Gloucestershire Local Skills Improvement Plan (LSIP)

Prioritised Findings - Advanced Manufacturing & Engineering

1. Introduction

The advanced manufacturing and engineering sector is a significant driver of growth and employment provision within the UK's economy. In 2022, the Royal Academy of Engineering[1] reported the value of the engineering sector amounted to £645 billion GVA, 32% of the country's economic output. A recent manufacturing report produced for the House of Commons (March 2023)[2] suggested that manufacture accounted for 9.2% of total GVA between October and December 2022, while total employment in VAT and PAYE registered businesses accounted for 2.67 million workers across the country. Manufacturing provides 11.6% of employment within the Gloucestershire region[3] . Whilst conducted before the covid-19 pandemic, the High Value Manufacturing Catapult published a report reviewing the skills challenges for the future of the sector that aligns with our findings within the Gloucestershire region[4].

The skills needs' risk within this sector is to maintain its economic value and employment base in the face of the changing nature of its supply chains and meet the decarbonisation challenge e.g. via electrification[5], aligning to the UK's Net Zero Strategy[6] for the benefit of all in the region.

We therefore have three types of skills priority for this sector:

- *Skills Shortage Occupations reflecting the current supply and demand,*
- *Skills for new technology (upskilling of existing occupations and new occupations), and*
- *Granular skills requirements reported by employers.*

Please note we have not distinguished at this stage between advanced manufacturing and engineering requirements and capabilities, but expect to further engage with sub-sectoral needs throughout the project lifespan as identified.

The West of England Plus LSIP Trailblazer 2020-21[7] , which covered a region extending north into Gloucester and Stroud, also provides additional granularity into skills' needs within the aerospace cluster across the South West and should be addressed where applicable; a significant number of thematics and needs carry over into the wider engineering and manufacturing intelligence in this LSIP, but there are greater foci on the potential of hydrogen and digitisation within this sub-sector too.

Further Education in the region for this sector is provided by Gloucestershire College, Cirencester College and South Gloucestershire and Stroud (SGS) College. There are currently 3 relevant T level

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[1] From *Royal Academy of Engineering* article November 2022 https://raeng.org.uk/news/a-hotbed-of-innovation-new-research-reveals-engineering-adds-up-to-an-estimated-645bn-to-the-uk-s-economy-annually

[2] From *House of Commons Library – Economic Indicators for Manufacturing*, March 2023 SN05206.pdf (parliament.uk)

[3] From *G First LEP Labour Market & Skills review January 2022* https://www.gfirstlep.com/downloads/2022/lmsr-section-1_labour-market-background_2022.pdf

[4] From *Manufacturing-the-Future-Workforce-Full-Report.pdf (catapult.org.uk) January 2020,* https://hvm.catapult.org.uk/wp-content/uploads/2022/06/Manufacturing-the-Future-Workforce-Full-Report.pdf

[5] From the *National Electrification Skills Forum*, 2021 https://hvm.catapult.org.uk/wp-content/uploads/2021/11/National-Electrification-Skills-Forum-Brochure-FINAL.pdf

[6] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

[7] Available at West of England Plus LSIP Trailblazer 2020-21

pathways within Engineering and Manufacturing: Design and Development for Engineering and Manufacturing; Maintenance, Installation and Repair for Engineering and Manufacturing; and Engineering, Manufacturing, Processing and Control. Apprenticeship uptake within this sector is particularly strong, but there have been declines in uptake in recent years, with a 9% decline overall since 2014-15 starts, in line with national trends across most subject areas – not specific to Gloucestershire but neither has the county escaped these worrying trends[8].

2. Labour market intelligence trends for the Gloucestershire region

Labour market tightness for the manufacturing sector comes out as top under research conducted since 2019 from the Covid Jobs Research UK group based at the universities of Edinburgh and Essex. They measure tightness as vacancies % unemployment, splitting this down into two component parts – tightness caused by vacancies being more proliferate, vs tightness caused by declines in 'search effort.' Manufacturing has seen the highest increase in labour market tightening since Q4 2019 at over 350% increase[9], primarily driven by a decline in search efforts towards vacancies in this sector, implying job seekers have a less favourable view of the career prospects that roles in the sector provides and/or that more skilled staff are remaining in their existing roles. Starkly across the UK, there are now 4.58 times more vacancies in Manufacturing per worker for a job in that industry than there were in 2019.

The Manufacturing sector is the second largest sector with 35,000 employees, equating to 13% of the total number of employees, which is well above the national figure. This indicates that the sector is the most locally concentrated of all the sectors. In particular, the computer, electronic and optical products, fabricated metal products, manufacture of machinery and equipment, aerospace, rubber and plastics and food products sub sectors account for the highest number of employees.

Employment in the Manufacturing sector in Gloucestershire matches the decline expected nationally but to a greater degree, projected to change by -9% between 2015-2025, compared with a UK forecast of -7%.[10] Looking at the 2017-2027 period Other Manufacturing is expected to be the second slowest growing sector within Gloucestershire's economy, followed by Engineering.[11]

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[8] From *Power Engineering International* article, January 2023
https://www.powerengineeringint.com/world-regions/europe/inquiry-launched-into-decline-of-uk-engineering-apprenticeships/
[9] From *COVID Jobs Research* Market Tightness by Industry Post-COVID - COVID Jobs Research UK, 2022, based on seasonally adjusted ONS Labour Market Force and VACS02 survey data.
[10] From *The Economy of Gloucestershire 2022*, Gloucestershire City Council
https://www.gloucester.gov.uk/business-economy/economic-growth-strategy-2019-2022/
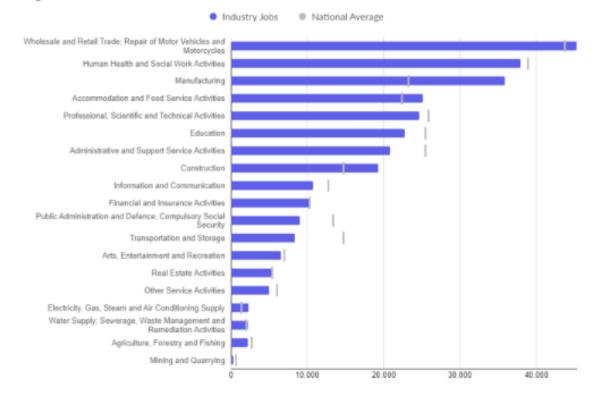[11] GFirst LEP Labour Market & Skills review, Chapter 2 (page 10)

Largest Industries

Legend: ● Industry Jobs ● National Average

Industry	
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	
Human Health and Social Work Activities	
Manufacturing	
Accommodation and Food Service Activities	
Professional, Scientific and Technical Activities	
Education	
Administrative and Support Service Activities	
Construction	
Information and Communication	
Financial and Insurance Activities	
Public Administration and Defence; Compulsory Social Security	
Transportation and Storage	
Arts, Entertainment and Recreation	
Real Estate Activities	
Other Service Activities	
Electricity, Gas, Steam and Air Conditioning Supply	
Water Supply; Sewerage, Waste Management and Remediation Activities	
Agriculture, Forestry and Fishing	
Mining and Quarrying	

(x-axis: 0, 10.000, 20.000, 30.000, 40.000)

Based on 2019 EMSI data, the proportions of vacancies within the manufacturing sector is materially higher than the national average, reflecting the particularly tight labour market immediately prior to the Covid-19 pandemic within Gloucestershire[12].

3. Job postings and forecasts to meet replacement and expansion need (existing staff leaving the sector's workforce either into different sectors or retirements and new employment generation against expected sectoral growth)[13].

The level of job postings in areas related to engineering and advanced manufacturing are broadly in line with the national average, for example 6.3% of job postings were for roles in Engineering, as compared to 6.1% for England overall[14].

The largest major occupation group within the sector is 'professional and skilled trades', which makes up 64% of the total workforce in this sector. This category includes welding trades, IT engineers, electrical and electronic trades and plumbing and heating engineers (Mapping the UK's Engineering workforce, Engineering Council). Nationwide trends are broadly replicated for the Gloucestershire region.

The National Foundation for Educational Research (NFER) has recently published up to date sectoral analyses of the replacement and additional labour needs by sector and LEP geography under the Skills Imperative 2035, led by Warwick Institute for Employment Research & Cambridge Econometrics[15].

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[12] GFirst LEP Labour Market & Skills review, Chapter 2 (page 34)

[13] From *HR Magazine*, article February 2023 https://www.hrmagazine.co.uk/content/news/businesses-face-record-recruitment-difficulties/

[14] *Department for Education Local Skills Dashboard*, 2023 https://department-for-education.shinyapps.io/local-skills-dashboard/

[15] From *National Foundation for Education Research* article, 2022 https://nfer.ac.uk/key-topics-expertise/education-to-employment/the-skills-imperative-2035/

For manufacturing in the GFirst LEP area[16] between 2020 and 2035 the sector is expected to require over 15,000 replacement jobs as the existing workforce moves into retirement or leaves the sector for alternative employment opportunities elsewhere. This contrasts with a net fall in positions within the sector as roles are deleted, of 4,880 FTE – or 13% of 2020's estimated workforce of 38,000. In proportion to other sectors within Gloucestershire, Manufacturing is expected to comprise 8.5% of the regional workforce in 2035, down from 11% in 2020.

This will partly be driven by replacement demand for traditional occupations as well as the leading role that the industry is expected to play in achieving the country's net zero targets, which will require new developments in sub sectors such as the electrification of manufacturing and jet zero.

4. Occupational Priorities (shortages within occupations)

We have attempted below to show some of the existing roles' needs and requirements to indicate where sectoral needs may be met via existing courses, with or without micro-interventions, but we faced significant issues with division of the existing engineering and manufacturing labour market due to gaps within labour market intelligence mentioned briefly above. Below we align some suggested roles and FE pathways via potential training needs rather than roles/shortages. We have not as yet looked at these shortages in relation to current supply volumes from colleges and ITPs, therefore these priorities are here for discussion with providers at this stage. We have attempted to RAG rate needs (Red, Amber, Green, with Red being highest) to highlight to most pressing existing role shortages within this sector, but this is based on wider speculative analyses of the changing engineering and manufacturing sectors rather than specific data sets and we therefore welcome further suggestions in delineation attempts.

Role	R	A	G	Priority/possible action and funding source. Growth in:
Production and entry level roles; Machinists, fitters, operatives	X			Full time 16 to 19 Apprenticeships
Project management		X		Apprenticeships Full Time 16 to 19 T levels
Data analysts	X			Apprenticeships Full time 16 to 19
Electrical engineers			X	Apprenticeships Full time 16 to 19
Mechanical engineers		X		T levels Higher Apprenticeships Full time and part time HE
IT Business Analysts, Architects and Systems Designers			X	T levels

[16] From Department for Education, 2023 https://www.gov.uk/government/publications/labour-market-and-skills-projections-2020-to-2035

				Higher Apprenticeships Full time and part time HE

The best available existing delineation of sector specific engineering and manufacturing technical pathways is provided via the Institute for Apprenticeships in their occupational maps[17]

Engineering, Design and Development Pathway		
Technical (L3)	**Higher (L4 -5)**	**Professional (L6-7)**
Design and Development Technician	Design and Development Technical Manager	Design and Development Engineer
Engineering, Manufacturing, Process and Control Pathway		
Fabrication and Welding Operative/Technician	Fabrication and Welding Technologist	
Food and Science Manufacturing Operative/Technician		
Manufacturing and Process Operative/Technician		Manufacturing Engineer
Manufacturing Operative		
Plant Operative/Technician	Manufacturing, Plant and Process Technologist	Plant and Process Engineer
Print and Packaging Operative/Technician	Print and Packaging Technologist	Print and Packaging Engineer
Quality Improvement and Project Control Technician	Quality Improvement and Project Control Manager	Quality Improvement, Health and Safety Professional
Maintenance, Installation and Repair Pathway		
Technical	**Higher Technical**	**Professional**
Manufacturing/Process Maintenance Operative/Technician	Manufacturing/Process Maintenance Advanced Technician	Manufacturing/Process Maintenance Engineer
Service, Repair and/or Overhaul Operative/Technician	Installation, Service, Repair and/or Overhaul Advanced Technician	Installation and Service Engineer

5. Occupational Opportunities – Skills for new technologies

We can identify some of the more imminent technological needs within this sector, in particular through the High Value Manufacturing Catapult's 'Manufacturing the Future Workforce' report of 2020[18], alongside the incorporation of LSIP primary input and source documentation. The HVMC report highlights the importance of 'early adoption and exploitation of innovation' as critical in the UK's industrial strategy, and outlines this sectors importance in identifying and incorporating new technologies for productivity and efficiency.

The 'Made Smarter' review in 2017 suggested that technologies grouped under 'Industry 4.0' (automation, data, connectivity and AI/Machine Learning for optimisation and efficiency) could create

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[17] From *Institute for Apprenticeships and Technical Education Occupational Maps*
https://www.instituteforapprenticeships.org/occupational-maps/
[18] https://hvm.catapult.org.uk/wp-content/uploads/2022/06/Manufacturing-the-Future-Workforce-Full-Report.pdf

around 175,000 additional jobs in the next decade, which extrapolated to a Gloucestershire economy would equate to 3,115 new roles, on top of the existing workforce. In particular, the aerospace cluster in the region is expected to ramp up production and incorporate higher volume delivery methodologies, so will require significant numbers of new employees in both existing and to be identified roles.

There is existing demand within all of these technologies but it is limited in volume. However, it is expected that there will come a point relatively soon, where many of these technologies will grow rapidly in volume. When this happens depends very much on Government policy. We have therefore broken down technological and expected sectoral needs into broad areas or specific to a technology. We have identified in the table below, the main occupations which are likely to be affected. In the next section of the report we provide a more granular identification of employers stated needs. We have divided these technologies into wider 'role areas' to indicate level and depth of need, and intend to deep-dive into these during the secondary phase of the LSIP delivery.

Right now our priority is that Colleges and other providers of training for these occupations, gear up their practical facilities as far as possible and begin (if not already), to offer both the upskilling needed and new occupational programmes where there is local demand. We hope to have discussions with providers about how demand could be stimulated further and timing of growth.

Occupations	Production and Technician	Professional	Technical Support (IT)
Technology			
AI	Awareness/ understanding/ operation/repair and maintenance	Awareness and understanding	Software development
Automation, robotics and cobotics	Awareness and understanding/operation/repair and maintenance	Awareness and understanding	Software development
Cyber security	Awareness	Awareness	Cyber security specialists
Sensors, Data, AI and analysis	Awareness and understanding/operation/repair and maintenance	Awareness and understanding/operation	Data analysis
Industrial digitalisation and digital design	Awareness	Awareness and understanding/design	Software operation
Advanced manufacture – emerging materials, composites, lightweighting, AI driven design, rapid prototyping, 3d printing, decarbonisation	Awareness and understanding	Awareness and understanding/design	Software operation
Transformation, systems integration and change management	Awareness and understanding	Awareness and understanding/design	Awareness and understanding

6. **Businesses Reported Skills Needs - Granular Business Intelligence via LSIP**

Please note that the LSIP research will continue until April 2023 in the first phase, with additional needs, refinements, deep dives and any identified new foci to continue longer term until May 2025. These below skills needs findings are based on the initial 3 months of LSIP research and delivery and hopefully indicate (in a no way comprehensive manner) expected 'direction of travel' in the final report. As any additional needs are identified and verified we will share prior to report release with stakeholders in the most appropriate identified means.

The ERB has worked to gather current in-depth business intelligence on perceived unmet needs, understanding of current delivery and potential economic and technological changes. The intention of the LSIP research methodology is to add current and granular intelligence to existing understanding and not to replace prior research into skills needs, particularly those datasets which could be considered statistically robust.

We have divided these findings into approximated areas of need, and – alongside the sections above on occupational shortages and industrial trends – expect these to form a reasonably comprehensive picture intended to address current and expected unmet needs within the sector, both in terms of interventions in existing provision (micro or modular) and identification of potential new provision (although this falls primarily towards in-work and modular needs due to the methodology utilised in the LSIP primary research phase). The areas these are outlined under are:

- Critical Workplace, Core and Transferable skills
- Core Digital Skills
- Sector Specific, Technological Change and Digitalisation Skills Needs
- Decarbonisation, Sustainability and Alignment to the UK's Net Zero Strategy Skills Needs
- Systemic/Labour Market/Other reported needs

We have indicated where we believe businesses have reported these needs most significantly in terms of where they fit within career and occupational progression (from new entrants through to experienced) and believe these are areas of funding and provision that align more or less closely:

Experienced Current Employees (upskilling, modular, CPD)	Experienced/ Occupationally Competent New Employees (upskilling, skills gaps, new work functions)	Career movers from another sector (part experienced and/or direct/linked training e.g. Boot Camps	Those in both work and formal training e.g. apprentices	Younger/New Entrants/non-experienced 16-19 and adults
In-house, innovation/AEB/LSIF	In-house/bespoke/ Innovation/AEB/ LSIF	AEB, Bootcamps, Other DfE e.g. certificates of future technology, In-house, LSIF	Apprenticeship	T Levels, other 16 to 19 vocational, Vocational HE and preparatory

We do not intend to be prescriptive in suggestions where FE Providers (and others) may see an ability to respond to LSIP skills needs findings, more to indicate where we see opportunities for action that align with occupational progression, life stages and current (particularly mainstream) funding mechanisms. These therefore represent the options we want to discuss with providers.

Critical Workplace, Core and Transferable Skills

Need Statement	Provisional Priority	Experienced Current Employees (upskilling, modular, CPD)	Experienced/ Occupationally Competent New Employees (upskilling, skills gaps, new work functions)	Career movers from another sector (part experienced and/or direct/linked training e.g. Boot Camps	Those in both work and formal training e.g. apprentices	Younger/New Entrants/non-experienced (16-19) and adults
Core skills reported as vital across new roles:	1. Explore implementation of				X	X

• Maths and physics • communication • Appropriate work ethic, timekeeping and calendar management • Business skills within engineering roles: sales, communications, 'financial viability in my role'	Skillbuilder(or similar) and work entry skills in pre-16 and post-16 academic education and Eng Apprenticeship 2. Work with education to increase take up of maths and physics and GCSE and A level together with manufacturing AAQ once available 3. Add business skills content to post 16 vocational programmes and Apprenticeships			X	X	X
Roles within the sector that need further recognition of progression pathways: • Tendering/procurement/ sales (including persuasion & negotiation skills) • Administration • accounting • marketing & comms roles	4. Work with employers and providers to implement Apprenticeships for these employee occupation including progression to higher levels within Occ. Maps	X	X	X	X	
Importance of new entrants 'hitting the ground running' and continuation of learning/study mindset	As 1 and 3 above			X	X	X
Understanding hybrid working and importance of collaborative practise in project management – effective rollout of company culture	5. Project management short course programme	X	X	X		
Relevant and timely leadership and management training, commercial and contractual understanding	6. Manufacturing management development programme (apprenticeship funded?)	X	X			
Succession and backfilling planning, including how to effectively recruit and retain.	6(a)Workforce planning support offer across manufacturing (LSIF)	X	X	X	X	X
Effective internal communication (project teams and planning)	As 5 and 6 above	X	X	X	X	X
Mental health, resilience and 'embracing challenge'	7. Establish HR support group across the area	X	X	X	X	X

Understanding innovation and new project planning	As 5 above					
Smaller companies – some need for additional company structuring, tax, R&D and incentives, how to recruit and retain	8. SME management programme (LSIF?)					

Core Digital Skills

Need Statement	Provisional Priority	Experienced Current Employees (upskilling, modular, CPD)	Experienced/ Occupationally Competent New Employees (upskilling, skills gaps, new work functions)	Career movers from another sector (part experienced and/or direct/linked training e.g. Boot Camps	Those in both work and formal training e.g. apprentices	Younger/ New Entrants/ non-experienc ed (16-19) and adults
Further understanding of core digital platforms and 'what good looks like': Microsoft – Excel still integral to numerous work/roles, effective use of Teams and Outlook Presenting and webinars Google platforms – meet, hangouts, drive etc	9. Training in basic practical digital skills both in the workplace and in FTE (as in construction4.)	X	X	X	X	X
CRM usage, internal IT infrastructure and development, enterprise communications systems, internal use, rollout, adoption and integration	As 9 above(relevant staff)	X	X	X	X(relevant Apprenticeships)	
Needs for understanding coding/softdev becoming wider across engineering roles – python in particular, computer modelling	10, Upgrading short course programme for relevant roles	X	X	X	X	
Design engineering requirements across wider roles: CDT, technical drawing, CAD	As 10 above	X	X	X	X	
Planning and management tools and methodologies – Agile, SCRUM. JIRA	As 10 above	X	X	X	X	
Wider need for understanding of cloud storage, digitisation, data and analytics, turning data into intelligence	As 10 above	X	X	X	X	
Recognition that internal training does not keep up with software and needs	As 10 above	X	X	X	X	

Sector Specific and Technological Change

Need Statement	Provisional Priority	Experienced Current Employees (upskilling, modular, CPD)	Experienced/ Occupationally Competent New Employees (upskilling, skills gaps, new work functions)	Career movers from another sector (part experienced and/or direct/linked training e.g. Boot Camps	Those in both work and formal training e.g. apprentices	Younger/New Entrants/non-experienced (16-19) and adults
Understanding project flow and efficiencies from R&D stages through prototyping, build, QA and certification	As 10 above	X	X	X	x	
Lean manufacture and quality improvement, design thinking and methodologies	As 10 above	X	X	X	x	
Electrification as a core sectoral change (and needs attached to high voltages, H&S, batteries and storage, codes and standards) gas systems and replacements – significant needs for electrical engineers	11. Short course programme for all managers and other relevant staff covering electrification/low carbon	X	X	x	X	X
Growth sectors mentioned for initial sectoral knowledge– space, NNB, SMR and fusion						
3d printing and scanning	As 10 above	X	X	X	X	
Design engineering – need for understanding across roles, more design requirements in more engineering and manufacturing roles	As 10 above	X	X	X	X	
Automation, robotics, cobotics gaining in wider awareness and adoption	As 10 above	X	X	x	X	
Troubleshooting, servicing and maintenance (inc. higher H&S needs) in technician and engineering roles	As 10 above (relevant staff)	X	X	X	X	
AI, machine vision, sensors, Machine Learning	As 10 above	X	X	X	x	
Commissioning, systems integration, Systems modelling	As 10 above	x	x	X	x	

Net Zero Skills

Need Statement	Provisional Priorities	Experienced Current Employees	Experienced/Occupationally Competent New	Career movers from another	Those in both work and formal training	Younger/New Entrants/non

		(upskilling, modular, CPD)	Employees (upskilling, skills gaps, new work functions)	sector (part experienced and/or direct/linked training e.g. Boot Camps)	e.g. apprentices	-experienced (16-19) and adults
Energy efficiency understanding (against energy crisis mitigation) – energy prices impacting change.	As 11 above	X	X	X	X	X
Sustainability assessments – calculations and monitoring, lifecycle assessments, whole life concept	As 11 above	X	X	X	X	
Sustainability and requirements within role, company and sector, wide understanding. How to effectively implement change, manage risks and liabilities	As 10 above	X	X	X	X	
Decarbonisation of fuels – electrification, alternative fuels and hydrogen	As 11 above	X	X	X	X	
Materials and changes – alternatives, efficiency in process and design, waste and packaging – some needs for polymers, chemicals and bio-substrates	As 11 above	X	X	X	X	
How to effectively communicate sustainability internally and externally	As 11 above	X	X	X	X	
Understanding funding for net zero, legislative changes and expected changes	As 11 above	X	X	X	X	
Carbon neutrality and offsetting	As 11 above	X	X	X	X	
Sustainability and innovation as interlinked drivers of change	As 11 above	X	X	X	X	

Local Skills & Labour System Feedback

Please note that although these are not explicitly skills needs, these are other issues highlighted by employers and stakeholders that may require addressing alongside interventions in provision directly.

Need Statement	Provisional Priorities	Experienced Current Employees (upskilling, modular, CPD)	Experienced/ Occupationally Competent New Employees (upskilling, skills gaps, new work functions)	Career movers from another sector (part experienced and/or direct/linked training e.g. Boot Camps	Those in both work and formal training e.g. apprentices	Younger/New Entrants/non-experienced (16-19) and adults
Widest sector reports significant issues with recruitment against expected sector growth	Part C LSIP					
Sector/industry preferences for short/modular/remote/flexible training provision, with smaller orgs reporting not able to release 20% for apprenticeships etc	As 10 and 11 above 12. Review Apprenticeships design to incorporate more OTJ in the workplace	X	X	X	X X	
Entry level applicants often lacking in calibre	Covered under 1 and 3 above				X	X
Investment for automation is difficult (depreciation versus physical footprint expansion)	Discuss with CA					
Businesses mixed recognition of need for workforce development planning as part of strategic growth	As 6(a) above	X	X	X	X	X
Retention & attraction difficult, large recognition of lack of diversity (esp. women in engineering) but no cohesive understanding how to effectively address	Part C LSIP					
Disconnect between industry salaries and FE salaries makes it hard to encourage industry professionals into teaching	13. Cross are initiative to recruit to FE teaching/training(see also construction)				X	X
Good recognition and understanding of benefits of VR/AR/video and simulation as beneficial practises for closing gaps	LSIP Part C					
Some non-city locations are becoming less attractive to younger workers looking for hybrid roles	LSIP Part C					
Sector looking for longevity in initiatives, legislation and training provision to provide certainty in planning	LSIP Governance with CA					