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Skills for Growth Action Plan

Advanced Manufacturing 2018 - 2020

 Liverpool City Region
Local Enterprise Partnership

 **The Apprenticeship Hub**
Liverpool City Region


European Union
European
Social Fund

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Foreword

Liverpool City Region has a long and proud track record of manufacturing dating back to the first industrial revolution. It has been home to significant developments and advancements which have had a long standing and global reach. The City Region stands poised at the brink of the Fourth Industrial Revolution to once again lead the world. Liverpool City Region 4.0 is a UK manufacturing first, providing support to businesses to help transform production. The implementation of Made Smarter in the North West will help to accelerate and embed this.

Advanced Manufacturing employers make a large contribution locally, employing close to 50,000 people and generating over £4bn of economic value. Average pay is strong but the workforce is ageing at a time when there is a need to modernise and embed new processes and approaches. Products made locally are exported across the globe and there is a high value attached to them.

The sector is expected to change beyond all recognition in the coming years, and there is a need to have a flexible and agile skilled workforce to deliver the products required in the future.

As technology is implemented, whether through Artificial Intelligence or Automation, the demands on employees will rise.

This Action Plan sets out the skills challenges for the sector and the need for employers, schools, colleges, training providers and universities to work together, supported through the public sector, to meet those challenges and seize the opportunities before us. Together, and only together, will we be able to make that difference and deliver the needed impact.



Steve Rotheram

Liverpool City Region Metro Mayor



Cllr Ian Maher

Liverpool City Region Portfolio Lead,
Skills and Apprenticeships

Skills Challenges Facing Advanced Manufacturing in Liverpool City Region

Importance of Advanced Manufacturing to the Liverpool City Region economy

The Advanced Manufacturing sector is of vital importance to the future prosperity of the UK and Liverpool City Region. The Government's Industrial Strategy¹ set out four grand challenges all of which will depend on the continued success of the advanced manufacturing sector to innovate and deliver world-class performance. The Made Smarter Review² highlights the challenges and opportunities the sector faces from Industrial Digital Technologies (IDTs)³ as digital processes, artificial intelligence and automation fundamentally change how manufacturing operates.

An internationally competitive Advanced Manufacturing sector makes a vital contribution to the regional and national economy through providing well-paid full-time employment (some 47,200 jobs in 2016) and strong growth (measured by Gross Value Added - GVA). The sector, broadly defined, covers a wide range of activity including chemicals and pharmaceuticals, automotive, metal products, electronics and manufactured fuels⁴. In 2016, the sector contributed £4.3 billion to the Liverpool City Region economy. In the decade between 2006-16 Advanced Manufacturing contributed 21 per cent of all Liverpool City Region GVA growth despite employing just under 7 per cent of employees in Liverpool City Region.

Forecasts for the future highlight that the sector will continue to make a strong contribution to the region's economy with continued growth in GVA but with a potential fall in employment – reflecting the need to keep pace with international productivity standards to remain competitive. In the next 5-10 years the sector will need to exploit the opportunities presented by digitisation, automation and continued globalisation – the 4th Industrial Revolution.

A key element of the Industrial Strategy is the focus on people and the challenge of improving skills and labour market performance of both the existing workforce and new recruits. Additional investment is planned for science, technology, engineering and maths (STEM) skills to underpin technological innovation and high value business growth. This shift in technical and professional skills will be vital to help retain the sector's competitive advantage.



Ensuring a Talented Workforce

Securing a skilled workforce

Securing a future talent pipeline for the Advanced Manufacturing sector is vital. Employees in the sector punch above their weight as they represent 6.6 per cent of employment but 13.9 per cent of total GVA. Ensuring that there is a steady pipeline of qualified candidates to fill available job opportunities is vital to the continued competitiveness of the sector.

This is a particular pressing issue in Advanced Manufacturing as the current workforce is ageing and will need to be replaced. The loss of their collective experience and practical knowledge will be very damaging if this process is not actively managed.

Discussions with key employers in the sector highlight that finding sufficient applicants with appropriate skills and qualifications is increasingly difficult. While many offer apprenticeships, which continue to be in very high demand, many employers also reported that they had unfilled vacancies elsewhere in their business:

- Over a third of Advanced Manufacturing sector employers in the recent Liverpool City Region skills survey⁵ reported vacancies that were hard to fill, above the survey average of 27 per cent.

- Almost three-quarters reported that applicants did not have the specific technical skills required, far higher than the survey average of 48 per cent).

Liverpool City Region's workforce is forecast to contract, by 2.6 per cent over the decade from 2016 to 2026 and by 1.6 per cent from 2026 to 2036. This is in contrast to continued growth in England of 3.0 per cent and 1.4 per cent over the same period. Liverpool City Region's population is growing but slowly in comparison to elsewhere and the City Region has more people reaching retirement age and fewer young people. This will add further pressure on employers seeking well-qualified candidates over a lengthy period.

This relative decline in population has been identified in the literature as a challenge to future growth in urban areas⁶. In particular, the research points to the challenge of retaining talented young people who may leave the area for Higher Education at a time when the population is ageing and fewer young people stay local and enter the labour market.

Figure 1

Sectors with highest proportion of employees over 50
Source: Liverpool City Region Employer Skills Survey 2017

	Maritime and Logistics	41%
	Health and Life Sciences	37%
	Advanced Manufacturing	37%
	Low Carbon and Energy	35%

Inspiring young people

A widespread concern among Advanced Manufacturing employers is that young people in education lack an understanding of the wide choice of potential careers the sector has to offer. This is not simply about diverting talented young people from entering into Higher Education towards an apprenticeship-based route but aiming to inspire them by bringing STEM related subjects to life, whatever educational pathway they choose. This lack of understanding leads to limited aspirations, a difficulty in understanding how these can be realised and a lack of engagement at a time when young people are making their subject choices at GCSE and then again at A Level that may limit their future career options.

Employers are also concerned that the current careers education and advice system in schools struggles to put forward a consistent and positive perception of what the sector has to offer. Almost all those involved in the discussions already engage in their local schools and some are undertaking specific initiatives to raise the profile of how STEM skills can be used, raise profile of the sector among young people, their teachers and parents and ignite their interest. These include:

- Siemens Curiosity Project⁷
- Unilever Bright Futures Programme
- AstraZeneca - Liverpool's Reach Programme
- Many other employers are STEM Ambassadors and active in STEM initiatives – Big Bang North West, Robot Challenge Days, Engineering Challenge Days etc.
- Engagement with schools local to their sites to provide careers talks and work placements, etc.
- Planned Eureka! Merseyside at Seacombe.

Providing a greater coherence with education and wider public sector partners will be essential to build on these initiatives and encourage greater interest from females in particular in career opportunities within the sector.

There is a clear need to improve the co-ordination of these efforts and their wider profile to ensure that they have a more durable impact and add to more than the sum of their parts. This will require concerted action in order to:

- Move away from the current transactional approach of many educational establishments towards more strategic and co-ordinated relationships with employers, where work placements are carefully matched to young people and provide a pathway to apprenticeships or longer work experience opportunities while at college or Higher Education.
- Engage school senior management and not just those responsible for guidance to better realise how employer-school connections can help inspire young people and motivate them to achieve more in their academic studies.



This impacts on the proportion of young people who opt to study STEM (science, technology, engineering and mathematics related) subjects at GCSE and A Level. These are already subjects which have suffered a decline in popularity nationally among young people and remain less popular with females. However, by not opting for some of these subjects young people do not have the necessary educational qualifications to pursue a career in the sector. While recent evidence does not suggest that Liverpool City Region has yet encouraged a boom in STEM qualified young people, there are some encouraging signs:

- At GCSE level Liverpool City Region maths attainment remains below the national average in most Local Authority areas.
- However, as a proportion of all starts, enrolments on STEM related A Levels has increased from 31.4% in 2013/14 to 33.4% in 2016/17 compared to 33.9% for England as a whole.
- Within this, there is a positive trend in the proportion of young people taking the principal science subjects and particularly maths in Liverpool City Region.

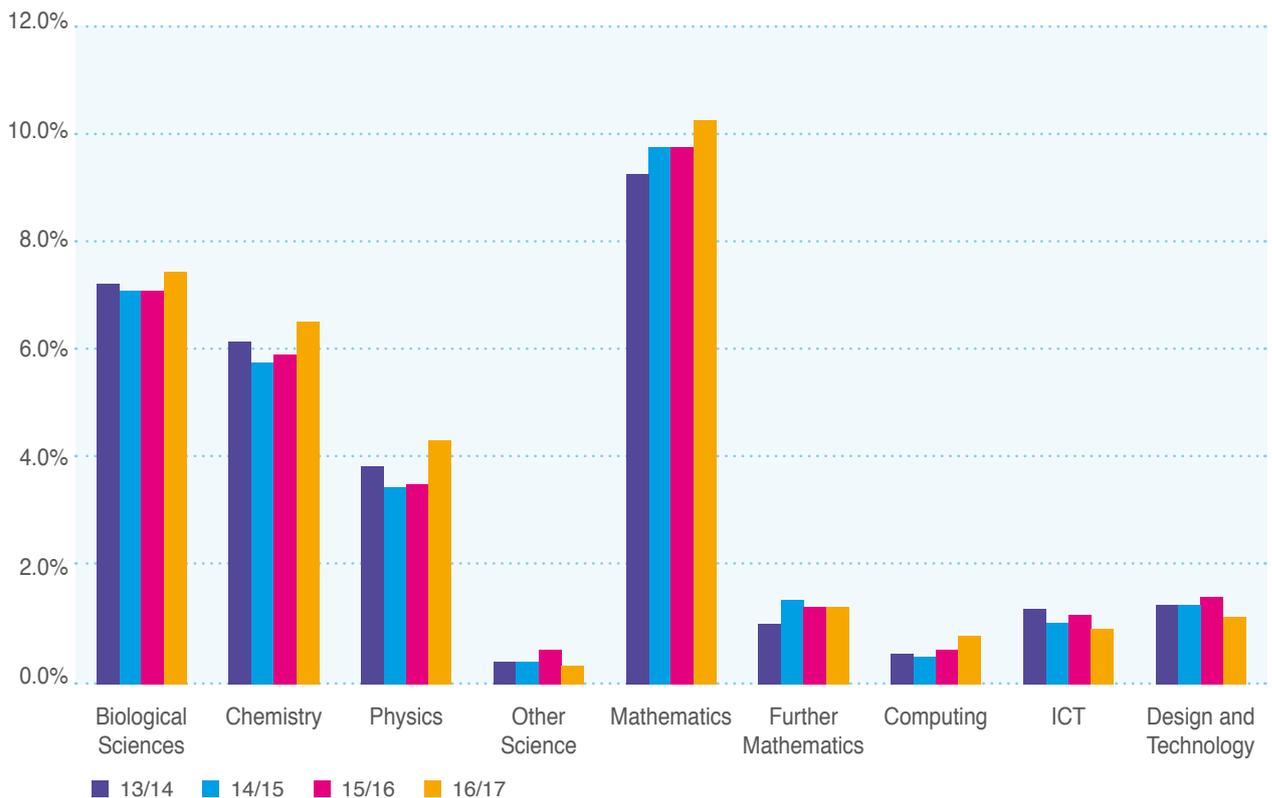
There is clearly room for improvement to match the national STEM rates. This will be important as every sector is now seeking candidates with a STEM-related background to help them address digitisation in their sector (see Figure 8). An analysis of the skills demanded in jobs with greatest recent growth⁸ found that, of the STEM skill set, which included science, technology design, engineering, mathematics, programming, systems analysis, critical thinking and computer use, it was technology design skills that were represented in the jobs with the greatest employment growth, followed by mathematics, computer use and critical thinking skills.

It is interesting to note that concerns expressed at the City Region level that the distinctive efforts made by Liverpool City Region Advanced Manufacturing firms to raise the profile of STEM-related careers do not appear to have a multiplier effect on the issue, have been echoed at a national level by the National Audit Office⁹. There is a concern that the significant investment in student, teacher and parental awareness does not lead to a more enduring understanding that inspiring young people can lead to greater motivation to achieve and deliver better school performance among educational institutions.

Figure 2

STEM-related A Level Entries as a proportion of all A Level Entries Liverpool City Region

Source: DfE State funded pupils



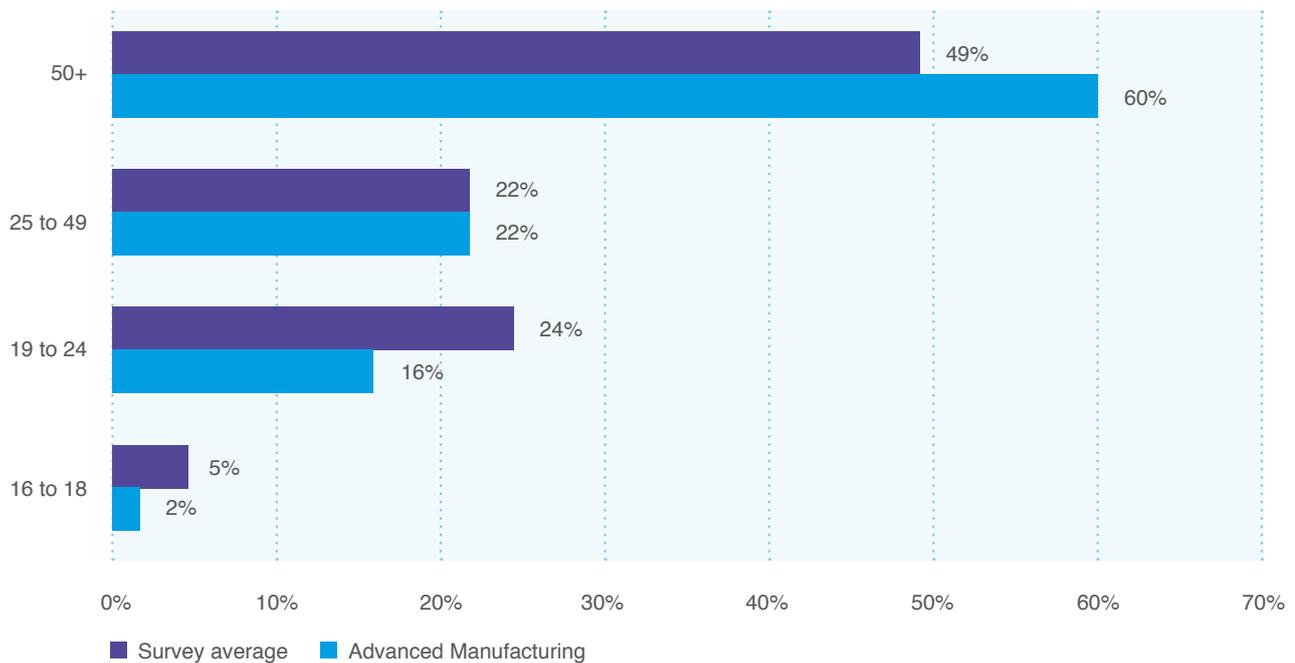
The Liverpool City Region employer survey¹⁰ suggested that the Advanced Manufacturing sector has a particular issue with an ageing workforce, with a significantly higher proportion of employees above the age of 50 and proportionately fewer in the 16-24 age range. Official data suggests that this survey result may be out of line with the sector as a whole with 37 per cent of workers over the age of 50¹¹.

We estimate that just under 30,000 employees will need to be replaced in manufacturing occupations over the next decade (excluding other occupations such as managerial, sales and administrative etc who work in the sector). The replacement of these experienced workers with new recruits will be a challenge as fewer young people are entering the Liverpool City Region labour market.

Figure 3

Sector age profile compared to all firms in survey

Source: Wavehill (2017) Liverpool City Region Employer Skills Survey 2017



Other parts of the pipeline need to be in place to ensure more STEM-skilled people progress to a point where they can become realistic candidates for technical job opportunities in the Advanced Manufacturing sector – this involves a more coherent approach to careers education, information advice and guidance in Liverpool City Region. It may also

require that similar action is required at HE level – national evidence suggests that just 24 per cent of STEM graduates actually take up STEM occupation six months later¹². This supports the anecdotal feedback received through Higher Education institutions nationally.

Figure 4

Estimated Replacement Demand, Selected Occupations, Liverpool City Region

Source: UKCES Working Futures 2012 to 2022, ONS and CPC calculations

Manufacturing Occupations	Replacement Demand
Science, research, engineering and technology professionals	8,518
Science, engineering and technology associate professionals	3,742
Skilled metal, electrical and electronic trades	7,575
Process, plant and machine operatives	6,291
Elementary trades and related occupations	3,334
Total	29,460



Careers Education, Information, Advice and Guidance (CEIAG)

Career advice has traditionally focused on an individual's dream job and the learning and work experience pathway required to secure that role. Changing jobs and careers and developing and updating skills will be a lifelong process in the labour market facing young people today. This requires young people to be equipped with the

skills and knowledge to navigate the labour market and learning systems themselves. With young people entering the labour force now expected to have on average 5-7 careers and up to 17 different employers, a traditional careers education approach will no longer be sufficient.



Changing jobs and careers and developing and updating skills will be a lifelong process in the labour market facing young people today.

Neither will it be possible for people to return to full-time education to re-train and gain wholly new qualifications before starting in a new career. Researchers in Australia using 2.7m adverts identified the skills required by the job roles and that many new job roles had significant overlap in the skills required across a range of jobs. The seven job clusters are the 'Generators', the 'Artisans', the 'Carers', the 'Informers', the 'Technologists', the 'Designers' and the 'Coordinators' each defined by a close association of the primary skills and attributes required of employees in that sector.¹³ Holding these skills would provide employees significant portability to enable movement between individual jobs within the cluster - when a person trains or works in one job, they gain skills for around 13 other jobs because employers demand very similar

skills in many jobs. Equally, depending on the job and cluster, those trained or employed in one job, would need only one additional skill to be a candidate for a further 44 different jobs.

The Artisans and The Coordinators are likely to experience lower growth and high exposure to automation; The Generators and The Designers are likely to experience moderate growth and medium exposure to automation; and The Carers, The Informers, and The Technologists are most likely to grow and persist into the future.

There are clear implications for the delivery of learning in this model – more modular and flexible delivery throughout an individual's working life – and these issues are picked up in the next section of this action plan.

Figure 5
Career clusters

Source: Foundation for Young Australians (2017)
The New Work Mindset: seven job clusters to help young people navigate the new work order



Preparing the existing workforce for the 4th Industrial Revolution

Potential impacts on employment and skills in Advanced Manufacturing

Industrial Digital Technologies (IDTs) are transforming industry. The convergence of relatively cheap computing power, data storage, digital sensors, robotics and artificial intelligence will transform industry of the future. The impact of the 4th Industrial Revolution will have profound impacts on employment and skills. Whereas previous waves of technological development have tended to automate standard and routine tasks in the workplace, IDTs have the potential to impact on a much wider range of tasks – Artificial Intelligence processes have already been demonstrated to be faster and more accurate in collecting and processing data – accounting procedures, paralegal work, transaction process and some medical diagnoses.

Forecasting which occupations will be affected and the degree to which employees will be replaced by robots or machines is not straightforward. Estimates vary from 40-60% of jobs being at risk of automation from current and forthcoming technologies. Many studies also suggest that all occupations will have to make some adjustments as the typical tasks undertaken in different occupations will need to evolve alongside increasingly capable machines.

Figure 6

Likely impact of IDTs on net employment in the UK

Source: Made Smarter Review, Figure 19, p53.

		ADOPTION RATE OF INDUSTRY 4.0 TECHNOLOGIES		
		30%	50%	70%
REVENUE GROWTH GENERATED	0.5%	65	-20	-90
	1.0%	265	175	100
	1.5%	475	380	300

■ Base case

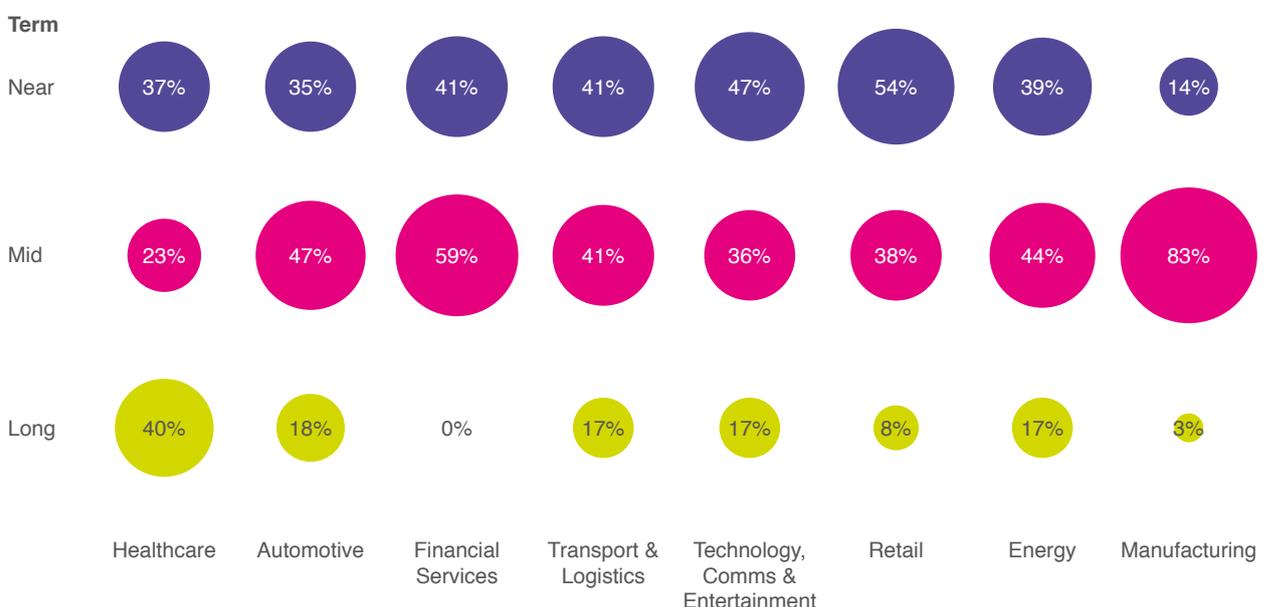
Net change in number of UK jobs (thousands) (2015-2025)

Change is highly likely across most types of employment but this does not necessarily mean that workers will be replaced by robots. Other studies have highlighted that the introduction of IDTs will also create jobs through demand for new roles with digital skills to support the automated processes, growth from being a more productive industry and a range of associated benefits from IDTs shifting the cost-structure of production – reshoring back from low-cost labour countries to shorten lead times to key markets, supply chain benefits and ‘servitise’ products where additional support services are bundled with products such as jet engines to monitor and improve their performance while in service.¹⁴ Modelling future scenarios for UK employment using an approach developed by Boston Consulting Group produced a number of scenarios where the improvement in sector performance will drive net employment growth. In the base case, a loss of almost 300,000 jobs will be offset by a gain of 100,000 new jobs and 370,000 jobs created through growth. Only when higher adoption rates do not deliver productivity growth did net employment fall.

The speed at which these changes will occur is perhaps more difficult to judge. The adoption of IDTs has already started and is gathering pace but many studies expect full implementation to occur within 15-20 years. Factors that affect the pace of automation will be:

- Technical feasibility
- Cost of developing and deploying solutions
- Labour market dynamics – skill shortage areas will automate more quickly as the costs of unfilled vacancies affect business performance
- Economic benefits – productivity and quality benefits
- Regulatory and social acceptance will affect pace of adoption¹⁵.

Figure 7
Speed of impact of Artificial Intelligence by sector
 Source: PwC 2017. Near term 0-5 years, Mid 5-10 and Long 10+



What are the implications for delivering learning?

A shift in occupational structure will have significant implications for skills and the delivery of training. Young people starting their engineering apprenticeships today in the automotive or manufacturing sectors will complete in around 4 years' time just as the bulk of IDTs will be adopted by their sector.

The current Apprenticeship Standard does not include any explicit skills for digital processes. Understanding and planning for the skills that may be required is not straightforward – a recent study in Australia estimated that around 70% of young Australians are getting their first jobs in roles that will, due to automation, either look very different or be completely lost in the next 10 to 15 years¹⁶.

Young people will require a combination of formal training, on-the-job training and experiential learning to develop both the specific technical skills and their real-world application. According to the Liverpool City Region business survey, the sector already has a higher than average take up of apprenticeships – 31 per cent of manufacturing respondents compared to 26 per cent of all respondents. However, in future, Apprenticeship Standards will need to be more forward-looking in order to anticipate (or respond flexibly) to new industry demands.

In general, courses and their associated qualifications will need to become more modular to allow them to be completed progressively and flexibly alongside work. However, a majority of employers and learning providers also expect that higher level skills will be required and there is a concern that apprenticeships in Liverpool City Region do not yet attract those who expect to do well in their academic qualifications at GCSE or A Level. This will require that young people who might otherwise consider a Higher Education route to a career in Advanced Manufacturing, may be better served by following an apprenticeship route to degree level – something that will challenge the current perceived wisdom of schools and 6th Form Colleges.

At present it is not possible to specify with any certainty the types of vocational skills that are likely to be required, even in five years. Higher technical skills are likely to be in high demand – to develop and maintain the integrated processes and Artificial Intelligence software but studies also suggest that there will be an emphasis on skills that are relatively hard to automate such as social and emotional skills, creativity, and high-level cognitive capabilities. Enterprise skills such as team work, creativity or problem solving will also be highly prized and are already closely associated with long-term job success.

Figure 8

Potential shifts for activities and educational requirements

Source: Mckinsey Global Institute (2017) Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation, December 2017

Net growth in work will involve more application of expertise, interaction and management: Germany example

Total work hours by activity type, 2016-30 (Midpoint automation, step-up demand) (million)



What is clear is that these ‘soft’ skills are not typical vocational skills and are often at best taught as a by-product of other learning. How best to develop these skills needs more consideration than has been the case previously in defining Apprenticeship Standards and curricula. Some have suggested that broader vocational courses will be necessary to provide employees with a breadth of skills to draw on. There is also an increasing focus on creativity, enterprise social and emotional skills – a number of Higher Education institutions have already introduced optional courses for their undergraduates

and in some cases have started to require that their computer science students to take classes in theatre or improvisation in order to develop their creativity and communication skills¹⁷.

“The future labour market needs not content experts or information processors but creators, analysers, problem solvers, collaborators and lifelong learners who are able to acquire new skills as old ones quickly become obsolete.”

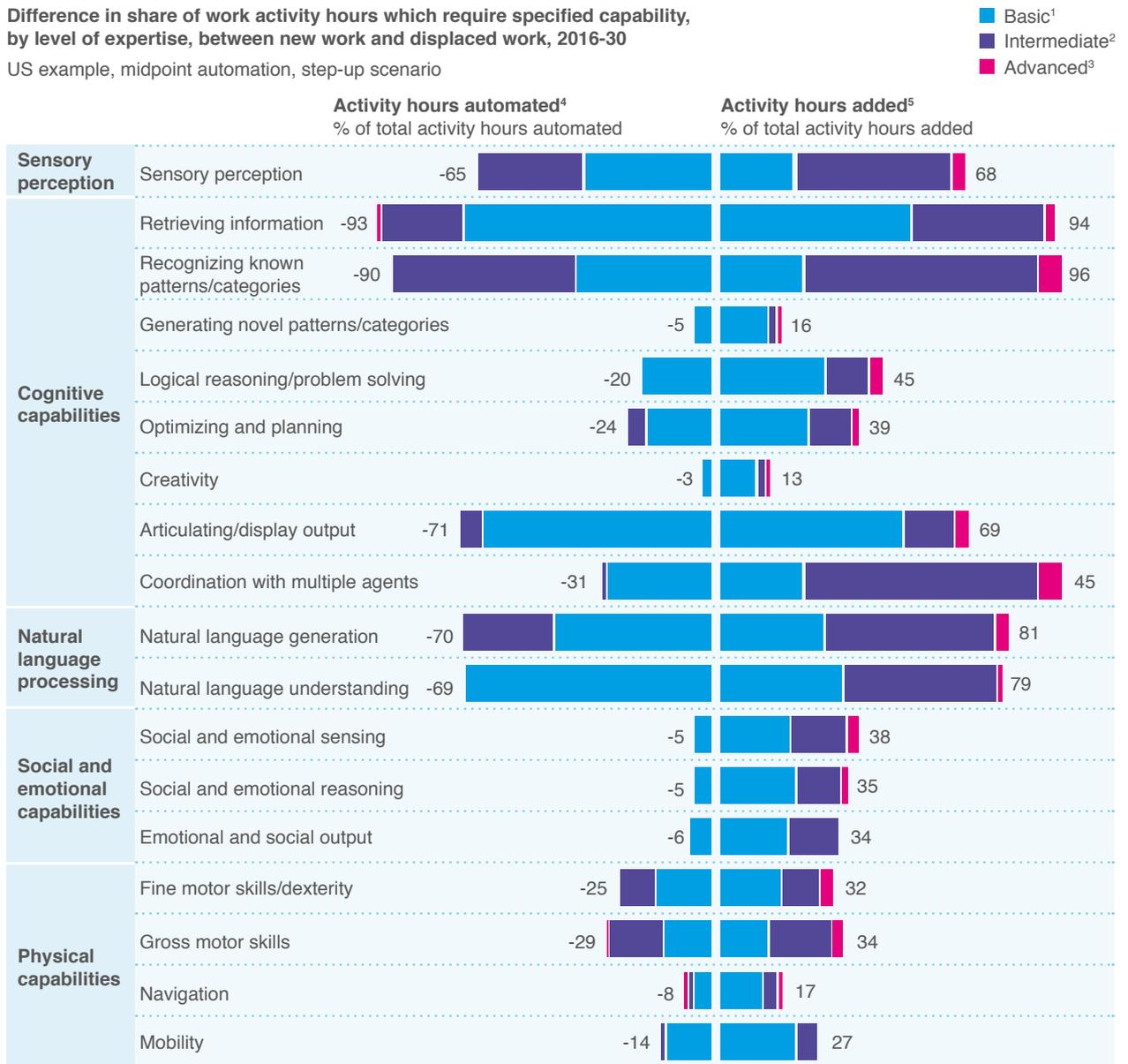
Gleason ed (2018) Higher Education in the Era of the Fourth Industrial Revolution, Palgrave Macmillan.

Figure 9
Characteristics of future work activities

Source: U.S. Bureau of Labor Statistics; McKinsey Global Institute analysis

Difference in share of work activity hours which require specified capability, by level of expertise, between new work and displaced work, 2016-30

US example, midpoint automation, step-up scenario



1. Below-median capability required.
 2. Median human capability required.
 3. At least 75th percentile capability required.
 4. 80.3 billion activity hours automated (38.6 million jobs).
 5. 66.3 billion activity hours added (31.9 million jobs).
 NOTE: Some occupational data projected into 2016 baseline from latest available 2014 data.

Midcareer job training will be essential, to help prepare the existing workforce for Industry 4.0 in their current job roles or enabling worker redeployment. Existing employees would not wish to completely re-train and so courses and their associated qualifications will need to become more modular to allow them to be completed progressively and flexibly alongside work¹⁸. These changes will challenge current educational and workforce training models, as well as business approaches to skill-building.

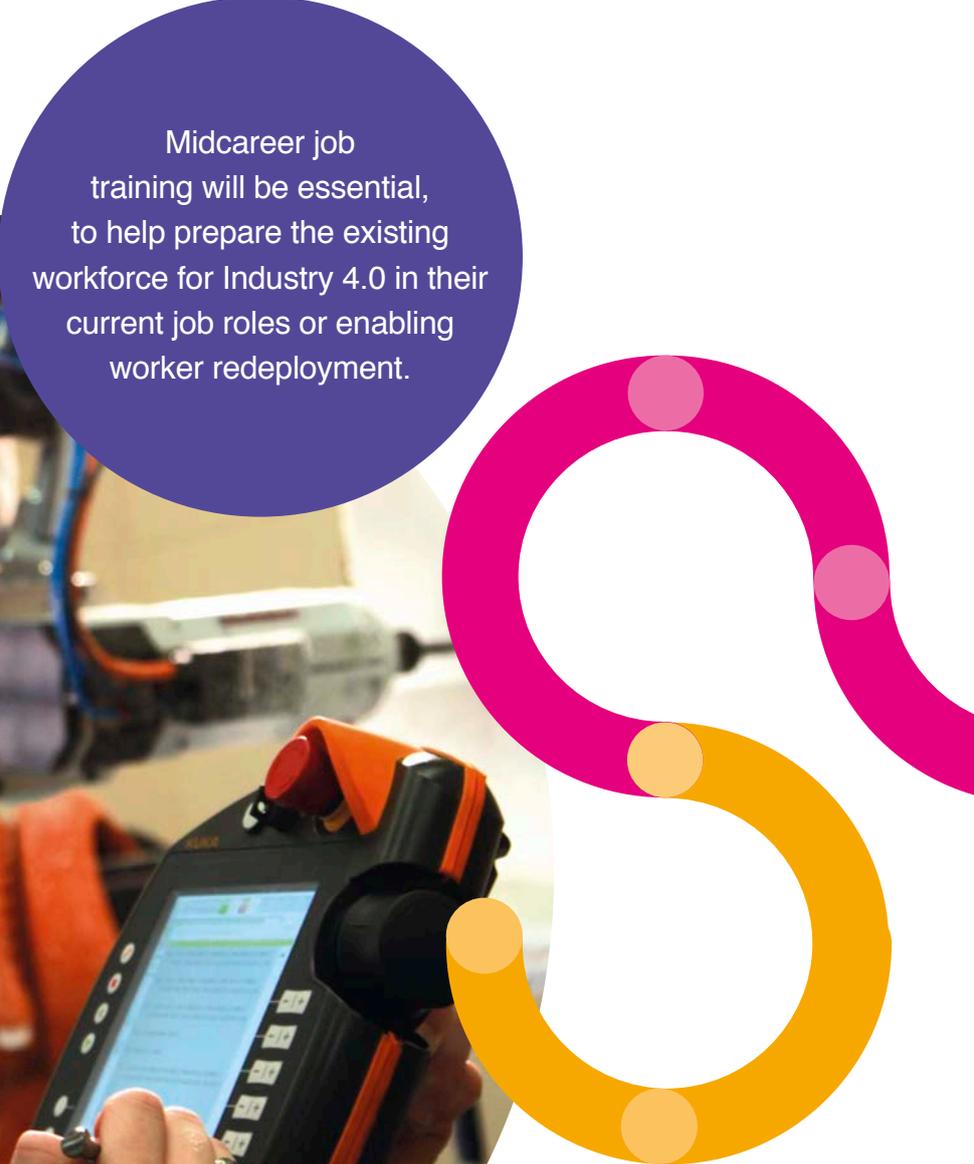
A number of employers have suggested that they have limited flexibility to use their Levy at a time when more is required. Securing time off the job to train is challenging for employers of all sizes, especially when Apprenticeship Standards do not have the flexibility to be delivered more quickly. The relatively slow pace of learning built

into their delivery is becoming a barrier to their take-up. Employers have cut other learning and staff development budgets in anticipation of the introduction of the Levy and so alternative learning routes are no longer available.

Learning providers in the sector have highlighted that while they can 'unbundle' course elements at qualification Levels 1 and 2. This 'unitisation' is not possible at higher Levels such as 3 and 4 which are more appropriate. This would require a change in funding rules from Department for Education to enable greater flexibility in delivery. How this might operate within the Levy funding system is another issue that will need to be explored in further depth. The issue here is not to atomise learning but provide a series of bite-sized learning that can build into a more coherent and flexible whole.



Midcareer job training will be essential, to help prepare the existing workforce for Industry 4.0 in their current job roles or enabling worker redeployment.



Who will provide the high-level specialist learning required?

At present most large Advanced Manufacturing employers have their own training centres. These facilities have been developed to provide the highly specialised training necessary for each employer. Where appropriate employers in the sector work with learning providers to recruit and train young people in generic engineering skills that provide a vital underpinning to the specialist skills that only the employer has the equipment and knowledge to teach. A number of SMEs also follow this route – seeking well-trained and motivated young people who they can specialise.

At this stage, it would seem likely that the adoption of IDTs will re-inforce this arrangement – the costs of keeping abreast of the most recent equipment and knowledge will be prohibitive for most learning providers and their competitive advantage is in providing high quality training which is sufficiently generic to offer a throughput of learners that is

economically viable. The introduction of T Levels may support rationalisation and more generic qualifications that could provide a foundation for more specialised skills but at present there is limited understanding on how these will operate and be funded.

This is not to say that learning providers cannot support the Advanced Manufacturing sector more widely in addressing their new learning requirements. A key point here is improving communications and co-working to help build a shared understanding of what learning is required to provide a flexible and more highly skilled workforce. A more strategic approach is required, one that would include sharing of information among learning providers and digitally streamlined consultation with employers. Agility can also be supported by better understanding the external environment.



Key Actions

The following sets out a set of actions that are designed to respond to the challenges identified in the previous section.

Inspiring young people

- Liverpool City Region benefits from a range of STEM-related initiatives that are designed to inspire young people from a young age and engaging those who then might consider taking more STEM-related qualifications at GCSE and A Level. More could be done by public sector partners to increase the awareness and uptake of these Liverpool City Region assets by schools which could be done through greater co-ordination and promotion of them.
 - There is evidence that STEM A Level enrolments have recently increased in Liverpool City Region and are just below the England average. More sustained support is required to improve the coherence of the Liverpool City Region STEM offer by supporting a multiannual programme of activities such as the Robot Challenge¹⁹.
- Employers and schools need time to build their engagement and buy into a programme of events and link such activity with work experience opportunities and careers education.
- However, national data suggests that 3 in 4 Higher Education STEM graduates are not working in STEM occupations. There is no evidence on what factors lay behind such a loss of relevant talent, but engagement with Liverpool City Region Higher Education institutions to explore what local issues could be addressed by Liverpool City Region employers should be considered.



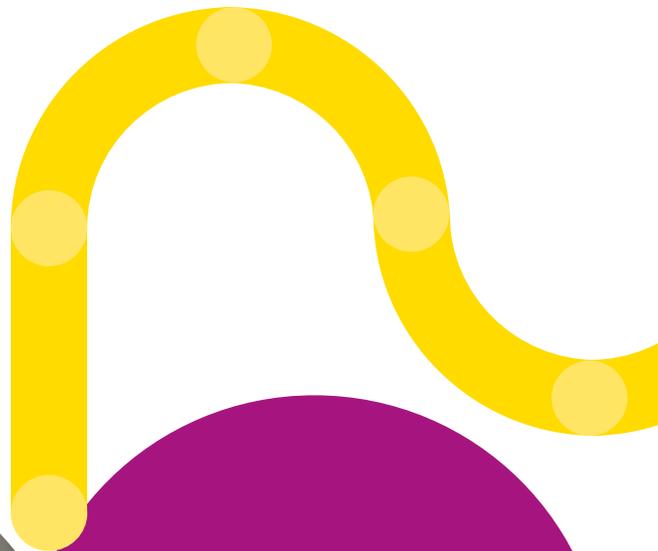
Improving education-work transitions

- Liverpool City Region Careers Hub is currently working across partners to improve the coherence of support for careers to young people and should put in place clear channels of communication to Advanced Manufacturing employer networks. This will help employers navigate the confusing mix of initiatives and signpost them to relevant support.
- There is also a requirement to develop a clear Liverpool City Region Brand for school-employer engagement for the Advanced Manufacturing sector. A higher profile will add value through an increased take-up among schools and engagement of a wider range of sector employers alike.
- The 4th Industrial Revolution will have a profound effect on job roles. Changing jobs and careers and developing and updating skills will be a lifelong process that requires young people to be equipped with the skills and knowledge to navigate the labour market and learning systems themselves. Such career management skills should be a focus of Careers Education, Information, Advice and Guidance support. The active involvement of Advanced Manufacturing employers should be a priority for the new Careers and Enterprise Network to build upon existing activity and ensure that the Schools Careers Hubs do not replicate existing services and communication channels.
- Some Advanced Manufacturing employers in Liverpool City Region already aim to provide a coherent programme starting with STEM inspirational events, school careers activity, related pupil work experience through to guaranteed interviews for Apprenticeships for those young people who follow this pathway. This would provide a template to achieve the Gatsby Foundation benchmarks for careers support in schools and now FE colleges. Careers Enterprise Network should be encouraged to build on this model by engaging a wider group of schools.



What future skills will Advanced Manufacturing require and who will deliver them?

- There are, as yet, no hard and fast answers to who will deliver the skill needs of the future. Learners will need to be flexible and expect to have to change careers. Partners should develop a structured programme of test and learn pilots and seek to develop a better understanding of the range of skills required, the best methods to deliver these to a wide range of employers, and appropriate funding mechanisms. Possible routes include:
 - Recent analyses have highlighted that similar occupations in career clusters share many competencies and moving from one job area to another may require only an additional competency rather than a full return to (re-) education. The ability to pick up additional skills quickly will need to be part of the future learning and teaching landscape. At present it is possible for providers to 'unitise'- deliver individual modules of a broader qualification but only at Level 1 and 2. Liverpool City Region Combined Authority should seek to pilot equivalent Unitised modules at Level 3 and 4 so existing employees in Advanced Manufacturing firms can access short courses and so add to their skills through modules rather than full courses. The funding model for this work will need to be developed with employers, the Institute of Apprenticeships and Technical Education, and the Student Loan Company, as well as devolved funders of adult skills for those aged 19+.
- Explore the development of new Standards that can combine the relevant skills for engineers and technicians of the future. This should involve bringing employers and providers together across a number of specialist areas: digital, mechanical engineering, electrical, Internet of Things and big data. What are the appropriate combination of skills – should digital technologists be trained in engineering or engineers trained in digital processes etc? Some work has already been undertaken at City of Liverpool College and Siemens on the requirements of the Digital Factory.
- A further route to developing wider understanding of the potential for digital processes is to promote widespread engagement through entry-level programmes such as The Duke of York's Inspiring Digital Enterprise Award (IDEA). In some areas this has been made a compulsory element in all apprenticeship delivery to ensure that all learners are engaged.



The ability to pick up additional skills quickly will need to be part of the future learning and teaching landscape.



- Some employers are concerned that as the 4th Industrial Revolution increases the pace of change and demand for skills, the relatively long training process underpinning Level 3 qualifications will itself become a barrier. Different approaches might include:
 - A number have raised the issue of whether apprentices might undertake at least some of their training (12 or 24 months) before commencing work with their employer. Such a 'programme-led' approach could be explored to assess the scale and cost of implementation. Scotland has developed a model under Foundation Modern Apprenticeships where some of the learning is undertaken in the latter years of the Key Stage 4 (Years 10-11) as part of the school curriculum.
 - Another option here would be for employers to aim to recruit from existing learners on engineering related courses BTEC/ HNC/ HNDs where they have developed underpinning knowledge and can then progress through apprenticeships more quickly (and cheaply).
 - Some consideration of mixed-methods learning (a combination of both online and offline learning) so that this can be delivered flexibly and cost-effectively.
- Training providers aim to keep their courses and equipment as up-to-date as possible but there are clear limits to being able to stay in front of industry standards. For some, making the best use of existing equipment and potentially adding digital processes to previously analogue equipment may prove more helpful for many employers who cannot afford to invest in cutting-edge equipment themselves. Other actions may add more value:
 - More can be done to build on links with industry to ensure that their tutors can experience current processes and appreciate where the next developments in industry are likely to arise. Short placements for teaching staff in local Advanced Manufacturing firms will go a long way to ensuring the curricula are kept fresh.
 - Another route to improving the preparedness of learners moving into local firms would be to introduce a mentoring scheme so that tutors are responsible for supporting their learners as they move into their new jobs. This will focus attention on whether the learner is well-prepared for the role and ensure that tutors' get a sense of where and how they can improve the relevance of their courses.



Engaging with SMEs in the Advanced Manufacturing sector

- Such are the specialist skills required by many employers in the sector that it is very likely that only they can provide their own final skills training. This creates an issue for small businesses. There are two potential approaches to overcoming this:
 - Large Advanced Manufacturers over-train or provide specialist training on behalf of smaller employers in their training centres. This can be further supported by Levy-paying employers who can now transfer (since April 2018) 10% of their Levy funds to other employers. This will shortly be extended to 25% of the Levy and provides a major opportunity for Liverpool City Region to retain otherwise unspent funds on training. This needs to be targeted on SMEs to avoid State Aid rules. The BAE employer ownership pilot operated this model for apprentices in their supply chain²⁰.
 - Smaller employers' network and use this as a platform to aggregate demand so they can become part of a viable course – similar to the old group training model.
- There is an emerging HR directors network involving SMEs in the Advanced Manufacturing sector in Liverpool City Region and with further support this could provide a platform to engage and disseminate information on potential joint training opportunities and act as a brokerage service to put SMEs in touch with apprenticeship levy-paying firms with unused allowances in order to reduce their training costs.



Endnotes

1. See www.gov.uk/government/topical-events/the-uks-industrial-strategy
2. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/655570/20171027_MadeSmarter_FINAL_DIGITAL.pdf
3. See <http://liverpoolcityregion.gov.uk>
4. Pharmaceuticals; Chemicals; Food and drink; Automotive; Printing and publishing; Metal goods; Manufactured fuels; Non-metallic min. products; Mechanical engineering; Manufacturing general; Rubber and plastics; Electrical engineering and instruments; Wood and paper; Other transport equipment (incl. marine engineering sector); Textiles, clothing and leather; Electronics; and, Basic Metals
5. Wavehill (2017) Liverpool City Region Employer Skills Survey 2017
6. Pike et al, Uneven Growth: Tackling Declining Cities, Joseph Rowntree Foundation, 2016.
7. See <http://www.siemens.co.uk/curiosity/en/>
8. Payton (2017) Skilling for Tomorrow, National Centre for Vocational Education Research, 2017 using evidence from the Australian jobs market.
9. NAO (2018) Delivering STEM (science, technology, engineering and mathematics) skills for the economy, HC 716, 17 January 2018.
10. Liverpool City Region Employer Survey, 2017. The survey interviewed 91 businesses in the Advanced Manufacturing sector and this relatively small group provides one explanation why the survey findings differ from official statistics.
11. ONS
12. NAO (2018) Delivering STEM (science, technology, engineering and mathematics) skills for the economy, HC 716, 17 January 2018, p4.
13. See Foundation for Young Australians (2017) The New Work Mindset: seven job clusters to help young people navigate the new work order for details on the detailed job roles.
14. Made Smarter Review, pp-47-53.
15. Mckinsey Global Institute (2017) Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation, December 2017. See also Frey and Osborne (2018) Automation and the future of work – understanding the numbers, Oxford Martin School, University of Oxford, 13 April 2018.
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17. Blake (2018) The Robots Are Coming, and They Want Your Job, VICE, September 13 2018. Accessed at https://www.vice.com/en_uk/article/kz5a73/the-robots-are-coming-and-they-want-your-job. Northeastern University, Boston but Manchester (AI Robot Overlord, Replacement or Colleague?) and Bristol (Bristol Futures) have recently introduced courses to develop personal attributes in their undergraduate students.
18. Payton (2017) Skilling for Tomorrow, National Centre for Vocational Education Research, 2017
19. <http://northernautoalliance.com/news/liverpool-city-region-robot-challenge-opening-up-young-minds-to-manufacturing-engineering-as-a-career-choice/>
20. <https://www.baesystems.com/en-uk/our-company/our-businesses-uk/military-air-and-information/employer-ownership-pilot>



