	47.2
55 to 64	13.7	13.0	13.2
65+	1.9	2.3	2.2
Total	100	100	100

Source: LFS, 2012
Notes: average of quarterly data; classification of STEM/non-STEM industries as set out in Appendix 1; employees only.

Around two-thirds of employment in STEM industries is comprised of people working in STEM occupations, a relatively large percentage of whom report having completed an Apprenticeship (see Table 3.2). In 2006, 23 per cent of employees in STEM industries reported that they had completed an Apprenticeship but this had fallen to just under 20 per cent of employees in 2012 a trend in line with non-STEM industries where just under 8 per cent of employees in 2006 and 6 per cent in 2012 reported that they had completed a formal apprenticeship (see Table 3.2)

Table 3.2: Percentage of employees in STEM and non-STEM industries reporting completion of a formal apprenticeship, 2006 to 2012.

	STEM	Non-STEM	All industries
2006	23.1	7.8	11.4
2007	21.5	7.4	10.5
2008	20.8	6.5	9.9
2009	21.6	6.2	9.6
2010	21.3	6.3	9.4
2011	20.2	5.7	8.8
2012	19.8	6.0	8.9

Source: LFS, 2006 to 2012
Notes: Annual averages; employees only; STEM/non-STEM classifications as set out in Appendix 1

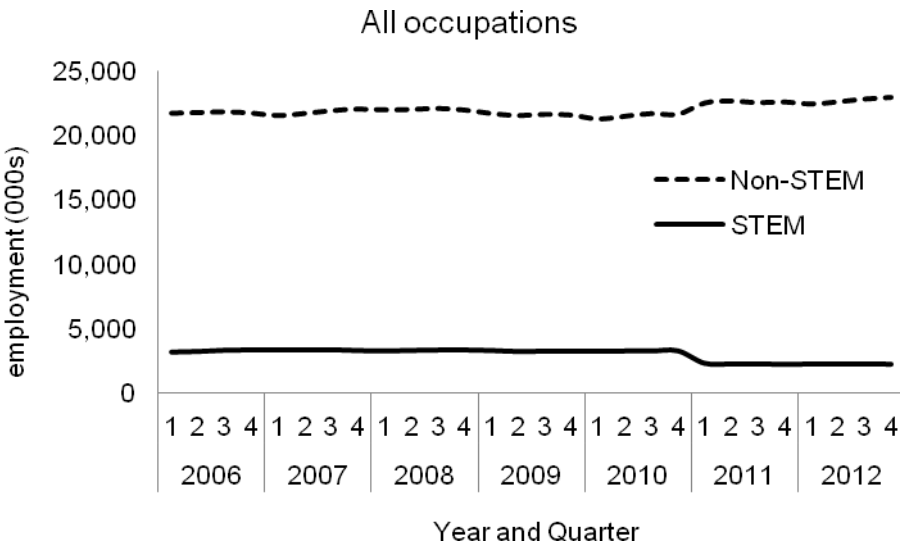
3.4 Trends in employment in STEM occupations

Using the definition of STEM occupations, mentioned above, it is possible to provide an estimate, over time, of the total number of people employed in occupations which have a substantial STEM skill content.

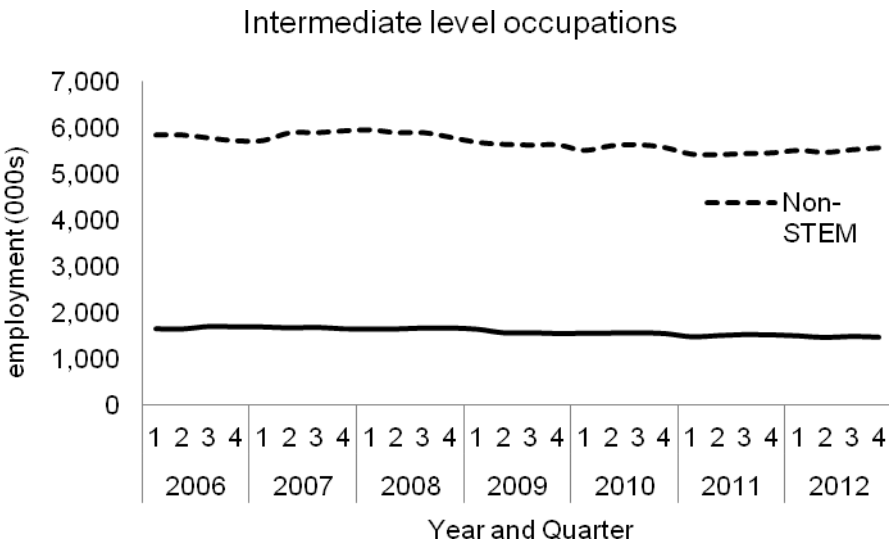
Figure 3.2 shows the number of people employed in STEM occupations and how this changed over time for all occupations, and just those at an intermediate level (i.e. associate professionals, skilled trades, and machine operatives). The data reveals a fairly sharp fall after 2010 which might reflect a delayed outcome from the 2008/9 recession for all STEM occupations, though this is not the case with respect to intermediate level occupations – the ones which Technical Apprenticeship are most associated with – which shows a relatively flat trend over time.

Figure 3.2: Employment change in STEM and non-STEM occupations, 2006 to 2012

(a) All occupations



(b) Intermediate level occupations



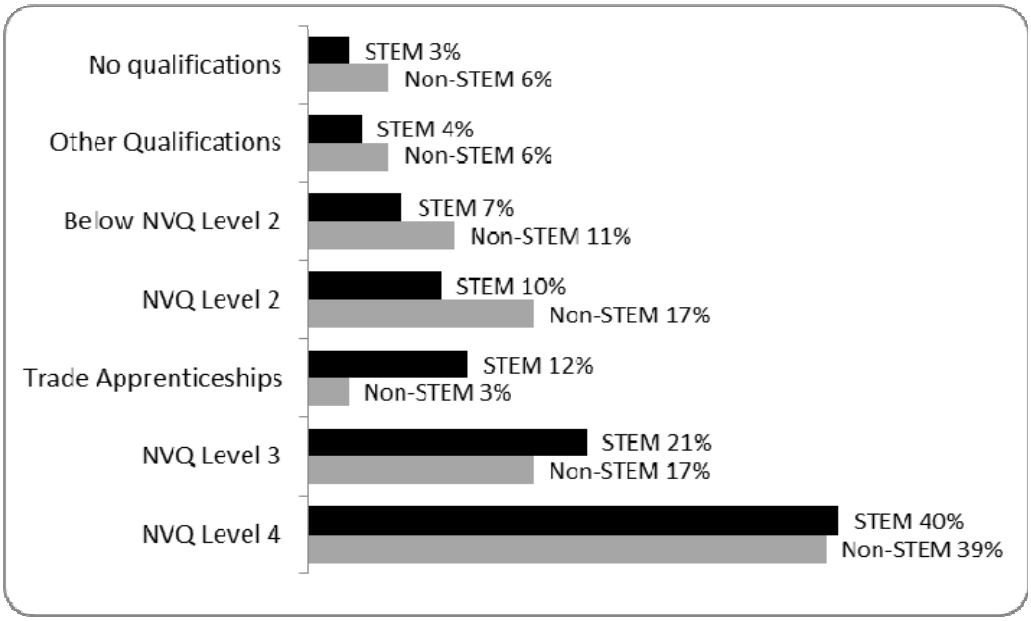
Source: Labour Force Survey 2006 – 2012
Note: Classification of STEM/non-STEM occupations as set out in Appendix 2

Typically jobs in STEM occupations are filled by men (nearly 90 per cent are filled by men and this has not changed much over the 2006 to 2012 period). There is not much difference with respect to the age profile between STEM and non-STEM occupations.

The highest qualification level of people working in STEM occupations is provided in Figure 3.3. Proportionately more people have Level 4 attainment in STEM occupations

but this is not much different from non-STEM occupations. Where there is a difference, it is with respect to the relatively high percentages of employees who report Level 3 and Trade Apprenticeships as their highest qualification, indicating the relative dependence of STEM occupations on Apprenticeships.

Figure 3.3 Highest qualification held by employees in STEM and non-STEM occupations, 2012



Source: Labour Force Survey 2006 – 2012
Note: Classification of STEM/non-STEM occupations as set out in Appendix 2

The previous figure showed the percentage of people who reported that an Apprenticeship was their highest level of qualification. There are, of course, people working in STEM occupations who may have initially entered their occupation via Apprenticeship and subsequently went on to obtain higher level qualifications. Table 3.3 shows the percentage of employees in STEM subjects who report that they have completed an Apprenticeship. Overall, around a third of employees report having completed an Apprenticeship – compared with 7 per cent in non-STEM subjects - which again highlights the relative importance of Apprenticeships to STEM occupations.

Table 3.3 Percentage of employees who have completed an Apprenticeship in STEM and non-STEM occupations, all sectors, 2006 - 2012

	Occupations		Total
	non-STEM	STEM	
2006	10%	34%	13%
2007	9%	31%	12%
2008	8%	30%	11%
2009	8%	29%	11%
2010	8%	29%	11%
2011	8%	34%	10%
2012	7%	32%	10%

Source: Labour Force Survey 2006 - 2012

3.5 Employer demand for Technical Apprentices

It is a moot point whether employer provision of Apprenticeships represents a supply side or demand side phenomenon, but given that employers who recurrently provide Technical Apprenticeships, especially at Level 3, often regard their investment in Apprenticeships as a long-term one where the Apprentice will go on to stay with the employer, it has been included in the demand-side analysis. The latest data suggests that around 9 per cent of employers had an Apprentice in 2012 (Shury et al., 2013) which is a substantial increase over the 2010 survey when it stood at 5 per cent.[3]

Based on data from Employer Perspectives Survey 2012, Table 3.4 shows the extent to which employers classified as being in STEM sectors – as defined above – are likely to participate in Apprenticeships compared with non-STEM employers.

[3] Some caution is required in making the comparison between the two surveys because of changes in questioning.

Table 3.4 Percentage of employers who currently have staff undertaking Apprenticeships

row percentages

	Whether have Apprentices			
	Yes	**No**	**Total**	**Base**
Manufacturing	14	86	100	98602
Construction	13	86	100	57309
Telecoms, IT and R&D	11	89	100	88797
All STEM	13	87	100	244708
All non-STEM	9	90	100	1708524

Base: All employers aware of Apprenticeships
Source: Employer Perspectives Survey 2012

In general, the data shows that employers in STEM sectors are more likely to take on Apprentices (13 per cent compared with 9 per cent overall). Within the STEM category there is not much difference between sectors with manufacturing employers (which fall into the STEM category) being slightly more likely to report that they currently have an Apprentice (14 per cent compared with 13 per cent in construction, and 11 per cent in telecoms, etc.). Overall, STEM employers account for 21 per cent of all Apprenticeships, whereas they account for 14 per cent of all employers.

The Apprenticeship Evaluation employer survey from 2012 provides further information about the type of Apprenticeships STEM and non-STEM employers provide (see Table 3.5). It is clear that the profile of Apprenticeships provided by STEM employers are different from those of non-STEM ones. The key findings here show that the types of Apprenticeships STEM employers provide are:

- delivered outside the sectors traditionally associated with this form of training (e.g. 74 per cent of ICT Apprenticeships);
- much more likely to be at Level 3;
- more likely to be aged 16-24
- more likely to be delivered to people who are new recruits to the business rather than existing employees.

Table 3.5 also highlights that many Technical Apprenticeships are provided in those industries which lie outside those traditionally associated with a relatively high demand for STEM skills. This illustrates the point made in the introduction to this chapter that STEM skills tend to pervasive across sectors given the pace of technical change experienced by most industries today.

Table 3.5 Characteristics of employers with Technical Apprentices, 2012

column percentages

	STEM Frameworks				
	Engineering & Manufacturing Technologies	**Information & Communication Technology**	**Subtotal: STEM Frameworks**	**Subtotal: non-STEM Frameworks**	**Total**
Industry					
Non-STEM	57%	74%	59%	81%	78%
STEM	43%	26%	41%	19%	22%
Size					
1 to 9	36%	21%	34%	36%	36%
10-24	19%	17%	19%	31%	29%
25-49	13%	15%	13%	14%	14%
50 – 249	21%	30%	22%	12%	14%
250-499	6%	6%	6%	2%	3%
500 or more	5%	9%	5%	3%	4%
Don't know / refused	0%	2%	0%	1%	1%
Level					
Level 2	55%	52%	55%	68%	66%
Level 3	45%	48%	45%	32%	34%
Age					
16-18 years	74%	62%	73%	50%	54%
19-24 years	20%	35%	21%	30%	29%
25+	6%	3%	6%	19%	17%
Status of Apprentice					
New recruits	91%	85%	91%	66%	71%
Existing Employees	9%	15%	9%	34%	29%
Total	100%	100%	100%	100%	100%
Base	607	66	673	3,402	4,075

Source: Apprenticeship evaluation: employer survey 2012

Note: The figures for level, age and status are based on responses to the employer survey (EASE) where employers were asked to indicate the number of Apprentices in each age group, at each level and new/existing recruits. These figures were then used to provide the total number and as such the percentages within each area (age, status, level) should sum to 100%.

3.5 Future Demand

Table 3.6 shows the expected level of employment in skilled trades occupations by 2020 across all industry. One may reasonably expect many of these jobs to be filled by people who have completed a Technical Apprenticeship. Overall the number of people employed in skilled trades jobs is expected to decline by 206,000 between 2010 and 2020. If consideration is given the level of replacement demands, which are likely to emerge principally as a consequence of people retiring from skilled trades jobs, then it is likely to be an additional 930,000 jobs for people to work in skilled trades occupations. Many of these jobs will be in construction – 424,000 – not all of which will require a Technical Apprenticeship to be completed. It is also apparent that the demand for skilled trades occupations is likely to be relatively high in sectors such as trade, accommodation and transport and business services.

Table 3.6 Replacement demands for skilled trades workers, 2010 to 2020 (000s)

	Levels		**2010 – 2020**		
	2010	**2020**	**Net Change**	**Replacement Demands**	**Total Requirement**
All Industries	2905	2699	-206	1136	930
Primary sector and utilities	218	207	-12	106	95
Manufacturing	550	458	-92	207	114
Construction	972	1031	59	364	424
Trade, accommodation and transport	684	570	-114	260	146
Business and other services	379	363	-15	154	139
Non-marketed services	102	70	-32	44	12

Source: Working Futures 4

There is also projected to be an additional requirement for 163,000 people to work as science, engineering and technology associate professionals some of whom may be expected to have completed a Technical Apprenticeship. Overall, the data suggests that there is the potential for additional demand for people to have completed a Technical Apprenticeship to be as high as 700,000. This is very much a best guess, assuming that all science, engineering and technology associate professionals and all skilled trades (outside of construction) are filled by people who have completed a Technical Apprenticeship. The key point here is that there is likely to be a strong demand for people to have completed a Technical Apprenticeship in the future, or at least the potential for Technical Apprenticeships to meet a substantial demand for skills.

3.6 Conclusion

The data reveal that the demand for people to work in STEM sectors and STEM occupations at an intermediate level has been more or less flat over the recent past. Looking to the future, however, there would appear to be significant replacement demands for those skills which Technical Apprenticeships have a potentially substantial role in meeting. It is also apparent that the demand for Technical Apprenticeships often falls outside the traditional sectors associated with a demand for STEM skills.

4. Trends in the Supply of Technical Apprenticeships

4.1 Introduction

Many Technical Apprenticeships require entrants to possess GCSE passes – or equivalent. Indeed, some Technical Apprenticeship Frameworks draw attention to the need, for the would-be Apprentice, to have, for example, five GCSEs at grade C or above.[4] Consistent with this, research, with employers looking to recruit young people to an engineering Apprenticeship, reveals that they typically require candidates to possess five GCSE at grade C or above including mathematics, English and a science subject (Hogarth et al., 1996; 2012). There have been concerns about the provision of science education in schools. The Roberts Review, for instance, in the early 2000s catalogued the multitude of problems the education system faced in getting young people to successfully pursue STEM subjects in school (Roberts, 2002). In particular it drew attention to the vicious circle of individuals having a poor experience of science education in school, a shortage of people going to study sciences in post-compulsory education which, in turn, reduced the pool from which the next generation of science teachers would be drawn (TLRP, 2006).

Data show that, over the 2000s, the number of people working towards a GCSE in subjects such as chemistry, physics, and biology has increased. The data in Table 4.1 shows that the percentage of students who study towards a science GCSE has fallen by 11 percentage points between 2007/8 and 2010/11, though the percentage working towards GCSEs in chemistry, physics, and biology has continued to rise. The data also indicate that the percentage of students who obtained a GCSE pass at grades A to C has remained stable in science, but it has increased in chemistry, physics, and biology. Moreover, the percentage point increase in obtaining an A to C grade in each of these sciences has been greater than that recorded across all subjects.

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4 For example Engineering Manufacture Apprenticeship at Level 3 says: "As a guide, the Engineering Manufacture Apprenticeship is suitable for applicants who have five GCSEs grade C or above including Maths, English, and a Science. This is not a hard and fast rule but may vary according to the pathway chosen (technician or craft) and the suitability of individual candidates".

Table 4.1: GCSE results of pupils at the end of Key Stage 4 in schools, by subject and grade, 2007/8 and 2010/11

As a percentage of pupils at the end of Key Stage 4 in all schools

	Attempts				Achievements A - C grades		
	2007/8	2010/11	% percentage point difference		2007/8	2010/11	% percentage point difference
Any Subject	97	98	1		79	82	3
English & Mathematics	91	91	0		48	56	8
Mathematics & Science	88	77	-11		49	52	3
English, Mathematics & Science	87	76	-11		45	49	4
English	94	94	0		61	68	7
Mathematics	93	93	0		55	63	8
Any Science	91	80	-11		59	59	0
Physics	10	21	11		10	20	10
Chemistry	10	21	11		10	20	10
Biological Sciences	11	21	10		10	20	10
Any Design & Technology	46	36	-10		28	23	-5
D & T: Electronic Products	2	2	0		1	1	0
D & T: Food Technology	11	9	-2		7	5	-2
D & T: Graphic Products	9	7	-2		6	4	-2
D & T: Resistant Materials	12	9	-3		7	5	-2
D & T: Systems & Control	1	1	0		1	0	-1
D & T: Textiles Technology	6	5	-1		5	4	-1

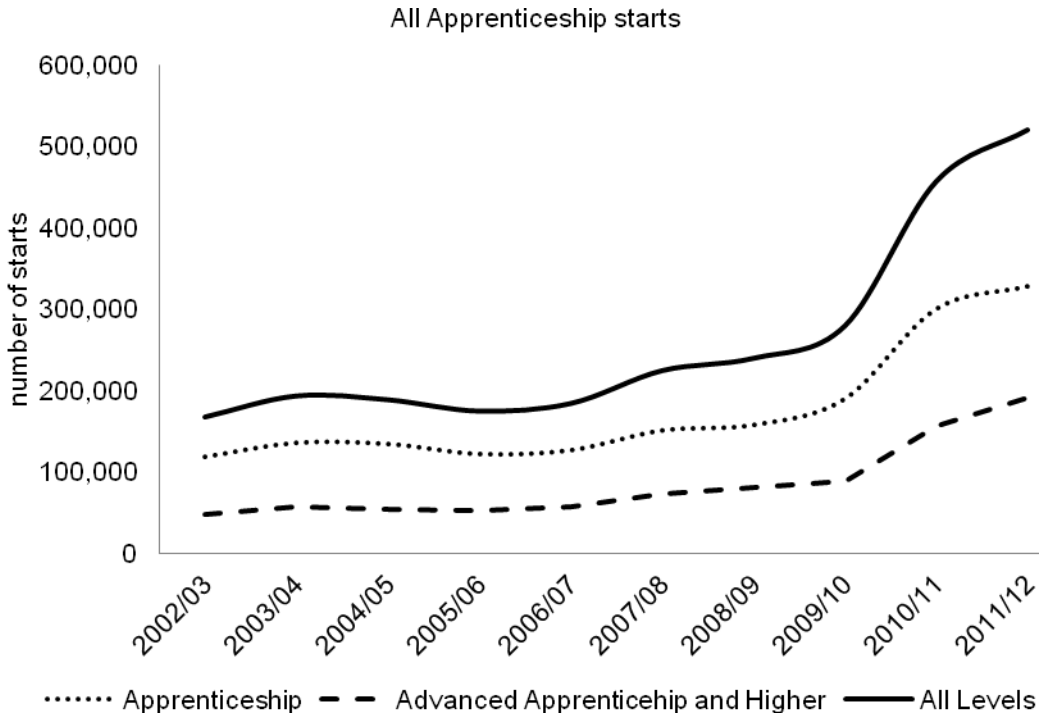
Source: Statistical First Release

4.2 Trends in Technical Apprenticeships starts

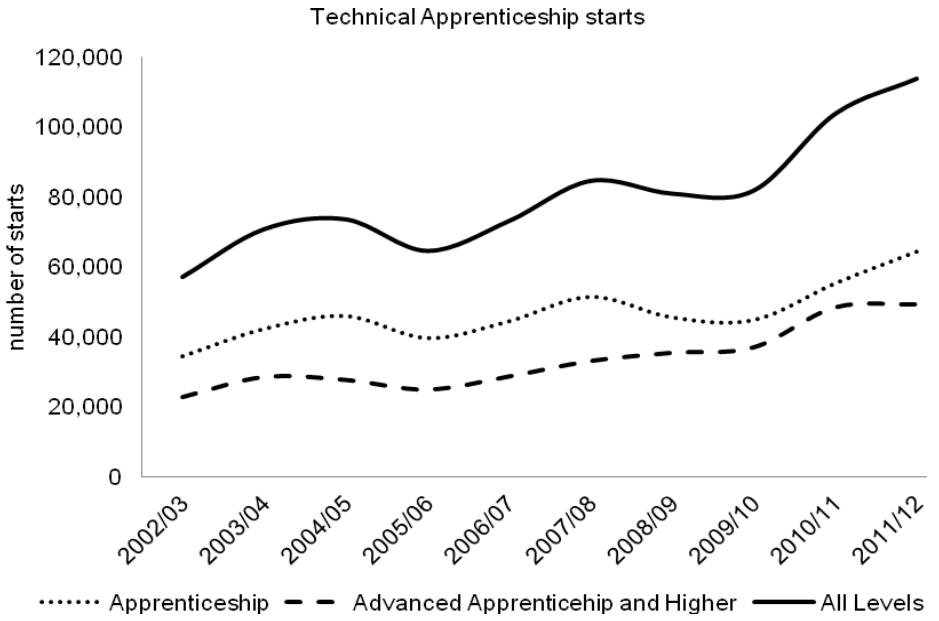
Figure 4.1, based on broad/sector Framework data, shows the annual percentage change in the number of Apprenticeship starts under STEM related Frameworks compared with comparable data for all starts. It shows that the number of Technical Apprenticeships has grown over the period between 2003 and 2012, but the share of Apprenticeships accounted for by technical ones has declined over the same period. In other words, Technical Apprenticeships have contributed less to growth in the overall number of Apprenticeships than those under other frameworks.

Figure 4.1: Trends in Apprenticeship Starts: for all Apprenticeships and STEM Apprenticeships

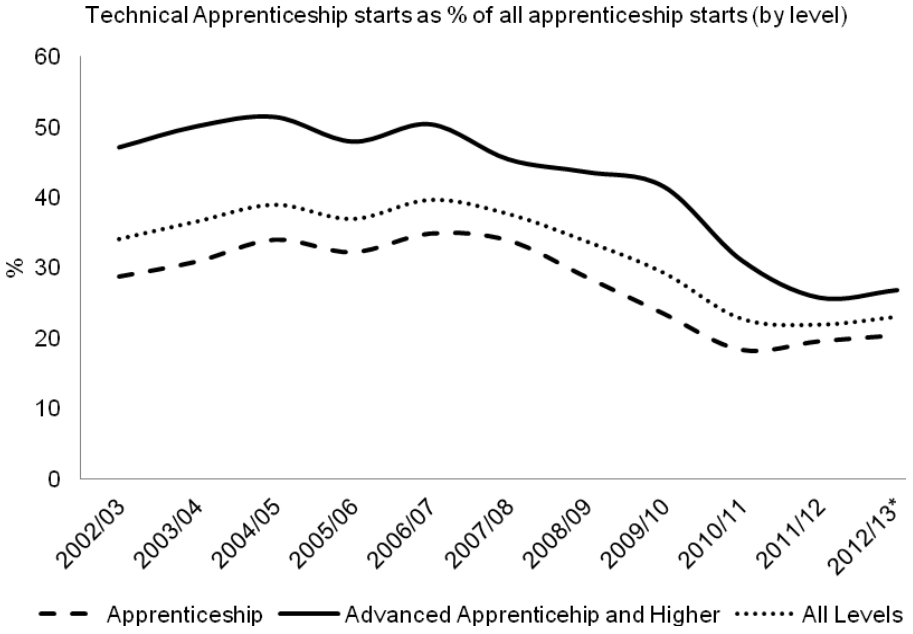
(a) all Apprenticeship starts



(b) Technical Apprenticeship starts



(c) Technical Apprenticeship starts as a percentage of all starts



Source: Statistical First Release, March 2013

The Individual Learner Record (ILR) provides a definitive source of data on the participation of learners in Apprenticeships in STEM Frameworks. Data were obtained for a number of academic years but the main results have been provided for 2010/11 to 2011/12.

In order to examine Technical and non-Technical related Apprenticeships in the ILR, the classification of Apprenticeship Frameworks into STEM and STEM-related subjects was developed by the Royal Academy of Engineering and used in their 2012 FE STEM Data project (Harrison, 2012).[5] Apprenticeship Frameworks were classified into STEM and STEM-related areas for the first time in the Royal Academy's project and the same Framework classifications have been employed in this study so that there is some comparability. In total, 122 Frameworks were classified as STEM/STEM-related Apprenticeship Frameworks in the analysis that follows. A full list of STEM/STEM-related Frameworks (as used in this analysis) is provided in Appendix 3.

Table 4.2 shows the number of learners in Apprenticeships by level for Technical, non-Technical and all Apprenticeships between 2010/11 and 201112/12. In 2011/12, there were 113,890 Apprenticeship starts in Technical Apprenticeships at all levels.

Table 4.2 Number of Apprentices starts by level, Technical and non-Technical related Apprenticeships, 2010/11 - 2011/12

	All Apprenticeships		**Non-Technical Apprenticeships**		**Technical Apprenticeship**	
Apprenticeship Starts	**2010/11**	**2011/12**	**2010/11**	**2011/12**	**2010/11**	**2011/12**
(Intermediate) Apprenticeships	301,100	329,000	245,780	264,540	55,320	64,460
Advanced and Higher Apprenticeships	156,100	191,600	107,530	142,160	48,570	49,440
All levels	457,200	520,600	353,370	406,710	103,830	113,890
	All Apprenticeships		**Non-Technical Apprenticeships**		**Technical Apprenticeship**	
Annual change	2010/11 to 2011/12		2010/11 to 2011/12		2010/11 to 2011/12	
(Intermediate) Apprenticeships	9%		8%		17%	
Advanced and Higher Apprenticeships	23%		32%		2%	
All levels	14%		13%		9%	

Source: Individualised Learner Record (ILR) standard file, learning aims data, 2010/11 to 2012/13
Note: 2012/13 represents incomplete annual data

[5] The Framework codes, used by the Royal Academy of Engineering, were supplied by Matthew Harrison, Director of the Royal Academy and also by the Information Authority. The research team is grateful to both.

The percentage increase in total Apprenticeship starts between 2010/11 and 2011/12 was less in Technical Apprenticeships than in Apprenticeships generally (9 per cent in Technical Apprenticeships compared with 14 percentage points across all Apprenticeships). In part this may be explained by the fact that a substantial share of the increase in the number of Apprenticeship starts was accounted for by those aged 25 years and older, whereas it is known that employers in STEM sectors have a preference for Apprentices aged 24 years and under who are typically new recruits to the business rather than existing employees.

Participation in Higher Apprenticeships (Level 4+) is markedly greater in STEM programmes than in non-STEM programmes, but a note of caution should be made as these Higher Apprenticeships in STEM areas are largely accounted for by Frameworks in finance and accounting which are not typically classified as STEM skills. In total, across all Frameworks, there were 3,505 learners enrolled in Higher Apprenticeships in 2010/11 – less than 200 of these learners were in non-Technical related Apprenticeships. In 2010/11 the total number of Technical Higher Apprenticeships was more than 4,000 compared to around 1,200 non-Technical related Apprenticeships at these levels in 2011/12. The number of Higher Apprenticeships has grown across all Frameworks, including STEM, between 2010/11 and 2012/13, though more markedly for non-STEM Frameworks.

4.3 The characteristics of Technical Apprenticeships

There are many factors which are likely to influence the decisions of individuals to participate in any kind of Apprenticeship and a Technical one in particular. These are likely to relate to a number of socio-demographic and educational characteristics. In order to provide a snapshot of how the characteristics of individuals differs according to whether they are working towards completion of a Technical (i.e. Technical related) or non-Technical Apprenticeship, Table 4.3 provides information relating to gender, age, ethnic group, and disability.

As can be seen in Table 4.3, across all Frameworks, participation has been roughly even between men and women in (Intermediate) Apprenticeships and Advanced Apprenticeships with 50 per cent and 58 per cent of learners being women at Levels 2 and 3, respectively. In non-STEM programmes at these levels, women are more commonly undertaking Apprenticeships with 58 per cent of Intermediate Apprentices and 68 per cent of Advanced Apprentices being women (2011/12). In contrast, in 2011/12, 17 per cent of Intermediate Apprenticeship learners and 27 per cent in Advanced Apprenticeships were women in Technical related Apprenticeships. it is clear that women are relatively under-represented in STEM Frameworks: in 2011/12, women comprised more than half (53 per cent) of all Apprentices but around a fifth (21 per cent) of Technical Apprentices.

Table 4.3: Apprenticeship starts by learner characteristics, Technical Apprenticeships and all others, percentages, 2011/12

Column percentages or absolutes

		Technical	Non-Technical	All
Base (number of observations)				
Apprenticeship		61,965	245,695	307,660
Advanced Apprenticeship		44,028	127,212	171,240
All		106,041	372,907	478,948
Gender (column %)				
Intermediate Apprenticeship	Female	17	58	50
	Male	83	42	50
Advanced Apprenticeship	Female	27	68	58
	Male	73	32	42
All	Female	21	62	53
	Male	79	38	47
Age (column %)				
Intermediate Apprenticeship	16-18	41	26	29
	19-24	23	29	28
	Over 24 years	37	45	44
Advanced Apprenticeship	16-18	36	11	17
	19-24	34	25	27
	Over 24 years	30	64	56
All	16-18	39	21	25
	19-24	27	27	27
	Over 24 years	34	52	48
Ethnicity (column %)				
Intermediate Apprenticeship	White	92	88	89
	Non-White	8	12	11
Advanced Apprenticeship	White	91	89	90
	Non-White	9	11	10
All	White	92	88	89
	Non-White	8	12	11
Learner reported LDD / health problem (column %)				
Intermediate Apprenticeship	Yes	9	8	8
	No	90	91	90
	Unknown	1	1	1
Advanced Apprenticeship	Yes	6	7	7
	No	93	92	92
	Unknown	1	1	1
All	Yes	8	8	8
	No	91	91	91
	Unknown	1	1	1

Source: Individual Learner Record

The gender imbalance in participation in Technical related Apprenticeships is not unique to the Apprenticeship programme. Participation in various types of education and training in STEM subjects, at all levels, has been markedly lower amongst women than men. Studies in part suggest that this is due to girls in school either not selecting STEM subjects when they choose their options and / or not enjoying the experience of studying STEM subjects (Engineering UK, 2011). There have been a number of initiatives aimed at increasing participation of women in these areas and in relation to Apprenticeships.

There are also differences between Technical and non-Technical Apprentices by age, as illustrated in Table 4.3. Overall, a greater share of Technical Apprenticeships are undertaken by learners aged 16 to 18 years old. Across all levels of programmes in 2011/12, 39 per cent of Technical Apprentices were aged 16 to 18 years old. This compares to 21 per cent in non-Technical related Apprenticeships and 25 per cent in all Frameworks. The share of Apprentices in STEM programmes who are aged 19 to 24 years is similar to that found in non-Technical related Apprenticeships: 27 per cent of Technical, 27 per cent of non- Technical, and 27 per cent of all Frameworks. To show the extent to which Technical Apprenticeship starts are accounted for by relatively young people, the share of starts accounted for by those over 24 years of age is instructive. While 34 per cent of people starting a Technical Apprenticeship were over 24 years of age, 52 per cent amongst non-technical Apprenticeships. This is even more manifest in relation to Advanced Apprenticeships where 30 per cent of those commencing a Technical Apprenticeship were over 24 years of age, compared with 64 per cent in the case of non-technical Apprenticeships.

The observed differences in the distribution of Apprentices by age group between Technical and non-Technical related Apprenticeships, in part reflects the nature of employment of Apprentices in particular sectors. Other studies have indicated Apprentices in engineering are more likely to be new recruits to a business than existing employees and, accordingly, tend to be relatively young. This finding also emerges in the case study evidence reported in the later sections of this report.

There is not much difference with respect to participation in Technical and non-Technical Apprenticeships with respect to ethnic group or work limited disabilities.

4.4 The Regional Distribution of Technical Apprenticeships

The regional distribution of Apprenticeships by level in 2012/13 is shown alongside the distribution of the English population aged 16-64 years (in 2011) in Figure 4.2. The distribution of Apprenticeships (across all levels and Frameworks) is similar to the distribution of the population aged 16 to 64 years. The main difference between the population and Apprenticeship distributions is that although the Greater London region accounted for 16 per cent of the population aged 16 to 64 years in 2011, just 9 per cent of all Apprenticeships (all Frameworks and all levels) were undertaken there in 2012/13. This pattern has been noticed before and initiatives, to increase uptake of Apprenticeships in the capital region, have been launched. The North West accounts

for a larger share of Apprenticeships per head of population than is the norm. Across all levels and Frameworks in 2012/13, the North West accounted for 17 per cent of Apprenticeships whilst 13 per cent of the working age population was located in this region. The share of Apprenticeships located in the North East is also somewhat greater than the region's share of England's working age population, 7 per cent of Apprenticeships (all levels and Frameworks) compared with 5 per cent of the population.

Comparing the regional distributions of Technical and non-Technical Apprenticeships, there is virtually no difference between these types of programmes with regards to Intermediate Apprenticeships. The only differences to note are that the North West comprises a smaller share of Technical compared to non-Technical Apprenticeships at this level (16 versus 17 per cent) and the East Midlands accounts for a greater share of Technical than non-Technical related Apprenticeships (10 versus 9 per cent).

At the Advanced Apprenticeship level, the regional distribution of STEM and non-STEM learners is also very similar. The most noticeable differences at this level are for the South East (accounting for 16 per cent of Technical but 13 per cent of non- Technical Advanced Apprenticeships) and Greater London (accounting for 7 per cent of Technical but 10 per cent of non-Technical Advanced Apprenticeships).

More notable differences are apparent for the distributions of Higher Apprenticeships in STEM and non-STEM subjects. The North West accounted for 25 per cent of non-Technical Higher Apprenticeships but 20 per cent of STEM learners at this level. Similarly, 21 per cent of non-Technical Higher Apprenticeships were located in the West Midlands, whilst just 13 per cent of STEM programmes were in this region. Compared to non-Technical Higher Apprenticeships, Technical related Apprenticeships at this level are relatively more concentrated in Yorkshire and the Humber (11 per cent of Technical Higher Apprenticeships were located in this region compared to 7 per cent of non-Technical ones), the South West (12 per cent compared to 8 per cent of non-Technical), and the South East (11 per cent of Technical and 7 per cent of non-Technical higher Apprenticeships were in this region).

4.5 Conclusion: Is Supply Keeping Pace with Demand?

It is difficult to be certain as to whether supply is keeping pace with demand. The data below (Table 4.4), drawn from the UKCES Employers Skills Survey 2011 shows the extent to which employers in STEM industries experience hard-to-fill vacancies (HtfVs) and skill shortage vacancies (SSVs) overall and experience HtFVs and SSVs for skilled trades workers in particular. This data shows that employers in STEM sectors are no more likely to experience HtFVs compared with non-STEM sectors (four per cent for STEM and five per cent for non-STEM) however, they more likely to experience HtFVs for skilled trades workers (i.e. those occupations which Technical Apprenticeships have historically supplied) and as a share of establishments with any HtfVs, a much greater share of STEM employers than non-STEM ones indicate that these are in Skilled Trades. Employers in STEM sectors are somewhat more likely to report that they face

SSVs (four per cent compared to three per cent for non-STEM) and the share of establishments with SSVs who report these for Skilled Trades is nearly twice as high for STEM sectors compared with non-STEM (35 per cent compared with 18 per cent). There is, accordingly, some prima facie evidence that an increase in employer engagement in Technical Apprenticeships may be warranted to offset any impact HtFVs may have on organisational performance. Data from the previous survey, NESS09[6], shows that employers in STEM sectors are slightly more likely to take on an Apprentice than those in non-STEM sectors (six per cent of employers in STEM and four per cent of non-STEM indicated that they had apprentice(s) at the time of the survey).

Table 4.4 Indicative evidence of skill mismatches in STEM industries (percentages)

	Any HtfVs	HtfVs in Skilled Trades		Any SSVs	SSVs in Skilled Trades		Any SSVs as % of those with HtFVs
	% of all establishments	% of all establishments	as % of those with HtfVs	% of all establishments	% of all establishments	as % of those with SSVs	
Manufacturing	6	2	42	5	2	44	82
Construction	3	1	49	2	1	50	81
Telecoms, IT and R&D	7	0	5	6	0	5	89
Total STEM	4	2	34	4	1	35	83
Total Non-STEM	5	1	17	3	1	18	75
Total All	5	1	20	3	1	22	76

Source: UKCES Employer Skills Survey, (ESS2011)
Base: All establishments unless otherwise noted; Data for England only

In the previous chapter a ballpark figure was given of the level of replacement demands which Technical Apprenticeships may fill over the next ten years. Even at the current growth rate, of around eight per cent in completion of a Technical Apprenticeship, this may well fall short of this ballpark estimate of future demand. Such a finding is highly speculative but suggests that at their current rate of growth Technical Apprenticeships may not fulfil the estimated level of replacement demands.

[6] The ESS2011 survey did not capture information on involvement in Apprenticeships so NESS09 data are required to indicate engagement.

5. Employer rationales for recruiting Technical Apprenticeships

5.1 The Training Decision

Most of our interviewees, based in firms, reported that they recurrently recruited Technical Apprentices. Each year an assessment was made of future demand for people skilled at an intermediate skilled level and, on the basis of this, the number of Apprentices to recruit was determined. In some instances, there was a degree of inertia insofar as the employers had a long history of taking on Apprentices and saw little alternative in doing so if they were to meet their future skill needs. Even in sectors where there is less of a history of Apprenticeship training (e.g. ICT) there was a strongly developed sense that Apprentices could offset future skill gaps. One IT employer commented that: *"we have to think about the audience that's up and coming*" so they target *"like-minded people"* as this is seen as *"really beneficial"* for the company. The company was very much about "*knowledge-sharing and coming up with ideas",* which they actively encouraged. When they decided to bring in Apprentices, it was *"looking to the future"*: developing skills and *"moulding the individual to the way we do things at [company]"*. There was recognition of the current skills gaps in IT and technology, and the Apprentices were brought in specifically to fill these gaps in the future (EA39, Media/IT).

There was also concern that an ageing workforce added impetus to the need to recruit Apprentices so they could replace skills which would otherwise be lost over the medium term. There was also recognition that they were operating within a dynamic supply environment such that it is possible to differentiate between employers according to how they responded to this environment. Four different types of employer behaviour can be distinguished in relation to engagement with Technical Apprenticeships:

1. those which had a long-standing commitment to hiring Apprentices each year, who were required to fill a particular tier of technical and engineering jobs in the establishment. The jobs were typically at the boundary between skilled trades / associate professional occupations;
2. employers which had a history of recruiting technical graduates and Apprentices but were involved in an on-going review of the balance between recruiting graduates in engineering and technology versus recruiting Technical Apprenticeships;

3. those which were new to recruiting Apprentices in general and were in process of determining the role they may play within the organisation;
4. those which were considering what role Level 4 (and above) Technical Apprenticeship may play in their organisation and the extent to which these will provide a bridge between technician to professional / managerial status within the organisation or produce a new cadre of higher qualified technician employees.

5.2 Apprentice roles within the organisation

An example of where employers made a clear distinction between the roles to be filled by Apprentices and graduates is provided by one case study employer (see Panel 1 below). Its Apprentice and graduate intakes were separate and it was anticipated that their career progressions would lead to different trajectories in the organisation. Some Apprentices may make the transition into professional / managerial roles but this was not the expected progression route.

Panel 1 Case Study 9: An established path for Technical Apprenticeship in Manufacturing

The company is a large multinational manufacturing firm with a long history of recruiting Apprentices and graduates and directly employed around 6000 staff in the UK. Historically, the company had always recruited both Apprentices and graduates but they would not compete with each other for jobs in the organisation. Graduates tend to be recruited into “the indirect areas”, whereas Apprentices were working in the direct areas (i.e. making things on the shop floor) or in maintenance.

In order to fill technician roles, the company has taken on 80 Apprentices in the past three years (all in STEM-related roles). They were planning to take on around 20 Apprentices in the forthcoming recruitment round and had already received a large number of applications. Overall, there is no shortfall in the number of applicants for Technical Apprenticeships. The Technical Apprentices are training to be technicians and obtain a qualification up to an HNC (Level 3). In total, they train for five years, which costs around £150,000 per Apprentice. None of the Apprentices will progress to the graduate scheme upon completion of the Apprenticeship.

A similar picture emerges with the employer featured below (see Panel 2), but in this case the company made a distinction between its Technical Apprentices; some would go onto fill higher level technician roles while others remained on the shop floor. It recognised that once Apprentices had completed their training some had the potential to go further in the organisation, but the company had to ensure that the technician role was suitably staffed so on balance was keen to retain its former Apprentices at this level in the organisation.

Panel 2 Case Study 10: Variable pathways for Technical Apprentices

The firm (CS10 employer) that this case study is based around is an instrument manufacturer which employs around 1800 staff in Europe, with 300 at the case study site. The vast majority of roles within the company require STEM skills, apart from some administrative roles. Both graduates and Apprentices are taken on routinely and a strong background in maths is essential for both. Graduates and Apprentices are regarded as equally important to the employer meeting its skills needs.

The company recruits only one or two Apprentices each year: the number has fluctuated over the past decade but since 2009-2010, they have made a decision to recruit annually. They have taken on four Apprentices in the past three years, all at Level 3 in Engineering. The demand for Apprentices is likely to remain at this level. The firm considers the Apprenticeship scheme to be an effective way of bringing people into the organisation which are perfectly fitted to meeting their business goals. Apprentices tend to fit well and have the company values as they have grown within the company. It also recognises that it is a costly process to train Apprentices and ideally, if affordable, they would like to train more Technical Apprenticeships.

For higher-level roles within the organisation the employer only looks for graduates. The Apprentices are brought in with the expectation that they will become technicians and around half of them will go on to do further study and will take a higher position than the technician level role, but not a level, in most instances, filled by graduates. All Apprentices work towards completion of an HNC in Engineering and, if identified as having potential, the company will give them the opportunity to obtain a further academic qualification and then place them in a *"stretch position"* within the organisation. Most Apprentices are ambitious and want to go further but the company has to balance business needs with the Apprentices' aspirations.

The company now also take on interns who are considered trainee technicians (generally recruited locally from those not in employment, education and training). This has been working well as they do not have the same drive as the Apprentices and are happy to stay in a lower-level job.

There is a hint in this case study example that there was a degree of fluidity in the roles Apprentices may fill in the organisation subject to the proviso that it could satisfy its demand for people at the technician level. For the employer in another example (CS12) there had been more of a root and branch review of its relative demand for graduates and Apprentices with respect to how to fill laboratory technician roles with the decision to move away from graduate recruitment towards Technical Apprenticeships.

Panel 3 Case Study 12:

Developing role for Technical Apprentices

The firm is a consumer goods manufacturer that employs 530 people and is part of a multi-national company. It currently employs nine engineering Apprentices, with another three to be recruited in the next year, and one laboratory technician Apprentice, with another two to be taken on in the next year. Apprenticeship training has also commenced at another site on recommendation of the case study organisation.

For the first time in the workplace's history it has taken on a laboratory technician Apprentice having previously recruited science graduates for this role. In a review of its training practices, the company decided that this was likely to be a better fit between an Apprenticeship and the needs of the company compared with the previous practice of recruiting science graduates. Science graduates, it had noted, wanted to take on more challenging tasks over time whereas the workplace's needs were for routine testing of a range of products carried out to an exacting standard. A laboratory technician Apprenticeship had, in the company's view, brought about a better fit between the individual's job aspirations and the demands of the job. It also recognised that as a result of completing the Apprenticeship the Apprentice is well versed in the company culture. The company observed that it needed to communicate to school-leavers the opportunity to follow a laboratory technician Apprenticeship since, in its view, young people with the academic qualifications it requires tend to regard Apprenticeship as something associated with engineering.

An example from the creative and media (ICT) sector (CS14, below) is of a relatively new company with no experience and limited knowledge of what Apprenticeships could contribute to their business. The interviewee recognised that Apprenticeships could provide a means of bringing young people into the business, who were interested in IT and who possessed knowledge of the markets in which the company's main clients were located, but as a small firm with no experience of the Apprenticeship system and the demands that it would make upon other employees to deliver the training required. The company found that a group training approach minimised its exposure to the financial risks of training someone and the costs this may impose on the business.

Panel 4 Case Study 14:

Adapting to the use of Technical Apprenticeships

The company employed around 50 people in its UK office. All employees, with the exception of some administrative staff, worked in digital and creative areas concerned with design, marketing, and content creation. The company had mainly relied on recruitment of graduates or experienced workers but had also taken on graduate interns on a number of occasions. Many of the people who work for the company have done so on a contract or freelance basis. To date the company has not employed Apprentices though at the time of the study they were finalising plans for the launch of a group training initiative involving employers in similar businesses located in the local area. The group training initiative was being led and delivered through a local community college and a private training provider. Most of the employers in the group training initiative would be taking on one Apprentice each.

The company expressed a number of rationales for becoming involved in Apprenticeships, the main one being a business 'no-brainer' as Apprentices would bring young people into their business – with all the new ideas they possess - whilst minimising the amount of financial risk attached to investing in training. The employer also felt that their involvement in Apprenticeship and youth training more generally was a socially responsible activity, but this was a secondary rationale.

The example above was of a company which was contemplating taking on an Apprentice who would work towards completion of a Level 4 Apprenticeship. It indicates the way in which a collective or group approach allowed the employer, who lacked knowledge about how to deliver an Apprenticeship and, accordingly, was a little uncertain about the net contribution of the apprentice to the business, reduced the risk to the employer to a level where it was willing to take on an Apprentice.

With Level 4 Frameworks being developed this had led some employers to contemplate how they could be accommodated within the business. The employer from CS10 (a technical instrument manufacturer) had progressed some of its IT Apprentices towards completion of a Level 4 qualification.

Panel 5 Case Study 10:

Progression from Level 3 to Level 4 Apprenticeships

The main markets of the technical instrument manufacturer at the heart of this case study are growing and they are also venturing into different areas, growing their Broadband market and accessing TV in various ways, e.g. on-demand, on I-Pads, etc. Around a third of employees are employed in occupations which are scientific / technical: numbers have increased and will continue to do so because of the way that the company is moving. When recruiting, they target young people with technological skills who are comfortable with apps and website design. The company recognised the current skills gaps in IT and technology, and the Apprentices were brought in specifically to fill these gaps in the future. Within the sector as a whole, Apprenticeships are becoming more popular, it was believed: companies such as Microsoft, Cisco, etc. have all been running programmes.

The company also has a large established graduate programme. The company decided to develop a technology scheme for IT Apprentices which had a similar structure to its graduate scheme. The company is quite new to the Apprenticeship scheme and took on 20 in IT this year, with a further 25 planned for next year. The calibre of applicants has been very high and the current Apprentices were matching the graduates in performance. Applicants need a minimum of 5 GCSEs at A-C, including English and maths, as well as creativity and good communication and team-working skills (good A levels, especially maths or ICT were preferred). The bulk of the Technology Apprentices progress straight from Level 3 to Level 4 during the course (six this year completed at Level 3 only). These decisions are made at the start, based on business need: the Apprentices start on a fixed-term contract for 12 months which allows them to complete the Level 3 qualification and, if there is a job available, they may then progress to a Level 4. The company offers a Level 4 qualification because of the advanced skills required.

> What was unclear at the time the case study was undertaken was the extent to which Apprenticeship entry and its potential to lead to Level 4 would overlap with the longer standing graduate training programme. At the moment there was a feeling that it was too early to tell.

At least one other employer was sceptical about the contribution a Level 4 Apprenticeship may make to their business given the respective roles filled by the current Apprenticeship programme at Level 3, and the graduate training programme, which met distinct needs within the business. However, one employer that had recently made the decision to take up Apprenticeships (as opposed to graduate-only recruitment) noted that:

> *I am a great believer in Apprentice training, it's the route I came through to get where I am, and I don't think there's any substitute for a good grounding in what you do…it stands people in a much better position than coming straight out of university (EA5, Green Agenda and Energy Supply).*

Although there is always an opportunity for a graduate:

> *…in our area the ideal route would be to go through the Apprentice route leading up to a degree qualification, that way they get the benefit of both worlds….what I've found I the past is that someone coming in directly from university hasn't got the grounded skills that an Apprentice has got. They don't have that experience and maturity in that type of environment (EA5, Green Agenda and Energy Supply).*

5.3 Recruitment, completion, and retention

The requirement for entry to a Technical Apprenticeship was typically five GCSEs at grades C and above which must include mathematics, English, and a science. In general, employers had little difficulty in attracting candidates with this level of qualification attainment. In addition, they required applicants to demonstrate an interest in their chosen occupation:

> *We believe that future of business tied up with training young people who understand our products - we're niche - so not having preconceived understandings of business is important and the Apprenticeships works well for this (EA11, Advanced Manufacturing).*

There was a general feeling that Technical Apprenticeships, especially where the candidate might be expected to work towards an HNC, were intellectually demanding and required candidates to have an enthusiasm for their chosen project.

Employers often look for applicants to show capabilities and an aptitude for the engineering side to achieve a minimum of HNC and go on to degree. One interviewee noted that they were:

> *…looking for people who don't want to go to university, that don't think that's right for them but have the potential to be successful at university - looking to work at an earlier age than university graduate we would train them in our field and send them to school for academic and different form of Apprenticeships skills (EA11, Advanced Manufacturing).*
>
> *When we recruit to the new Higher level Apprenticeships applicants need to demonstrate interest and aptitude, a desire to better themselves. They need to be able to say where they want to be in next five years and what foundation degree will do for them. They give up their own time and holidays to do the higher level course so need commitment (EA16, Advanced Manufacturing).*

Another company noted that would-be Apprentices need to be well rounded. Its IT Apprentices needed to know about apps, websites, and how to make the most of these. As a result, they require creativity and *"fresh, innovative thinking".* Even if the role is *"quite techy"*, such as programming or coding, they still prefer to attract an "*all-rounded individual"* (EA39, Media/ICT).

Typically, employers would employ their training provider to conduct an initial sift of applicants, in part due to the volume of applications which were received every year. Employers were active locally, and in some instances nationally, in promoting their Apprenticeship programmes amongst school and college students, and some ran Young Apprentice schemes to give students experience of working in the firm.

From the initial sift, it would usually be the employer who made the final choice of who was taken on to the Apprenticeship. While Apprentices were often, although not always, employed on a fixed-term contract for the duration of their training, there was an expectation that the Apprentice would be permanently employed at the end of their training. In general, employers were not training in excess of their anticipated demand for skilled labour except where, as explored through some examples in section 7.4 (below), they were acting in the capacity as a group trainer for other local employers.

For larger employers completion was not an issue since nearly all Apprentices successfully completed their training, while the smaller employers tended to rely upon their provider to help ensure that the Apprentice completed.

5.4 Delivering Training

The general model of training was that of a three to four year Technical Apprenticeship at Level 3 with, in several instances, the opportunity to progress towards a higher level qualification depending upon there being a job opening which requires training at a higher level. Typically, training was delivered off-the-job by day or block release at a local college with a structured programme of on-the-job training in the workplace. This has been well documented in several other studies (e.g. Hogarth et al 2012).

The larger organisations had developed close working relationships with a local training provider with the latter often delivering a bespoke Apprenticeship for the employer. It was also apparent that the larger companies had retained training centres and academies such that some of the off-the-job training could be undertaken on-site. There were selected examples of case study employers, especially those at the head of the supply-chain, stipulating that their suppliers should train Apprentices or have employees who have completed Apprenticeships:

> *Built into the contracts we let is our principle that for every £3m spend they have to deliver one Apprentice or if their workforce profile doesn't require Apprenticeships, they have to offer work placements and other types of training opportunities, workforce development, taster sessions….. So they have to put into us a plan of how they are going to deliver that (CS4 employer)*

This was unusual however: more often, employers at the head of the supply chain simply wanted products and services to be delivered at the cost and quality agreed, regardless of whether their supply chain recruited and trained Apprentices. That said, there were examples of larger employers making their training centres and academies available to other local employers in an effort to cover the costs of providing these facilities[7]. As such there was the development of a quasi-group training association being created where large employers are providing training facilities to smaller local employers. Local employers were able to make use of what often amounted to access to start-of-the-art technology and know-how. Case study 2 (see Panel 6 below) presents an example of how employers become quasi group trainers.

Panel 6 Case Study 2

Becoming a group training organisation

The company is a large advanced manufacturer which has a long history of recruiting Apprentices (at Level 3) and graduates. It is highly dependent upon its supply chain to deliver the products it needs at the quality it stipulates: *"that's why we do a huge amount of work to support them. We actually train Apprentices for the supply chain to make sure that they've got the right skills moving forward and they understand the challenges that they're going to face just as we do with an aging workforce on a growing order book".*

As well as supporting the training of their suppliers, the company has also become a 'community' supplier to local companies – both large and small – who send their Apprentices to be trained. The training manager commented: *"There's a lot of trust between the industries…everybody looks at [the company's] flagship Apprenticeship scheme…and they want to be part of that 'if I can get my Apprentice up to your standard then fantastic!' It's only going to profit the local industries and the local community".* Presumably by contributing to the pool the employer is able to ensure that there are fewer approaches to recruit its skilled staff in an area which still has a relatively strong manufacturing base, as well as assisting with the funding of the training academy.

[7] See for example Case Studies 2, 4 and 5 in Section 9 Group training models and satisfaction with training provision.

Clearly then, group training can emerge organically in the form of a large employer (or a grouping of large employers) becoming the pre-eminent provider of training in a given industry or sector for the use of both supply chain and other companies (see also section 9 below).

5.5 Meeting employer demand

A critical question is whether the supply of Technical Apprenticeships meets employer demand. A number of observations can be made here:

1. employers in general reported that they had no problem at all recruiting the Apprentices they wanted. In general, there were very many more suitable applicants than places available such that employers were spoilt for choice in many instances;
2. there were examples of companies saying that ideally they would like to have recruited more Apprentices because there was likely to be an increased demand for the type of skills they possessed in the future;
3. it was noticeable that where one company had needed to expand production that it quickly ran into skill shortage and needed to quickly find new sources of skill supply including increasing overtime work.

Our evidence suggests that the training provided by employers was intensive, typically requiring Apprentices to spend a substantial amount of time engaged in off-the-job training through day or block-release at a local college. This is confirmed by other research (see Hogarth et al., 2012). Accordingly, the number of Apprentices taken on is sensitive to projections of future labour demand, as demonstrated by the employer at the centre of Case Study 9).

Panel 7 Case Study 9:

Expansion and the Training decision

The company is going through a period of rapid expansion following the go-ahead from the parent company to become the central manufacturing point for a major new product. This has resulted in the company needing to recruit a substantial number of skilled electro-mechanical engineers who have typically completed an Apprenticeship. They are also looking to recruit professional / managerial staff too.

The company has experienced a degree of difficulty in finding the skilled employees it requires. They have tapped into new sources of skills, including ex-service personnel or local employers who are making their staff redundant. Whilst this has been successful, the company has had to persuade employees to work overtime including the introduction of an extra night shift, which has proved unpopular with employees. The company needs to be cautious about the extent to which it can resort to unpopular measures such as overtime because it faces competition from other employers for its skilled employees who are, as a consequence of being trained by the company, attractive to other employers.

Clearly the decision on whether to invest in training of any kind, including Technical Apprenticeships, is not something that is taken lightly by employers and is thus sensitive to demand. In the creative and media sector, where there was a demand for IT skills which could be delivered through Technical Apprenticeships, contracts were often of short duration. Accordingly, it was more difficult to be sure about future workloads which may then justify investment in an Apprentice. Many such firms would echo the view that *"we'll only offer an Apprenticeship if we've got a long term position"* (EA2, IT).

5.6 Conclusion

The previous chapters which provided statistical evidence relating to the supply of, and demand for, Technical Apprenticeships suggested that demand based on analysis of those industries which can be classified as ones which are dependent upon STEM skills. On the other hand, the data suggests that the numbers of hard-to-fill-vacancies (HtFVs) are relatively high in STEM sectors – indicating that there may be sub-optimal skills supply in the sector - and replacement demands in the period to 2020 are projected to be substantial for those occupations to which entry is typically through completion of an Apprenticeship.

In this section, based mainly on the case study interviews, there is evidence of employers outside the traditional STEM sectors demonstrating a demand for Technical Apprenticeships, notably IT skills required in the creative and media sector. There is also evidence of employers needing to respond to a dynamic supply side environment with the emergence of Level 4 Apprenticeships and changes in the funding arrangements for HE and FE which had led some employers to review their relative reliance on graduate recruitment and Apprenticeships.

In relation to the first point, employers in sectors such as the ICT, parts of creative and media regarded the introduction of Apprenticeship as a new development and, accordingly, they had some uncertainties about how it would work out in practice. To date, their experiences had been largely positive but they were dependent upon the training provider to guide them through the process. This stands in contrast to the more established engineering Apprenticeships where the employer was much more informed about the role they wanted the training provider to play and had much more influence over that role.

For at least one relatively small employer, the uncertainties attached to investing in Apprenticeships were mitigated by the Group Training Association which they had joined. One GTA respondent noted that *"I am frequently told that employers struggle to recruit experienced engineers, [and that is] a frequent reason why they come to us in search of an Apprentice"* (GTA2, Engineering and Engineering Construction). Another benefit of GTAs, as opposed to stand-alone private training providers working with

SMEs is that they were said to focus *"on what the employer wants rather than delivering to the qualification"* (TP42, Engineering).

For SMEs the group training arrangements removed much of the risk attached to their participation in Apprenticeships insofar as the GTA would effectively manage the Apprentice and would be employed by the provider for the training period. Whether this is a fair funding arrangement is a moot point given that the share of the costs and benefits accruing to the employer and the training provider may be uneven. On the other hand, this may be what is required in order to engage employers in the first instance and encourage them to participate further in this form of training. It is clear that in the case of the smaller employer that they would not have participated in this form of training without the group training arrangements being in place. For more discussion about group training and satisfaction with training provision in general see Section 9 (below).

With regard to the relative balance between graduate and Apprenticeship recruitment, the situation is fairly fluid. While some employers intended for the time being to retain the distinction between graduate and Apprenticeship recruitment with the former entering professional and managerial positions, and the latter in skilled trades and associate professional (technician) roles, some other employers were reviewing the situation. In engineering, at present employers appeared to regard the Technical Apprenticeship pathway as leading to the fulfilment of a technician role rather than a professional / managerial one. The Level 4 Apprenticeship would, in some employers' views, be consistent with current practice where Apprentices sometimes go on to higher level training after the completion of the Level 3 Apprenticeship.

In other instances there were examples where the employer had decided to switch from graduate recruitment into Apprenticeships. In part this was a result of employers thinking that on balance there was a better fit between the skills of the Apprentice and the needs of the job, whereas graduates tended to want more conceptually demanding work which would be better remunerated. For all employers, there was a consensus that Technical Apprenticeships fulfilled a major business need and were highly valued by employers.

6. Barriers to increasing capacity

This section looks at evidence from our research on the ability of providers to satisfy current demand and meet any additional future demand. It looks at demand from employers and explores the ways in which it might be constrained; conversely, it presents examples of how the system can cope with increased demand. The section goes on to explore the implications of more SMEs becoming involved in Technical Apprenticeships, including supply-side barriers such as Information Advice and Guidance (IAG) and the schooling system.

6.1 Constraints on demand from employers

As noted in previous sections the type of Apprenticeships with which the study is concerned are relatively expensive ones for the employer to deliver. This inevitably constrains the capacity of the employer to take on Technical Apprenticeships. It also has implications for the capacity of firms to meet skill demand should there be an increase in demand for skills resulting from, for example, business expansion. Some of the employers who participated in the study were in the process of business expansion which had led to step change in the volume of Apprentices they recruited. There were also examples of infrastructure projects also resulting in a marked increase in the demand for Apprentices and the skills which Technical Apprenticeships produce.

Capacity in the training system is about the extent to which providers are able - or unable - to meet the demand for Technical Apprenticeships from employers. Previous sections have shown that employers are mostly able to satisfy their demand for Apprentices even with relatively high entry requirements - indeed there is some evidence of an over-supply of applicants to larger firms – but there is evidence of problems arising where demand increases. And there is still a perceived need for the system to be more employer-led:

> *There is still a feeling that a lot of this is driven by providers….but are they listening to employer voices enough? ….. there are some common things that all businesses need; they need employees to be technology literate, need to be numerate and literate, need some industry-specific [elements]… we need Sector Skills Councils to work more on this, we need them to deliver and promote options that have generic units and some specialised units that are specific to our needs. (CS4, Construction - national infrastructure)*

Learning providers sometimes struggle to meet the demands of employers. One response was for the employer to become their own provider, sometimes in conjunction with other firms in the region. One such employer noted that, while not trying to be critical of other training providers *"they are always going to be on to a loser in terms of setting the Apprentice up…In our training centre Apprentices are trained on all the*

equipment which is used in plant and therefore they progress very quickly". Overall, the interviewee felt that colleges often cannot cover the wide spectrum of employers needs and were not sufficiently focused on specialisms required (CS5, Engineering employer).

There were examples of collaboration between employers and providers where they work together to analyse skills' needs, adapt programmes to local industry's needs and, where necessary, think about whether the provider needs to revise a training programme. One interviewee, representing a provider of engineering and advanced manufacturing Apprenticeships, noted that: *"here [at large advanced manufacturing company] they are very forward thinking and open to ideas"*, which makes it easier to develop the programme through discussion with [employer] colleagues:

> *They guide through what they need in the industry but generally we come together and work things out together, and local industries are quite happy with that CS2 (FE College, advanced manufacturing and engineering)*

While many of the providers reported that the principal problem was that of persuading a sufficient number of employers to take on Apprentices, where labour markets were particularly tight, meeting the demand for Technical Apprenticeships from a major company could be difficult to satisfy as the following example illustrates. This provider was responsible for the training delivered to a high tech manufacturer which had required its Apprentices to have well developed literacy, numeracy and communication skills to gain access to its Apprenticeship programme *(see Panel 8).* Typically these were the skill sets which employers in other sectors wanted or led the individual learner to stay on in full-time education.

Panel 8: Case Study 10

Expanding capacity in an area with few large employers - the role of training providers

The private group training provider at the heart of case study 10 delivers Level 3 Engineering Apprenticeships to several employers within the local area. The case study employer described the training as excellent and was not considering any alternative providers. The training provider has a very good relationship with its employers and will deliver beyond the requirements of the Framework if required by the employer. The provider market in the area was considered to be quite saturated already, with little room for new entrants. The provider does not deliver Level 4 training as this was not considered appropriate for the engineers they were training (the interviewee categorised Level 4 as *"management training"*) and also because they had not had any requests from employers to do so: the majority of the employers they work with are willing to pay for their Apprentices to do a degree and would prefer to go via this route as the Level 4 Apprenticeship was very new and *"it's not recognised in the industry".*

The provider's main competitors for delivering Engineering Frameworks are local colleges. There are not many large employers in the area and the SMEs can only take one or two Apprentices every year, due to affordability. Although there is a large manufacturer in the area (a very large employer of engineers), the company runs its own training scheme rather than make use of the private training market. The training

provider noted that there is only a finite population of school leavers every year, and an even smaller sub-sample of those that are interested in engineering as a career. In the previous year recruitment had proved to be difficult to find enough young people of a high standard and as a result, one person received three or four Apprenticeship offers from different employers.

Although the recommendation within the Engineering Framework is a grade C at GCSE, employers tend to require much higher marks because they want them to progress to higher education (unlike a *"traditional"* engineering and manufacturing Apprenticeship, employers are looking for *"higher-end"* engineering technicians), so the pool of young people from which to select is quite small. The provider has widened its search into other regions in an attempt to get good candidates and is now recruiting people who will relocate from further afield.

Another training provider was a faced with meeting a sharp rise in demand from one of its principal clients for people to enter Technical Apprenticeships. In order to meet the increasing demand from the employer, the provider, in conjunction with the employer and local agencies, had introduced a pre-employment training programme designed to increase the pool from which the employer could recruit its Apprentices *(see Panel 9)*. The example is unusual insofar as it relates to a Level 2 rather than Level 3 Apprenticeship, and the fact that the manufacturer was in a semi-rural location.

Panel 9 Case Study 9 The use of pre-enrolment training to expand capacity in a rural context

The training provider offers a three to six week pre-Apprenticeship training programme for people registered as unemployed, prior to them embarking on Apprenticeships in engineering at level 2. Many of the pre-Apprenticeship training completers subsequently become employees of the manufacturer and the remainder either find employment or Apprenticeships with other employers. Around 60 per cent of participants enter employment or further training.

There is a close relationship between the training provider and the manufacturer, with the latter specifying the skills requirements the former delivers. This includes the pre-Apprenticeship training and working with relevant stakeholders towards the accreditation of the programme.

Pre-Apprenticeship training was thought likely to increase, given expected future demand for people to enter Level 2 Apprenticeships. While the training provider is confident in its ability to increase the volume of its training, there is recognition that it is becoming somewhat more difficult *"to get people with the right attitude and who want to come and train to do these jobs."* Moreover, local transport is an issue for those without a car given the rural location of the manufacturer.

6.2 Implications for the supply of Apprenticeships if demand increases

One area of anticipated future demand is Higher Apprenticeships, and several of our interviewees noted the importance of building their profile in order to attract more and better candidates. One Advanced Manufacturing employer notes that: *"The demand for Higher Apprentices is set to increase for next 3-5 years in order to fill more niche roles in the organisation"* (EA44, Advanced Manufacturing) and this was echoed by a

LEP representative in an area dominated by Automotive employers who reported over-capacity at lower levels, suggesting a greater need to advertise the benefits of higher-level Apprenticeships (L10, Automotive sector). Another aspect to this was the preference some employers had for older applicants, many of whom already had A-Levels and who were likely to be more geographically mobile than 16-year old applicants living in the parental home. This may mean that for SMEs and independent providers, which tend to recruit locally, growth in Higher Apprenticeships - possibly as an alternative to recruiting graduates - could become more difficult to fulfil.

Financial considerations are clearly issues that may prevent an increase in the uptake of Technical Apprenticeships, especially so for SMEs. Start-up costs are high for Technical Apprenticeships:

> *Unless you're associated with a big employer, it is quite hard to enter the market…The private sector in the local area is very much dominated by SMEs. Larger organisations have more facilities on site (L10)*
>
> *I don't think colleges have the facilities that they used to have… [We have the in-house capacity to do our own training and] are able to do the work they would have been able to do in college perhaps 20 years ago. The college no longer has the tooling and equipment… they [colleges] are relying more on the companies to provide some of the training that they would have done (EA19, Life Sciences)*

One employer that does not currently engage with Apprenticeships noted the more generalised cost implications:

> *If I've got to do a job, if I do it on my own it can take two hours with an Apprentice it's going to take three to four hours. …. I've got to pay them, there's no funding out there plus I'm paying double because I'm training them as well. Because you spend so much time with an Apprentice they won't earn you any money really until their first real year out of an Apprenticeship (EWA24, Advanced Manufacturing).*

6.3 Implications if more SMEs were to become involved in Technical Apprenticeships

There are a number of barriers specific to SMEs and among our interviewees SME representatives reported more barriers than other types of firm, especially where they are not part of a supply-chain of companies tied to larger firms. Indeed large employers, learning providers and LEPs all agree that SMEs face more and/or higher barriers than larger firms would. Major barriers include the time and cost of employing and training Apprentices, and access to funding and provision that suited their needs. One SME noted that the message that it is good to have young people to add value to your business, but that employers cannot take them on 'green', they need to be ready

work and contribute to the business as well as having the skills (EA16, Advanced Manufacturing). The following comments typify the response of SMEs:

> *[The] problem is the balance between good work-based skills and a decent level of academic achievement so we have to ensure they can develop literacy and numeracy skills - but there is little in the way of funding for this, small employers particularly are less interested in this side of it (TP32, Automotive)*
>
> *The funding, the government is always telling everyone that the funding is there for [Higher] Apprentices, but as far as I'm concerned it isn't, and I think that's misleading… unless it's Level 2 or Level 3 you have to pay. I'm sure the blue chip companies with the names, I'm sure they have ways and means of getting the funding. In fact if you listen to the news they've had it and they aren't paying for their Apprentices, and we are (EA1, advanced manufacturing)*

SMEs appear to be less keen to take on Apprenticeships but a number of strategies are being adopted to overcome barriers. One interviewee noted local area initiatives to encourage SMEs to take on Apprenticeships in engineering: *"There are a whole new suite of grants being made available and our local LEP is very supportive of SMEs to increase engineering apps in [region]" (*TP37, Engineering). But where SMEs engage in training in an area where there were larger firms operating, the larger firms will often take the best candidates and leave gaps in the supply-chain companies. This can *"dramatically change the landscape"* (TP7, Engineering). This was also noted in another context:

> *Some smaller employers may worry about sending their Apprentices to [large employer-as-provider] in case they end up managing to get a job there (CS2, FE College, advanced manufacturing and engineering).*

Large employers also often recognise the difficulties faced by smaller supply-chain companies:

> *It would help if they made the training free, or if the government removed employers' NI contributions for Apprentices. For supply chain companies, retention is a big issue after training so there needs to be some greater incentive for these employers (EA41, Life Sciences)*
>
> *We are trying to leave a legacy for the sector through giving our current Apprentices transferable skills which will enable them to make the transition into nuclear new build…We are giving the Apprentices that we are training now transferable skills which will also enable them to be taken on by SMEs in the sector who do not have the capacity to train their own Apprentices (CS3 ICT employer).*

There is some room for manoeuvre for those designing Frameworks to recognise some of the needs of smaller businesses. One interviewee, a training provider, noted in relation to the process of developing a Higher Apprenticeship (in manufacturing research and development) that *"one of the issues that kept being raised by all*

employers but particularly the smaller ones, was that the resource used to deliver the provision, particularly the theoretical aspects, lagged significantly behind what was happening in industry". While technology used in industries is advancing all the time, *'the knowledge isn't being transferred…. [there needs to be a] larger focus upon smaller companies that often have to be even more innovative to service [the market]"* (TP34, Manufacturing).

6.4 Implications of increased demand for the supply-side: Information, Advice and Guidance (IAG)

Many providers, employers and others noted issues about the way that information, advice and guidance in schools acts as a barrier to the take up of Apprenticeships - especially Technical Apprenticeship - by suitably qualified young people. For some the issue was the overall lack of IAG since the demise of the Connexions service, while for others it was a suspicion that schools had vested interest in keeping young people on an academic track. A combination of these factors is said to maintain the impression that Apprenticeships are not for the better qualified young people as indicated by the following comments:

> *When they are 14 this is when we should be starting to encourage Apprenticeship schemes…[for example] if you want to be an engineer, this is what you need to do, this is the grade you have to achieve, this is where you need to go to apply for, these are the companies, let's go and see these companies, let's show you the factory and the laboratories (EA37, Life Sciences)*
>
> *It is not so much a lack of IAG but the wrong IAG in some cases; a frequent example is candidates coming to us with Key Skills Literacy or Numeracy as they have been advised that they are equivalent to GCSEs (TP-GTA2, Engineering and Construction)*
>
> *It amazes me still that when you go into schools how many teachers still don't know what the STEM acronym means (TP32, Automotive).*

One training provider noted that school students are *"the captive audience of schools"* and that schools may steer them towards HE, particularly given the raising of the participation age to 18 years. Providers report that is difficult for them to access schools to give advice, especially around the key decision making point when GCSE options are chosen:

> *The raising of the participation age to 18 means that schools will increasingly be our competitors, so there is little likelihood that schools are going to recommend Apprenticeships when there is funding for them if young people stay with the school (TP28, IT)*

Some identify the school culture as a major barrier to uptake: *"we need to convince teachers, rather than the kids. One of the biggest obstacles is that teachers are not a*

product of the Apprenticeship system" (CS1, ICT). Again, the following comments were typical:

> *The key is selecting the right candidates, there has been a tradition of IAG in schools recommending the poorest academic achievers for Apprenticeships but the automotive industry now needs more than just good hands-on skills (TP32, Automotive)*

LEPs reported the same barriers. There is *"no coherence between the IAG that's provided in schools and the local labour market"*. For one LEP interviewee there was a need for more support for careers advisors:

> *[Schools] still push the A Level and university route. There's nothing wrong with that, but there are some exceedingly good high level Apprenticeships out there for highly qualified academic school leavers, and I think sometimes that information is not shared as widely in the schools as it could be* (L2)

Another LEP interviewee noted that *"We also need to articulate that doing the vocational route is as valid as going via a degree"* (L10). Others highlighted reluctance amongst local schools to support their higher academic learners into the Apprenticeship Framework, instead:

> *Schools are looking for their students to go to A levels and not Apprenticeships - individuals are not getting the best advice…When parents see a good percentage from school going to uni they think it is a good school - but not if that percentage is going on to Apprenticeships…we need to change society's views of Apprenticeships (L6)*

Others cite the inappropriateness of the school curriculum for employers' needs and low levels of maths, science and communication among those young people coming forward for Apprenticeships. The following comments were made by employers in this regard:

> *Getting the young people engaged in STEM at school is probably my biggest concern. We have a number of schools in our local area who are [specialist] language or sports schools, and some that are technology, but they don't all offer the same curriculum so we will have candidates applying to us that haven't had the opportunity to do an engineering related subject because their school doesn't offer it (EA3, Automotive)*

> *We have difficulty with the difference between what business wants and what schools are delivering, we have to work to skill those that are coming into jobs in the industry, that have taken supposedly engineering related courses at school. There is a poor alignment between industry needs and what schools deliver, it is about the curriculum which is not suiting the career needs of young people coming our way to the needs of employers - they are not being offered by schools (EA36, Green Agenda/Energy supply)*

> *STEM starts with the foundations of what you need to be able to have for a role in the sector, so we make a major push on it, we work really closely with the education system to support teaching in schools to a high standard and is covering the things that we would like it to cover (CS2, advanced manufacturing)*

If demand for Technical Apprenticeships were to increase the most obvious way to counteract the barriers created by the schooling system would be to increase outreach activities (which most larger firms report engaging in already) including the use of STEM Ambassadors:

> *We do huge amounts in schools, colleges, universities on advice and guidance teaching. We have hundreds of STEM ambassadors, who every single day are out there promoting [the company] , Early Career Opportunities and STEM (CS2, advanced manufacturing employer)*

> *There are some good local examples of links with local schools but many schools do not offer guidance at a more sophisticated level of STEM sector... Young people [have] no clear view of careers in science, engineering even at 18! (TP-GTA3, Engineering)*

Incentives to encourage STEM Ambassadors included a suggestion from one of our national infrastructure case study employers:

> *Would also be good if more employers took on STEM ambassadors, if they could be given tax-breaks as an incentive through the NI system maybe; if you look at how we encourage maternity leave, that is done via NI, we could use same method to encourage Apprentices that way (CS4, Construction - national infrastructure)*

One Apprenticeship lead for an SME in the media industry noted that the mentoring of Apprentices can be daunting and that many managers do not know how to do this. *"The provider should be able to give training to managers in how to cope with mentoring".* The interviewee also believed that success stories of current Apprentices would be a valuable asset for managers as well as applicants (EA39, ICT). Apprenticeships need to be seen as a good alternative to HE. For one (engineering) interviewee the Apprenticeship offer was *"becoming more positive than it was previously, and [we] are having greater engagement with schools, for example with big engineering events for schools".* They are also starting a new initiative with 14-year olds to encourage study of STEM subjects involving graduates making presentations to younger students (EA40, Engineering/Manufacturing).

There are a specific set of related barriers to raising the number of young females entering the Technical Apprenticeship route. Some interviewees are trying to address this by carrying out targeted outreach in girls' schools and by arranging Master classes where female Apprentices give inspirational speeches to school girls about the possibilities of careers in technical sectors (EA39, media ICT). One training provider noted that:

> *Less [women] apply but when they do they have made an active decision to work in IT, have researched it etc. they don't just come like the boys for whom it is normal (TP28, ICT)*

The barrier to Apprenticeship take up among women is even more difficult in industries not perceived to be 'woman-friendly' such as the Automotive industry:

> *Gender imbalance is something the auto industry suffers from so we have programmes of outreach in schools to promote females in STEM subjects in general as well as specifically in automotive - it is about dispelling myths (TP32, College, automotive)*
>
> *The issue is knowledge and understanding in schools……[among girls] there is a misunderstanding of what an Apprenticeship is, they either think of dirty, physical jobs or of low-level things like hairdressing (EA35, Life Sciences).*

6.5 Conclusion

The evidence suggests that the large employers at the head of their supply chains are able, by and large, to recruit both the number and the quality of the Apprentices that they require, though even here there were instances where employers would prefer their Apprentices to have high levels of mathematical ability. In general, the larger employers had a large number of applicants from which to select their yearly intake of Apprentices. Young people, it was said, were attracted by the cache of completing an Apprenticeship with companies which had a strong reputation across industry for developing the skills of their employees. Where problems could arise was in relation to:

1. a marked increase in demand for the type of skills which Technical Apprenticeships supply because of (a) business expansion within the Apprentice employing company, or (b) other developments in local or national labour markets which tended to attract people from the extant skills stock in an area;
2. demand from employers in lower tiers of the supply chain who were unable to attract the same quality of applicant as larger firms at the head of the supply chain.

Where supply was proving insufficient a number of diagnoses were supplied by employers, training providers, and LEPs, including:

1. guidance to young people to stay on in full-time schooling rather than apply for an Apprenticeship;
2. insufficient supply from certain sections of the school population, particularly young women.

The veracity of the first view should not be taken at face value. Potentially, young people staying on full-time schooling – usually respondents were referring to staying on in the sixth form - to obtain A levels does not preclude them from commencing an

Apprenticeship at a later date and possibly completing it more quickly. It needs to be borne in mind, however, that recent changes to the funding of Apprenticeships for older applicants may militate against this. The principal worry of training providers and employers, in this regard, however, was that young people were being guided down the academic pathway towards higher education rather than being asked to consider the potential benefits that completion of a Technical Apprenticeship may offer them.

To counter the above, employers had engaged in outreach programmes, often aimed at specific groups such as young women, who are under-represented in the population of Technical Apprenticeships. Apprenticeship and STEM Ambassadors were regarded as having an important role in this regard.

It should also be noted that SMEs appear to face a distinct set of problems insofar as they were often in the lower tiers of the supply chain and encountered all of the problems faced by other companies at the same level in recruiting Apprentices. The additional barrier they faced was the capacity in-house to deliver the Apprenticeship. This often related to simply knowing how to manage the Apprenticeship as well as being able to provide all of the elements of the Apprenticeship for which the employer was responsible, including the key mentoring role.

If the above relates very much to employer demand for Apprentices and the supply of suitable applicants for available places, there is also a need to consider the role of the intermediary between the two: the training provider. The constraint here relates to the capacity of providers to take on additional Apprentices, keep up to date with theoretical developments in various spheres, and ensure that their equipment is up to date. The key issue here is that the entry costs to this form of training is relatively high and, accordingly, the supply of training is not necessarily as elastic as that relating to demand.

7. Models of, and satisfaction with, training provision

This section looks at satisfaction with the various models of training provision from the point of view of employers, training providers and LEPs, and this encompasses the quality as well as the organisation of training and issues related to the operation of Apprenticeship Frameworks. Overall those interviewed were largely satisfied with the quality and appropriateness of training provided and the relationship between employers and providers. Various models of provision are employed depending on the industry and sometimes location and these are described below. The section then goes on to explore the appropriateness and quality of provision; how group training is organised; and the relationship between Frameworks, models and employer requirements.

7.1 Types of training provision

The typical types of training provision that employers are engaged with in the UK include:

- the employer/provider direct relationship which have evolved organically according to need;
- employers-as-providers (where employers have established their own training academy, sometimes in conjunction with supply-chain companies);
- shared Apprenticeship models;
- various models of group training (including Group Training Associations (GTAs) and Apprentice Training Associations, ATAs); and
- the more recent Employer Ownership Schemes (EOS).

The Shared Apprenticeship model - whereby large companies and some of their supply chain sub-contractors share Apprentices as and when required - is becoming an increasingly popular model of delivery and is found in the Construction industry where short-contracts mean that otherwise Apprentices may be left 'high and dry' if they remained with one employer. Employer Ownership Schemes, whereby companies are directly funded by Skills Funding Agency to provide training, are becoming more common, particularly in industries with a higher proportion of SMEs, such as Construction. They fit most directly with the policy agenda of making Apprenticeships more responsive to employers' needs.

Group Training Associations (GTAs) emerged in the 1960s as groups of training providers working under one umbrella to avoid overlap of provision and offer economies of scale by sector and/or region. ATAs are also mostly led by training

providers. They recruit Apprentices who are then hired out as a flexible workforce to other employers, known as ‘host companies’ for the work-based element of their Apprenticeship. This model appears to be more common in the Life Sciences sector where the sharing of opportunities for Apprentices to access resources and equipment with employers is highly valued, and are largely used by larger employers as SMEs often don't have the range of work to offer experience to Apprentices.

This section contains several examples of group training from the case studies, including a case study that offers examples of:

- a shared Apprenticeship model and an employer that has established its own training academy to meet its own needs and those of its supply chain (CS4);
- an example of an employer-as-provider that offers training for its supply chain and other SMEs in the region (CS2);
- a consortium bringing together large multinational employers in a training academy (CS5); and
- a college-based case study focused around provision for the Nuclear industry (CS3).

The section begins by reporting on interviewees' views on the quality and appropriateness of training provision.

7.2 The appropriateness and quality of provision

Private providers

Employers are generally satisfied with the quality of training provided by private training providers and feel that they have a good relationship that allow for flexibility and co-operation where change is seen to be appropriate. One advanced manufacturing company, some of whose staff have gone on to work for the local provider and which is involved with a local Skills Alliance, noted that:

> *We have some places for staff to come in...and took them around the built environments specific to their teaching. They found it very helpful and we want to build on this…to help them as part of their professional development … to see what we do…to relate their teaching styles to what we do (*EA9, *Advanced Manufacturing)*

Another noted that *"we constantly review our schemes and we are talking to suppliers to say 'this is now important to us'".* However they had not taken up the opportunity to become involved in group training:

> *[The GTA model is] just too difficult, you get half a dozen different employers in a room, how are you going to get a course that suits everybody without putting a vast amount of effort into it? It's just easier to do it yourself (EA6, Advanced Manufacturing)*

While employers and providers are generally satisfied, one interviewee from an IT company noted that their particular needs - at Level 4 - were not funded and that government and other bodies (such as NAS and the Skills Funding Agency) could make more of the business case for Apprenticeships and promote parity between the vocational education and training and academic/higher education routes. Government, the interviewee believed, could do more by providing tax breaks to encourage training (EA43, IT).

Where there is little tradition of large companies looking to recruit Apprentices, it can create supply problems for SMEs. One private training provider in a region with little tradition of engineering and manufacturing notes that with supply of training tied so much to demand and the funding regime, some courses are in short supply (e.g. fabrication and welding) because there is little demand. In such circumstances *"when you do get a demand for it, then you can't find anyone to deliver it because colleges are employing people to meet the largest demand, it's numbers-driven".* If an employer then wanted the college to run a particular course, they would have to be prepared to pay for it (TP39, Engineering). For larger companies it is believed to be easier as they often *"do their own [training] … they do work with colleges but they do an awful lot themselves, they invest in training centres...With scale we could do a lot more…to plug into existing Frameworks" (*E42, Green Agenda/Energy supply).

Colleges

There were concerns about the quality and appropriateness of some college provision. One interviewee had been told that the college was held in high regard but had found that the paperwork was not accurate and up-to-date and the college failed to ensure that there was sufficient staffing to complete the modules. Others reported that colleges were very poor at assessing NVQs and understanding the standard of work acceptable to the employer. This was linked to the funding of Apprenticeship training:

> *We feel with colleges the output related payments for achievement ensures that everybody passes no matter what the quality of the work. Nobody from the college came to assess the quality of the Apprentice. They used simulation in the college and not real work for their NVQs (TP31)*

As a result the employer decided to become their own training provider because they didn't trust the college's assessment.

Another issue for general Further Education Colleges was seen to be the broad nature of their offer (in contrast to the specificity of smaller private training providers which focus on a single industry or sector). One Group Training Association had formed because of this problem note that *"too many local colleges [are] delivering Motor Vehicle and Health & Beauty with no regard for the local labour market!"* (GTA2, Engineering and Engineering Construction). One LEP representative believed that college providers should expend more effort promoting their 'niche' training provision by course or by Framework - rather than the college itself - which is too often the focus of how courses are offered. This would enable employers and young people to more easily find out where to access specialised training modules. Local Enterprise Partnership or City Regions could host 'training clearing houses' as part of their remit (CS4, LEP).

7.3 Group training

Providers and employers coming together to establish a Group Training Association (GTA) was seen as one response to quality and appropriateness issues. They have been seen to work particularly well in Engineering, Construction and Energy Supply industries where there is a tradition in some regions of smaller firms training Apprentices, which allows them to be more responsive to needs:

> *I would say our biggest strength is that the majority of employers we recruit completed an Apprenticeship themselves and/or have a significant proportion of their management team who completed Apprenticeships. Much of our Apprenticeship programmes begin with a period of off-the-job training [a block of usually either 6 or 11 months] and their own experience helps them to appreciate the value of this. This off-the-job training means we deliver more skilled and competent Apprentices more quickly than a day-release programme can do. GTA2 (Engineering and Construction)*

GTAs do not offer guarantee of quality and appropriateness however. One employer, who is on the Board of Trustees of a GTA that had a poor Ofsted result, noted that quality has become a serious issue for them, and that the GTA hadn't been as responsive to changes in Apprenticeship as should have been (EA11, Advanced Manufacturing).

Shared Apprenticeship models of training are often seen as a way that employers can have more influence on the quality and relevance of training, as Case Study 4 illustrates:

Panel 10 Case Study 4:
A shared Apprenticeship model designed for specific need

Case Study 4 is based around an infrastructure project involving complex construction and tunnelling. Over the lifetime of the project 8,000 employees will be used across the main company and major supply chain companies, including at least 400 Apprenticeships. The Talent and Resources Director for the main employer had come to the belief that to make Technical Apprenticeships sustainable you need to have long range planning, and the emphasis in construction is short-term which isn't helpful. For this complex project the lead company and its main supply-chain partners have established a shared ownership model:

There is more that large companies can do to support the supply chain – be it about structure or encouraging supply chain to support them through employing Apprentices – perhaps through a shared Apprenticeships model….when you have a project with a finite life ….one of things companies want is some certainty about future projects once this project has ended some of these Apprentices might only be only part way though their Apprenticeship, so we are looking to establish our own co-ordinated approach to finding work and placements to ensure they can complete their Apprenticeship, so that we can find other places for them.

The employer also believed that public procurement requirements that, for example, a fixed proportion of Apprenticeships should be provided by supply chain companies as a condition of contract:

Built into the contracts we let is our principle is that for every £3m spend they have to deliver one Apprentice or, if their workforce profile doesn't require Apprenticeships, they have to offer work placements and other types of training opportunities, workforce development, taster sessions…So they have to put into us a plan of how they are going to deliver that.

The project lead company and some its major contracting partners have also:

Established our own Training Academy with bespoke facilities which acts as a hub and we have spokes out into other FE colleges that provide some of our training, which is also used by subcontractors so they act as provider for the supply chain (CS4, national infrastructure project).

7.4 Accessibility of Apprenticeship Frameworks

Scale is seen as an issue when it comes to firms accessing a Framework suited to their needs, but that is no guarantee of provision. One LEP representative noted that there is a tendency for providers to put on provision for popular courses due to minimum number for running a course, therefore while Apprenticeship Frameworks exist, accessing them is not always possible. The provider may suggest a different Framework that meets the employer's needs. It is then up to the employer to decide whether to go for a slightly different Framework or seek to source training from outside of the area (L7). There is certainly evidence of conflict between providers and employers in terms of what goes into the Frameworks, with at least one LEP representative believing that larger employers hold more sway in Framework design than SMEs (L9).

When asked about a possible conflict about the form and organisation of training, one noted that there may be *"some tensions in terms of how flexible providers can be around the learning"* for example the employer may prefer their Apprentices to be taught one day a week or in a block (of solid learning away from the workplace). Not all providers can accommodate this and *"may be a bit too rigid"* and one LEP noted:

> *The large employers are big enough to say this is what we want, and it's a big enough contract for [the local] College to be able to flex...*[somewhere in between might present] *a happy medium (L10)*

Another issue that impact SMEs is their distribution across a large region:

> *Smaller engineering firms are often dispersed around [the county] and not close to the facilities, representing practical barriers. Day release can be difficult. Larger organisations can bring in providers themselves, using their own facilities (L10)*

The range of Framework options is mostly seen as beneficial. One provider noted that *"the choice of pathways is more of a benefit to the employers because now you can put people on pathways which are even more related to their job role".* As a provider, they would deliver more than required of a Framework if they thought it was needed for an individual (e.g. some progression units). They would also consider bespoke training for employers (e.g. one employer prefers their Apprentices to come in on a full-time block whereas others prefer day release).

For others the range was seen to be so wide that it actually deters uptake. In Engineering, the 23 pathways are often found to be *"too complex and confusing for employers. There should be fewer [and they should be] more adaptable or optional [i.e. a core with options]. I don't think there's pent-up demand that can't find a provider, I think it's about providers making their offer and making their Apprenticeships easier for employers to understand"* (TP41). While the status of Apprenticeships has improved in recent years, the delivery has become more complex: *"very, very structured and strict … the training also takes longer with more academic requirements"* (TP41). However, the general perception in the Engineering sector seemed to be that industry seems to be more involved in developing Frameworks along with sector skills councils in recent years and welcomed the addition of functional skills (English and maths) (TP35).

For SMEs the main problem can be a lack of awareness of the Frameworks on offer, and if in more specialised areas of employment, knowing how to access training courses. Local Enterprise Partnerships can have an important role in helping SMES navigate a dynamic labour market and thus increase demand by raising profile of specialised provision across the region:

Panel 11 Case Study 4:

The role of the Local Enterprise Partnerships and other regional bodies

The regional training market in which Case Study 4 operates consists of approximately 50 colleges and 300 training providers offering Apprenticeships. The LEP, in conjunction with the local branches of the Association of Colleges and the WBL Alliance are currently doing some case studies for a report on innovative provision.

Generally the LEP has to manage a demand-led world; we are not in a planning world anymore so the LEP is about facilitating networks where supply and demand can meet.

What is required - according the Apprenticeship lead for the LEP - is a clearing house that would introduce market pressure:

To complete the market we need to weed out the poor provision, promote greater specialist provision in FE and skills - part of the issue with colleges is they don't tend to promote one course or another but their whole provision.

An alternative approach would be to create a space for niche advertising - through a league table ranking system (perhaps modelled on newspapers' University rankings) so that people don't have to search through Ofsted reports:

Metrics may be things like outcomes; satisfaction (employers and trainees); non-completion rates. It would then be easy to see which providers offer which Frameworks and other courses. So it would encourage and promote niche provision which is not solely reliant on what local applicants and local employers want - it can be pan-region (CS4, LEP Apprenticeship lead).

Another approach is for large employers to establish their own training academies. Case Study 5 (centred on Advanced Manufacturing) has used the approach of developing a research academy that will provide training as required as well as research and development to maintain the global advantage regional firms believe they have:

Panel 12 Case Study 5:

A joint enterprise training academy

In this case study a training academy was established by several large multinational engineering and advanced manufacturing firms. It came about as a result of a historical dissatisfaction with provision on offer:

Five years ago we as employers were so fed up with the 'state of the nation' in this region with regards to skills provision we decided to build a consortium of employers which is actually now the LEP manufacturing forum (Leads on Skill for the LEP manufacturing forum).

The general feeling across all those interviewed for this case study (employers, providers and the Apprenticeship lead for the LEP) was that Apprenticeships were at their peak in the 1980s and the [largest local employer] model was rigorous and fit for the general purposes of many local firms. In this case study region machining skills were believed to be particularly lacking, with capacity among the larger firms for 100 Apprenticeships in the local area. The regional spokesperson for Apprenticeships noted that there was no shortage of engineering graduates, but that there was a shortage of who went on to engineering in a job capacity:

Between training and first job there was quite high leakage and I think businesses realising that they could never compete with the salaries at that level just thought the Apprentice route is something where we can grow our own! (L5, CS5).

Employers and providers are convinced the demand is there:

We are looking at requiring around 8000 engineers in this region alone to keep up with the demand [in terms of retirement and global competitive advantage]...with the emerging technologies we have to keep on top of that...I don't think there is enough provision in this region to meet that demand (TP1, CS5).

Within the Training Centre assessment focuses on maths, English, mechanical reasoning, manual dexterity, team building and presentations, and in its first year of operation had around 100 successful applicants. Another feature of this case study is interviewing training prior to putting them in front of employers. Consortium employers contribute money, master class delivery (expertise), materials and components to work on. From a supplier perspective they will bring in machines, tooling and training materials and they are establishing an awards scheme with the bigger employers sponsoring an Apprentice of the Year for each firm.

An alternative model is one based on a single large employer that offers training to other firms in the region, including its supply chain. Case Study 2 is an example of this - again in the Advanced Manufacturing sector:

Panel 13 Case Study 2:

Employer-as-provider

The focus of the case study is global advanced manufacturing and engineering company, in the civil and defence aerospace, marine and energy markets. The company has a history of Apprenticeships, and train their Apprentices internally. The company also train Apprentices from the supply chain as well as Apprentices from other local large companies in the railway industry, i.e. beyond their core industrial needs. The company employ over 43,000 people globally, 22,000 in the UK and around 12,000 in the region. They currently have about 700 Apprentices all in STEM related subject areas; the number of Apprentices have increased in recent times, but stabilised this year with an increase in Higher Apprentices (almost a 10 fold increase in the past 3 years). Despite being located in area which has traditionally been strong in the use of engineering and manufacturing Apprenticeships, they report shortages in manufacturing engineering, electrical engineering areas and have established an Early Career Programme in place to improve this. The programme includes Young Apprenticeships, Advanced Apprenticeships, Higher Apprenticeships, Graduate programmes and internships. At any one time they have around 2,000 trainees on global programmes.

The ageing workforce is a significant issue for both the main employer and their supply chain, though the main employer representative felt that the supply chain were less aware of this. *"If you look at the age profile within the sector, it's common knowledge within engineering that the average age of the workforce is near to the 50 mark"* (CS2, employer 1). The company are very reliant on their supply chain as 65% of their product comes through this route:

….that's why we do a huge amount of work to support them. We've actually train Apprentices for the supply chain to make sure that they've got the right skills moving forward and they understand the challenges that they're going to face just as we do with an aging workforce on a growing order book (CS2, employer 1)

The reputation of the SMEs and the larger employers draw Apprentices to the area. *"Apprentices move and relocate to the [region] because of the nature of the employers that they're able to work with"*. The SMEs as well as the larger employers are drawing them to the area because of *"the reputation of the supply chain…[and] they're able to work in a close proximity to engineering companies that are really well developed within the industry"* (CS2, LEP).

However there are concerns around smaller businesses and the supply chain being unaware of the future challenges in the sector: *"The stats say something like only 7% of SMEs train Apprentices, that's way lower than it could be"* (CS2, employer 1).

Independent providers such as FE colleges can also form an integral part of a group training enterprise, as illustrated by the following example from the main college that supplies Apprenticeships for the Nuclear decommissioning and supply industries. However, Case Study 3 contains notes of caution about maintaining the supply of Apprenticeships in a relatively isolated region if demand grows rapidly.

Panel 14 Case Study 3: Addressing the risk of a surge in demand

Case Study 3 is centred on a regional college which has become the main training centre for Technical Apprentices in the Nuclear and ICT industries in its (relatively isolated) region. Currently approximately 400 out of 1,100 Apprentices trained through the college are on Technical Apprenticeships in STEM subjects (mainly in Green Agenda/Energy Supply and IT sectors). The college reports increased demand for STEM skills in the geographical region. Key employers are making large scale investments in STEM projects and the college delivers a range of related Foundation Degrees in engineering and building services and can deliver up to BSc. The college believes that it is able to be responsive to employer needs and requests:

We are seeing a steady increase and anticipating an increased requirement for mechanical and electrical degrees. We are also thinking about gearing up for specialist welding…[the college] are effectively managing the Apprenticeship programme for 6 Apprentices from [Employer 4] who are employed by the Technical Apprenticeship scheme through COGENT (CS3, Training Provider)

Apprentices are normally employed by the companies they are placed in, are carefully selected, have high level functional skills and achieve well. The college has developed a strong relationship with employers in the nuclear sector and are able to be flexible in their delivery to serve the employers best. The college has a focus on Apprentices for the whole energy sector and its usual approach is to deliver training on company premises where possible and appropriate (given the nature of the Nuclear industry). The college notes that there may be supply constraints if major infrastructure projects (including the expansion of Nuclear building) go ahead:

If [proposed new power station], High Speed 2 and [major IT infrastructure project] come to fruition at the same time there will be increased demand for construction, Civil engineers, project management (CS3, Training Provider)

Supply barriers identified by the college include insufficient numbers of trained teaching staff if demand rises, which might result in the supply of young people in the region wishing to become Technical Apprenticeships going unsatisfied. The question that is raised here is, can the college, other providers and large employers (one of which in the Energy supply industry notes on its website that it had received over 200 applications for 50 Apprenticeship places) expand the capacity of the local training market rapidly to meet this demand?

7.5 Conclusion

Employers, providers and those responsible for regional planning seem to be satisfied with the range of Apprenticeship models in operation, which have often evolved to suit the needs of specific industries, sectors or regions.

There have been examples where, because of a perception that the training market (be that colleges or independent training providers) has been unable to satisfy employers' requirements, firms have established their own training academy, often in conjunction with their supply chain.

Employers that thus become providers can then become quite dominant in their region or sector, enabling them to have the first pick of the 'best Apprentices' and also the largest voice in the shaping of Apprenticeship Frameworks and this can act as a detriment to smaller firms. The role of LEPs and City Regions in identifying suitable provision and bring employers and providers together is likely to become more important if demand for Technical Apprenticeships is to expand, and may have a particular role in establishing clearing houses for the labour market in some regions.

8. Conclusions, Policy Implications and Recommendations

Employers in the range of sectors included in this study placed a high value on the contribution Technical Apprenticeships made to their businesses. It was also apparent that Technical Apprenticeships have been able to penetrate sectors outside the traditional heartland of engineering, such as the creative and media sector. Employers in all STEM sectors recognised the value this form of training would continue to make to their businesses over the medium-term.

Employers were keenly aware of potential uncertainties facing the future demand for their products. They were generally unwilling to provide training over and above that required to meet projected demand beyond replacement demand or that required to meet current orders. In relation to some Level 2 training, employers reported that the productive contribution of the Apprentice over the training period could cover training costs, but most Technical Apprenticeships were at Level 3 and these were regarded as costly in the short-term at least.

It was also apparent that an increase in the demand for skilled labour resulting from, say, the start of a major infrastructure development, or a marked pick-up in the economy, could quickly result in skill shortages in local labour markets unless LEPs are able to fulfil a brokerage role. This suggests that currently there is a lean system of skills supply in place for technician type skills. This runs the risk of current supply being unable to keep pace with demand if there is a pick-up in the demand side especially when set within the context of expected future levels of replacement demand for people to work in associate professional and skilled trades occupations.

There is also prima facie evidence that supply is not keeping pace with demand at the margin. Employers in sectors which have a substantial demand for science, technology and engineering skills, are more likely to report hard-to-fill vacancies for skilled trades workers, than other sectors. In other words, they experience recruitment difficulties for workers who would typically have completed a Technical Apprenticeship. Looking to the future there are likely to be high levels of replacement demands for skilled trades and associate professional workers in sectors such as engineering as a consequence of impending retirements, and this may accelerate career progression for Apprentices that follow.

The first issue to address is how to increase the number of Technical Apprenticeships offered by employers. The evidence suggests that employers are reluctant to train in

excess of their predicted future demand for skilled labour because of the cost of training an apprentice to, for example, completion of a Level 3 Technical Apprenticeship.

One way of increasing the supply of Technical Apprenticeships is to use the existing capacity which is already in place. There is evidence of employers becoming quasi-group trainers for their industries by taking on Apprentices from local companies. They are willing to do so provided that they can cover their costs and the benefit they derive are related to economies of scale. Potentially this approach may lead to increased supply at the local level if more employers can be persuaded to work together in this way. There is potential for LEPs to use their brokerage to encourage this type of activity amongst employers of all sizes and providers.

There is also evidence that more traditional approaches to group training (e.g. GTAs, ATAs) can also prove beneficial to smaller employers, or those which are new to Technical Apprenticeships and which are a little uncertain about their capacity to deliver the Apprenticeship in a way which benefits their business. This is not to say that this is the only model which can be applied to this group and there may be other ways of finding a means of minimising the risks smaller, or companies new to Apprenticeships face in supporting a Technical Apprenticeship. But there is scope for encouraging the use of this type of approach.

Consideration could be given to encouraging employers in sectors such as digital and creative, or relatively small organisations, to become part of group training approaches. It is likely, given the lack of knowledge some employers have in these sectors of how Apprenticeships are delivered and funded, that there will need to be a third party which, in the initial stages, establishes a group training approach. Whatever model of provision is envisaged by SMEs, attention should be given to the provision of support for the mentoring of Apprentices in smaller firms whose management may not have the time or skills to take on this important role.

The introduction of Level 4 Technical Apprenticeships is a new phenomenon and the study has relatively little to say about these at this juncture. It is not clear, at the moment, the extent to which training at this level will principally fulfil a demand at the para-professional level (for example, higher level technicians) or provide a route into professional and managerial occupations typically filled by graduates at the moment. Level 4 Apprenticeships have the capacity to fulfil both roles but employers may need to be further informed about the potential role they may play within organisations.

Employers generally reported that they were able to meet their demand for Technical Apprentices. There were some concerns expressed about the general academic preparedness of some applicants – notably with reference to their mathematical skills – but employers were able to recruit Apprentices of the calibre they required. But as noted above demand and supply are finely balanced. If demand increases then there will need to be a commensurate increase in supply. A number of actions may be required to bring this about:

- Technical Apprenticeships are typically offered in industries which are in long-term employment decline (i.e. manufacturing). There needs to be recognition that despite this there are high levels of replacement demand projected to arise in the future such that there are likely to be many relatively secure employment opportunities which Apprentices can fill. This is an important element of any information advice or guidance provided to individuals;

- there may need to be increased awareness from careers guidance professionals of the potential to take up Technical Apprenticeships in industries outside of the STEM heartlands. The danger of not doing so is that the employers in these sectors are put off by there being insufficient supply of people willing to take up Apprenticeships;

- employers too may need to ensure that the Technical Apprenticeship is an entry point which can, potentially, lead to a career at a professional / managerial level. The key here is in ensuring that at the point of completion Technical Apprentices have access to those courses which will provide them with entry to professional / managerial occupations should that be their preferred destination;

- more broadly, the potential growth in the supply of young people willing to take on Technical Apprenticeships may be enhanced by the emergence of a clear work-based pathway from Level 2 Apprenticeships through to professional qualifications and Professional Body accreditation (mirroring the academic GCSE-A Level-Degree pathway) that doesn't require Apprentices to leave industry and enter Higher Education to achieve such status;

- the lack of diversity among those progressing into Technical Apprenticeships remains an issue including with regard to the gender disparity in many key sectors. The government could consider ways in which more technical apprentices can be encouraged to engage in outreach activities such as the STEMNET Ambassador programme in order to promote apprenticeships as a route into STEM careers.

There is evidence in this report that Technical Apprenticeships have been able to penetrate new sectors of activity such as the digital and creative sector. Where employers are new to Apprenticeships there is a degree of uncertainty about what will be expected of the employer to support apprentices through their training and the cost risks the employer may face in doing so. In new areas of activity this points to the need, bearing in mind issues of deadweight, for support to be provided to employers who are interested in taking on an apprentice but who are potentially put off by the concerns mentioned above. As noted elsewhere in this report a group training approach is one way of achieving this, but it may also be measures of support such as providing additional support via training providers and other key stakeholders – including financial support but other kind too – to encourage take-up by SMEs and support them in delivering the training through, for example, information about good

practice. There may be lessons to be learnt here from the Apprenticeship Grant to Employers initiative.

The recommendations set out above are in many respects not new and are being pursued within current policies. It is more about the degree of emphasis they are given in each sector and the need to amplify their importance if Apprenticeships are to provide employers with the STEM skills they require. Higher Education remains a relatively attractive destination for many of the young people employers with a demand for STEM skills would ideally like to recruit to their Apprenticeships. The key is ensuring that Apprenticeship is as attractive alternative to HE for some groups of young people. At the very least this will require employers and policy makers to ensure that the returns to a Technical Apprenticeship can, ultimately, provide a comparable set of rewards.

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Appendix 1: SIC07 Industry divisions (2-digit) classified as STEM industries in analysing the LFS

Source: Adapted Mason, G. (2012)

05 Mining of coal and lignite	24 Manufacture of basic metals
06 Extraction crude petroleum and gas	25 Manuf fab metal prods, ex machinery
07 Mining of metal ores	26 Manuf computr, electronic & optical
08 Other mining and quarrying	27 Manufacture of electrical equipment
09 Mining support service activities	28 Manuf of machinery n.e.c.
10 Manufacture of food products	30 Manufacture of other transport
11 Manufacture of beverages	31 Manufacture of furniture
12 Manufacture of tobacco products	32 Other manufacturing
13 Manufacture of textiles	33 Repair and installation of machinery
14 Manufacture of wearing apparel	35 Electricity, gas and air cond supply
15 Manufacture of leather and related	36 Water collection, treatment & supply
16 Manufacture wood and wood products	41 Construction of buildings
17 Manufacture paper & paper products	42 Civil engineering
18 Printing and recorded media	43 Specialised Construction activities
19 Manufacture of coke & refined petrol	61 Telecommunications
20 Manufacture of chemicals	62 Computer programming and consultancy
21 Manufacture of pharmaceuticals	71 Architectural and engineering
22 Manufacture rubber plastic products	72 Scientific research and development
23 Manuf non-metallic mineral products	

Appendix 2: SOC2010 Occupations classified as STEM occupations

Source: Adapted from Occupational classification of STEM occupations set out in: Jagger, N., Sigala, M., and Sumption, F. (2010), Mason, G. (2012) and Greenwood, Vignoles and Harrison (2012)

1121	production, works, and maintenance managers	3122	Draughtpersons
1136	information and communication technology managers	3123	building inspectors
1137	research and development managers	3131	IT operations technicians
2111	chemists	3132	IT user support technicians
2112	biological scientists and biochemists	3217	pharmaceutical dispensers
2113	physicists, geologists and meteorologists	3218	medical and dental technicians
2121	civil engineers	5211	Smiths and forge workers
2122	mechanical engineers	5212	moulders, core makers, die casters
2123	electrical engineers	5213	sheet metal workers
2124	electronics engineers	5214	metal plate workers, shipwrights, riveters
2125	chemical engineers	5215	welding trades
2126	design and development engineers	5216	pipe fitters
2127	production and process engineers	5221	metal machining setters and setter-operators
2128	planning and quality control engineers	5222	tool makers, tool fitters, and markers-out
2129	engineering professionals nec	5223	metal working production and maintenance fitters
2131	IT strategy and planning professionals	5224	precision instrument makers and repairers
2132	software professionals	5231	motor mechanics, auto engineers
2212	psychologists	5232	vehicle body builders and repairers
2216	veterinarians	5233	auto electricians
2321	scientific researchers	5241	electricians, electrical fitters
2431	architects	5242	telecommunications engineers
3111	laboratory technicians	5243	lines repairers and cable joiners
3112	electrical/electronics technicians	5244	tv, video and audio engineers
3113	engineering technicians	5245	computer engineers, installation and maintenance
3114	building and civil engineering technicians	5249	electrical/electronics engineers nec
3115	quality assurance technicians	5314	plumbers, heating and ventilating engineers
3119	science and engineering technicians nec	8143	rail Construction and maintenance operatives
3121	architectural technologists and town planning technicians		

Appendix 3: Frameworks classified as Technical/Technical-related Apprenticeships

As used in the analysis of the ILR

Source: adapted from Harrison (2012) and file received from the Information Authority.

103	Process Technology	348	Water Industry
105	Electrotechnical	351	Advising on Financial Products
106	Engineering	352	Industrial Building Systems
107	Engineering Construction	355	Construction Diploma
111	Polymer Processing and Signmaking	356	TV Production
113	Metals Processing	357	Nuclear Decommissioning
116	Construction	358	Building products Occupations
117	MES Plumbing	359	Extractive and Mineral Processing Occupations
201	Accountancy	365	Purchasing & Supply Management
202	Aviation Operations on the Ground	369	Specialized Process Operations (Nuclear)
204	Bakery	370	Surveying
206	Transport Engineering and Maintenance	371	Paper Manufacture
208	Ceramics Manufacturing	403	Food and Drink
211	Electricity Industry	405	Aviation Operations on the Ground
212	Heating, Ventilation, Air Conditioning and Refrigeration	416	Signmaking
215	Furniture Furnishings and Interiors Industry	418	IT, Software, Web & Telecoms Professional
216	Glass Industry Occupations	419	IT Application Specialist
219	Amenity Horticulture	420	Supporting Teaching and Learning in Schools
224	Man-Made Fibres	423	Fashion and Textiles
225	Meat and Poultry Processing	424	Polymer Processing Operations
227	Print and Printed Packaging	429	Rail Services
230	Security Industry	431	Bus and Coach Engineering and Maintenance
234	Marine Industry	433	Vehicle Parts
235	Automotive Industry	434	Vehicle Body & Paint
237	Newspaper Industry	436	Vehicle Maintenance & Repair
241	Providing Financial Services (Banks and Building Societies)	437	Vehicle Fitting
247	Equine Industry	439	Animal Care

248	Insurance	446	The Gas Industry
254	Land-based Service Engineering	448	Photo Imaging
259	International Trade and Services	449	Creative and Digital Media
264	Food and Drink Manufacturing Operations	453	Providing Mortgage Advice
265	Gas Industry	454	Accounting
277	Water Industry	455	Providing Financial services
278	Rail Transport Engineering	469	Ceramics Manufacturing
282	Building Services Engineering Technicians	470	Health Pathology Support
283	Industrial Applications	479	Health Dental Nursing
284	Fencing	480	Health Pharmacy Services
285	Jewellery, Silversmithing and Allied Trades	489	Contact Centre Operations Management
286	Optical	493	Costume & Wardrobe
294	Electrical & Electronic Servicing	494	Technical Theatre
296	Payroll	502	Glass Industry
297	Ports Industry	504	Improving Operational Performance
298	Oil & Gas Extraction	506	Laboratory and Science Technicians
299	Farriery	511	Equine
300	Rail Transport Operations	512	Plumbing and Heating
301	Learning and Development (Direct Training & Support)	513	Electrotechnical
311	Supporting teaching and learning in schools	514	Refrigeration & Air Conditioning
314	Dry Stone Walling	515	Heating & Ventilating
327	Vehicle Fitting	517	Advanced Engineering Construction
328	Vehicle Maintenance and Repair	518	Engineering Construction
329	Roadside Assistance and Recovery	519	Construction Specialist
330	Vehicle Body and Paint Operations	520	Construction Civil Engineering
331	Vehicle Parts Operations	522	Construction Building
335	Engineering Technology	524	Environmental Conservation
336	Engineering Technology	525	Land
337	Installing Cabling Systems	527	Horticulture
338	Munition Clearance and Search Occupations	528	Agriculture
343	Highways Maintenance	529	Veterinary Nursing
344	Fitted Interiors	531	Trees & Timber
346	Providing Financial Services	540	Manufacture Craft and Technician
347	Gas Network Operations	551	Furniture, Furnishings and Interiors Manufacturing

Appendix 4: Stage 2 Stakeholder interview questions

Questions about the demand side

1. What are employers' needs for skilled labour in your sector/policy area?
    - specific types of STEM skills which employers need?
    - specific employers' needs?
    - regional variations?

2. What are your perceptions of the current skills base in your sector?
    - are there any areas of clear shortfall?
    - anticipated new demand expressed by employers?
    - are there any regional variations?

3. What is the level of Apprenticeship provision in your sector?
    - e.g. do most large firms use Apprenticeships?
    - if not, why not?
    - do most small firms use Apprenticeships?
    - if not, why not?
    - are there alternative supply of skilled labour (graduates, imported labour?)
    - are there employers that rely on graduates and/or imported labour as an alternative to Apprenticeships? (more likely among small or large employers?)
    - are there any regional variations?
    - does demand vary by level, ie is there a need for more provision/engagement in Advanced Apprenticeships (Level 3) or Higher Apprenticeships (Level 4).
    - does demand vary by gender? e.g. are there employers particularly looking for female Apprenticeships?

4. What is the likely impact of major civil infrastructure projects (e.g. High Speed 2, Broadband roll-out) on demand in your sector?

5. Which training providers in your sector are delivering SFA agreed Apprenticeship Frameworks?
    - are Apprenticeship Frameworks appropriate for need in your sector?
    - if not how can they be improved/further developed?

6. Are there many training providers in your sector offering relevant provision that is *not covered* by Apprenticeship Frameworks?
    - if so, why?

- is there a conflict between understandings of training providers and employers as to what should go into an Apprenticeship Framework?

if so

- How can these be resolved?

Questions about the Supply side

7. Is the current supply of people working towards completion of a STEM Apprenticeship sufficient to meet current demand in your sector?
   - If not, what are the supply problems in your sector?
   - what areas of current demand are not being met?
   - e.g. is there a shortage of females entering Apprenticeships in your sector?
   - are there regional variations?
   - does supply vary by level, i.e. is there a need for more provision/engagement in Advanced Apprenticeships (Level 3) or Higher Apprenticeships (Level 4).

8. Are there new areas of work in your sector, e.g. major civil infrastructure projects (e.g. High Speed 2, Broadband roll-out) or new investments by existing employers in established industries, that are creating new demand?
   - how well placed is the supply-side is to meet that demand?
   - what factors are barriers to supply?
   - what is the potential capacity for existing providers to increase provision in this sector?

9. What factors facilitate supply?
   - is there potential for new entrant providers to deliver increased provision?
   - are there regional variations?

Barriers to optimum/expanded supply

10. What barriers are there for existing training providers?
    - lack of demand from school leavers
    - lack of demand from girls?
    - lack of places offered by providers
    - lack of Apprenticeship opportunities offered by employers
    - lack of awareness of Apprenticeships/inadequate IAG in schools/colleges
    - local economic restrictions
    - lack of skills in the provider base (i.e. existing providers not offering training in adjacent skills areas, such as IT in an area provision in engineering

11. What barriers are there to new training providers coming into the market?
    - lack of demand from school leavers
    - lack of places of offered by providers
    - lack of opportunities offered by employers
    - lack of awareness/ IAG in schools/colleges

- local economic restrictions
- lack of skills in the provider base (as above)

The delivery mechanism for Technical related Apprenticeships in your sector

12. Group Training Associations are one model for the delivery of Apprenticeships.
    - How are these working in practice in your sector?
    - Can you identify areas for improvement? / ways in which they could work more effectively?
    - what other models of delivery work in your sector? e.g.
    - Apprenticeship Training Associations (ATAs)
    - Employer Ownership Scheme (this is very new - companies directly funded by Skills Funding Agency to offer their own provision of training)
    - Shared Apprenticeship model (where large companies and some of their supply chain sub-contractors share Apprentices)

General wrap up question

13. Can you think of any ways that we can we encourage additional provision in the sector that you have not already discussed?

Appendix 5: Stage 3 Employer interview questions

Company background

1. Could you give me a brief overview of what your organisation does?

2. When was your company established?

3. What is the size of your company in terms of turnover and the number of employees?

4. Are you employment levels growing, static or contracting? Why?

5. Could you tell me about whether your main markets are growing or contracting?

6. Have there been any shifts in your main markets (i.e. moving out of one set of products into another)?

7. What are the specific types of STEM skills which *you* need? What are *employers' needs* in this locality/sector?

8. Looking to the future, what are likely to be main business developments over the next three to five years in your organisation and sector, and what is driving these developments? (e.g. technology, government policy). *Probe about:*
    - are there any new skill requirements?
    - how much of this is dependent on contracts yet to be let?
    - to what extent do you employ in anticipation of winning contracts?
    - what is the likely impact of major civil infrastructure projects (e.g. High Speed 2, Broadband roll-out) on demand in your sector?

Employment structure

9. To what extent are critical functions in your organisation retained in-house or subcontracted out?

10. In your organisation how many people are employed in occupations which are scientific / technical in nature or to which people are recruited or promoted into where they have STEM skills? *(This will include skilled trades workers /*

scientific and technical professional and associate professional staff) Probe around:

- have the number of people in these occupations changed in recent times?
- do you think that the number of people in STEM occupations will change over the next three to five years? Why?

STEM Apprentices

11. How do you recruit people into STEM occupations? *Probe around:*
    - initial vocational education and training (i.e. Apprenticeships)
    - recruitment from the external labour market (i.e. graduate entry)

12. Have you experienced any difficulties in terms of recruiting graduates and other experienced workers into training positions? *Probe around:*
    - Specific skills required which are in short supply;
    - People lacking experience;
    - People not suitably qualified;
    - Quality of applicants (motivation / enthusiasm).

13. How many Apprentices have you taken over the last three years? How many have been in STEM subjects?

14. What is the trend regarding number of STEM Apprentices you take on? (increasing / static / decreasing) *If increasing or decreasing* - what are the reasons for this?

15. Do you have a preference for graduates qualified in STEM or for Apprentices? If so, why? *Probe about:*
    - are there employers that rely on graduates and/or imported labour as an alternative to Apprenticeships?
    - if so does your firm *lose out in competition* from those that use graduate or imported labour?
    - do you see Apprenticeships replacing graduates?
    - are you aware of higher Apprenticeships? (which are higher education qualifications)
    - do Apprenticeships replace other types of training?

16. What is your perception of the level of Apprenticeship provision in your sector? *Probe about:*
    - do most large firms use Apprenticeships? what about small firms?
    - if not, why not? (e.g. concerns about non-completion?)

17. What specific STEM Apprenticeships are people recruited into? Level and subject? *Probe about:*

- is there a need for more provision/engagement in Advanced Apprenticeships (Level 3) or Higher Apprenticeships (Level 4)?

18. What are the entry requirements (number of GCSEs plus subject requirements, and other attributes sought)? *Probe about:*
    - Are there gender differences? e.g. are you particularly looking for female Apprenticeships?
19. Do you have any difficulties recruiting Apprentices to STEM traineeships? If so, why? *Probe around:*
    - Shortage of people who have the qualifications required for entry
    - People more likely to stay on to higher education
    - People reluctant to enter industry
    - Has your organisation done anything to make Apprenticeships more attractive to would be applicants?
    - Are there any socio-economic differences in terms of who applies? (i.e. social class, ethnicity) Gender differences?

20. Is there currently a shortfall in the number of STEM Apprentices you would ideally like? If yes, why? *Probe around:*
    - difficulties recruiting Apprentices
    - difficulties retaining Apprentices
    - are you having to take on Apprenticeships to replace those lost to other employers?

21. How is the demand for Apprenticeships likely to develop over the next three to five years? What are the reasons behind any increase or decrease? *(Note to interviewer: need to relate this to any major new projects / developments the respondent may have mentioned in discussing future business developments)*

22. [*Ask if the business has been established for more than 10 years]* In your opinion do you think Apprenticeships have changed in the last few decades? *If yes* Why?

IF NO APPRENTICES CURRENTLY

It is anticipated that the employers will have STEM Apprentices since they will have been recruited on this basis. But if they do not currently have STEM Apprentices:

23. Why are there currently no Apprentices in your organisation? *Probe around:*
    - Why isn't there any demand for this type of training currently?
    - Have there been particular barriers to taking on STEM Apprentices such as cost?
      Are these likely to persist into the future?

Training Apprentices

24. Could you give me a brief description of the structure of Apprenticeship training for one of the typical STEM Apprenticeships the organisation delivers? *Probe about:*
    - the duration
    - off-the-job versus on-the job training
    - the assessment process
    - progression from Level 2 to 3 to 4, etc.

25. What kind of involvement do you have with the provider/what does your partnership in delivery look like? *Probe around:*
    - does most of the learning happen in the workplace?

26. Could you tell me about your engagement with SSCs, NAS and other bodies regarding recruitment and subsequent training of Apprentices? What has been the nature of that engagement?

27. Which training providers do you use? What are the reasons for using these/this provider? *Probe around:*
    - Cost
    - Expertise
    - Location

28. Do you know which providers in your area are delivering Skills Funding Agency agreed Apprenticeship Frameworks?
    - are the current Apprenticeship Frameworks appropriate in this area for need in your sector?
    - if not how can they be improved/further developed?
    - are they offering more than the Framework?

29. Are there many training providers in your sector offering relevant provision *not covered* by Apprenticeship Frameworks?
    - if so, why?
    - do you think there is a conflict between the understandings of training providers and employers as to what should go into an Apprenticeship Framework?
    - *if so* How do you think these be resolved?

30. How satisfied are you with your training providers? Why? *Probe around:*
    - have you found any difficulties in finding a provider who can deliver the technical skills the company wants (even if this goes beyond what a particular STEM Framework specifies)

31. *[If dissatisfied]* How will you address any weaknesses in past provision of training or dissatisfaction with training providers?

32. Has your organisation been engaged in any group training?
    - If so, what were the arrangements? If not, why not?
    - why did you engage with group training?
    - What is your overall impression of the experience?
    - In what ways could group training work more effectively?

33. Does your organisation train to a standard during the Apprenticeship which goes beyond that demanded in the Framework? *Probe around*:
    - is the Apprentice considered a fully experienced worker at the end of the Apprenticeship or whether they are regarded as a trainee for a further period.

34. How will your organisation arrange the training of its STEM Apprenticeships in the future?

35. Will future training arrangements be sufficient to meet your demand for STEM Apprentices – if not, why not. *Probe around:*
    - how well placed are training providers to meet the demand?
    - what barriers are there?

General wrap up question

36. Have you got anything else to say?

Appendix 6: Stage 3 training provider interview questions

Questions about skill needs

1. Are there any longstanding and/or current *strengths* in the provision of STEM related Apprenticeships in [locality]? *Probe around:*

a) How has the sector/region been able to develop its strengths in the provision of STEM skills?
   - key employers making large scale investments in STEM projects
   - presence of major providers locally with long tradition of providing STEM skills

2. Are there any longstanding and/or current *weaknesses* in the provision of STEM related Apprenticeships in [locality]? *Probe around:*

a) What are the reasons for any weaknesses? *Probe around:*
   - Lack of on-going demand from certain employers
   - Large numbers of SMEs unable to make recurrent investments
   - Difficulties keeping up to date with new skills / technologies and investments in equipment and machinery by providers
   - How have any longstanding/current weaknesses been/are being addressed by providers, and local economic development agencies

b) What are the implications for the area / sector of these weaknesses? *Probe around:*
   - Employers choosing not to train
   - Employers seeking training outside of region
   - Skill shortages / skill gaps

c) Is there a lack of provision on certain STEM skills – if so, which ones / strength of provision in certain/ all STEM skills

3. What is the likely impact of major civil infrastructure projects (e.g. High Speed, Broadband rollout) on demand in your sector? *Probe around:*

- are there any new skill requirements?
- what role for employers in enhancing provision?
- what role for providers in enhancing provision?

4. Which providers in your area are delivering Skills Funding Agency agreed Apprenticeship Frameworks? *Probe around:*

- are the current Apprenticeship Frameworks appropriate in this area for need in your sector/region?
- if not how can they be improved/further developed?

5. Are there many providers in your sector offering relevant provision *not covered* by Apprenticeship Frameworks? *Probe around:*

- if so, why?
- is there a conflict between understandings of providers and employers as to what should go into an Apprenticeship Framework?

if so, How can these be resolved?

Identifying need and barriers to need

6. Is the current supply of people working towards completion of a STEM Apprenticeship sufficient to meet current demand? *Probe around:*

- If no, what are the supply problems in your sector?
- are there any problems with non-completion?
- is there a shortage of females entering STEM related Apprenticeships?
- what areas of current demand are not being met?
- does supply vary by level? (i.e. is there a need for more provision/engagement in Advanced Apprenticeships (Level 3) or Higher Apprenticeships (Level 4)?)

7. Are there new areas of work in the STEM sector? e.g. major civil infrastructure projects or new investments by existing employers in established industries that are creating new demand? *Probe around:*

- how well placed is the supply-side to meet that demand?
- what supply barriers are there?
- what is the potential capacity for existing providers to increase provision in this sector?
- are there any other drivers of increased demand?

8. What factors facilitate supply? *Probe around:*

- is there potential for **new entrant** providers to deliver increased provision?

Barriers to optimum/expanded supply

9. What barriers do you face in terms of supply? *Probe around:*

- lack of demand from school leavers

- need for a change to school curriculum?
- lack of demand from girls?
- issues in terms of geographical location?
- lack of Apprenticeship opportunities offered by employers? (small or large employers?)
- lack of places offered by providers?
- lack of awareness of Apprenticeships/inadequate IAG in schools/colleges?
- local economic restrictions?
- lack of skills in the provider base? (i.e. existing providers not offering training in adjacent skills areas, such as IT in an area provision in engineering)

10. What barriers are there to new providers coming into the market? Are they different to those affecting existing providers? *Probe around:*

- set up costs for high tech training?
- lack of demand from school leavers?
- lack of opportunities offered by employers? (small or large?)
- is there a problem with non-completion?
- lack of places of offered by providers?
- lack of awareness/ IAG in schools/colleges?
- local economic restrictions?
- lack of skills in the provider base?

The delivery mechanism for STEM related Apprenticeships in your sector

11. Which of these models are you aware of, i.e. operating in your region or your sector? *Probe around:*

- Group Training Associations (GTAs)
- Apprenticeship Training Associations (ATAs)
- Employer Ownership Scheme (this is very new - companies directly funded by Skills Funding Agency to offer their own provision of training)
- Shared Apprenticeship model (where large companies and some of their supply chain sub-contractors share Apprentices)

General wrap up question

12. Can you think of any ways that we can we encourage additional provision in the sector that you have not already discussed?

Appendix 7: Stage 3 regional and sectoral interview questions

Questions about skills needs

1. Are there any longstanding and/or current *strengths* in the provision of STEM Apprenticeships in [locality]? *Probe around:*

a) How has the sector/region been able to develop its strengths in the provision of STEM skills?
   - key employers making large scale investments in STEM projects
   - presence of major providers locally with long tradition of providing STEM skills

2. Are there any longstanding and/or current *weaknesses* in the provision of STEM Apprenticeships in [locality]? *Probe around:*

b) What are the reasons for any weaknesses? *Probe around:*
   - Lack of on-going demand from certain employers
   - Large numbers of SMEs unable to make recurrent investments
   - Difficulties keeping up to date with new skills / technologies and investments in equipment and machinery by providers
   - How have any longstanding/current weaknesses been/are being addressed by providers, and local economic development agencies

b) What are the implications for the area / sector of these weaknesses? *Probe around:*
   - Employers choosing not to train
   - Employers seeking training outside of region
   - Skill shortages / skill gaps

c) Is there a lack of provision on certain STEM skills – if so, which ones / strength of provision in certain/ all STEM skills

3. What is the likely impact of major civil infrastructure projects (e.g. High Speed 2, Broadband rollout) on demand in your sector/region? *Probe around:*
   - are there any new skill requirements?
   - what role for employers in enhancing provision?
   - what role for providers in enhancing provision?

4. Which providers in your area are delivering Skills Funding Agency agreed Apprenticeship Frameworks? *Probe around:*

- are the current Apprenticeship Frameworks appropriate in this sector/region?
- if not how can they be improved/further developed?

5. Are there many providers in your sector/region offering relevant provision *not covered* by Apprenticeship Frameworks? *Probe around:*

- if so, why?
- is there a conflict between understandings of training providers and employers as to what should go into an Apprenticeship Framework?

if so

- How can these be resolved?

Regional/sectoral role

6. What overarching responsibility does your organisation have in terms of the supply of training? *Probe around:*

a) Is there a role for your organisation in bringing together supply and demand?
b) Is there a role for your organisation in bringing together employers and providers?
c) Is there a role for your organisation in promoting Apprenticeships among young people? *Probe about:*
    - what age groups are your focus?
    - what Apprenticeship levels?
    - Do you work with schools?
    - Do you work with other organisations?

Identifying need and barriers to need

7. Is the current supply of people working towards completion of a STEM Apprenticeship sufficient to meet current demand in your sector/region? *Probe around:*

If no, what are the supply problems in your sector/region?

- are there any problems with non-completion?
- is there a shortage of females entering Apprenticeships in your sector?
- what areas of current demand are not being met?
- does supply vary by level? (i.e. is there a need for more provision/engagement in Advanced Apprenticeships (Level 3) or Higher Apprenticeships (Level 4)?)

8. Are there new areas of work in your region/sector? e.g. major civil infrastructure projects or new investments by existing employers in established industries that are creating new demand? *Probe around:*

- how well placed is the supply-side to meet that demand?
- what supply barriers are there?
- what is the potential capacity for existing providers to increase provision in this sector/region?
- are there any other drivers of increased demand?

9. What factors facilitate supply? *Probe around:*

- is there potential for new entrant providers to deliver increased provision?

10. What barriers are there to existing providers? *Probe around:*

- lack of demand from school leavers?
- need for a change to school curriculum?
- lack of demand from girls?
- issues in terms of geographical location?
- lack of places offered by providers? (small or large employers?)
- lack of Apprenticeship opportunities offered by employers?
- lack of awareness of Apprenticeships/inadequate IAG in schools/colleges?
- local economic restrictions?
- skills in the provider base? (i.e. existing providers not offering training in *adjacent skills areas*, such as IT in an area with traditional provision in engineering)

11. What barriers are there to new providers coming into the market in your sector/region? Are they different to those affecting existing providers? *Probe around:*

- set up costs for high tech training?
- lack of demand from school leavers?
- lack of places of offered by providers?
- lack of opportunities offered by employers? (small or large?)
- is there a problem with non-completion?
- lack of awareness/ IAG in schools/colleges?
- local economic restrictions?
- skills in the provider base?

The delivery mechanism for STEM Apprenticeships in your sector

12. What kind of involvement do training providers have with employers? What does the delivery partnership tend to look like? *Probe around:*

- does most of the learning happen in the workplace?
- is there a difference between micro businesses/SMEs and larger organisations?

13. Which of these models are you aware of, i.e. operating in your region or your sector? *Probe around:*

- Employer as provider model
- Group Training Associations (GTAs)
- Apprenticeship Training Associations (ATAs)
- Employer Ownership Scheme (this is very new - companies directly funded by Skills Funding Agency to offer their own provision of training)
- Shared Apprenticeship model (where large companies and some of their supply chain sub-contractors share Apprentices)

General wrap up question

14. Can you think of any ways that we can we encourage additional provision in the sector/region that you have not already discussed?

Appendix 8: Stage 3 interview questions for non-participating employers

Company background

1. Could you give me a brief overview of what your organisation does?
2. When was your company established?
3. What is the size of your company in terms of turnover and the number of employees?
4. Are you employment levels growing, static or contracting? Why?
5. Could you tell me about whether your main markets are growing or contracting?
6. Have there been any shifts in your main markets (i.e. moving out of one set of products into another)?
7. What are the specific types of STEM skills which *you* need? What are *employers' needs* in this locality/sector?
8. Looking to the future, what are likely to be main business developments over the next three to five years in your organisation and sector, and what is driving these developments? (e.g. technology, government policy). *Probe about:*
    - are there any new skill requirements?
    - how much of this is dependent on contracts yet to be let?
    - to what extent do you employ in anticipation of winning contracts?
    - what is the likely impact of major civil infrastructure projects (e.g. High Speed 2, Broadband roll-out) on demand in your sector?

Employment structure

9. To what extent are critical functions in your organisation retained in-house or subcontracted out?

10. In your organisation how many people are employed in occupations which are scientific / technical in nature or to which people are recruited or promoted into where they have STEM skills? *(This will include skilled trades workers / scientific and technical professional and associate professional staff) Probe around:*
    - have the number of people in these occupations changed in recent times?
    - do you think that the number of people in STEM occupations will change over the next three to five years? Why?

STEM Apprentices

11. Your company has decided not to offer Apprenticeships. Can you tell us why? (*use all of these prompts if not covered by respondent*)
    - Costs associated with employing Apprentices
    - trading conditions (lack of orders etc)
    - perception that the supply of young people will not come forward if we did offer them
    - availability of other forms of labour (e.g. graduates, imported labour)
    - issues with the Apprenticeship Framework (i.e. not happy that the content of the Framework fits their specific needs)
    - lack of provision in your field/sector (from training providers, FE colleges)
    - lack of provision in your region (from training providers, FE colleges)
    - No demand for this type of training currently
    - Other barriers?
12. Would reducing cost and risk (e.g. through group training or shared Apprenticeships models) encourage you to take up Apprenticeships?
13. Are you planning on taking on any STEM Apprentices in the future? Why?
14. What is your perception of the level of Apprenticeship provision in your sector? *Probe about:*
    - do most large firms use Apprenticeships? what about small firms?
    - if not, why not? (e.g. concerns about non-completion?)
15. [*Ask if the business has been established for more than 10 years]* In your opinion do you think Apprenticeships have changed in the last few decades?
    - *If yes* Why?
    - How? Better or worse?
16. Is there anything else that you would like to say?

Appendix 9:
Email text for survey of GTAs

Researchers at Sheffield Hallam University and the University of Warwick have been commissioned to carry out research on behalf of the Department of Business, Innovation and Skills (BIS) and the National Apprenticeship Service (NAS) into the need for and capacity to deliver STEM related Apprenticeships in five key sectors of the economy: Advanced Manufacturing; UK Automotive Industry; Information Communication & Technology; Increased Green Agenda & Energy Supply; and Life Sciences. We feel it is very important to gather the views of Group Training Associations and this short email survey is designed to offer all GTAs the opportunity to put their perspective. All responses will be fully anonymised in any reporting, with neither GTA nor individuals identified.

If you are willing to participate simply click reply and add your text below each of the following questions:

1. Which STEM Apprenticeship Framework areas (i.e. employment sectors) is your GTA involved in?
2. What are the major skills needs in your area?
3. What are traditional strengths in Apprenticeship provision in your area?
4. What are the traditional weaknesses in Apprenticeship provision in your area?
5. Is most provision at Level 2, Level 3 or Level 4? or evenly spread?
6. What barriers are there to young people taking on Apprenticeships?

   e.g. lack of demand by employers?

   e.g. lack of interest from young people?

   e.g. lack of information advice and guidance from schools?

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