

Skills and Performance Challenges in Advanced Manufacturing

This slide pack presents the skills and performance challenges in advanced manufacturing

Background and context

- The study is one of a rolling series of Sector Skills Insights reports examining skills and performance needs in specific sectors. It examines the mix of skills needed in specific occupations, as well as employer awareness of and engagement with National Occupational Standards (NOS).

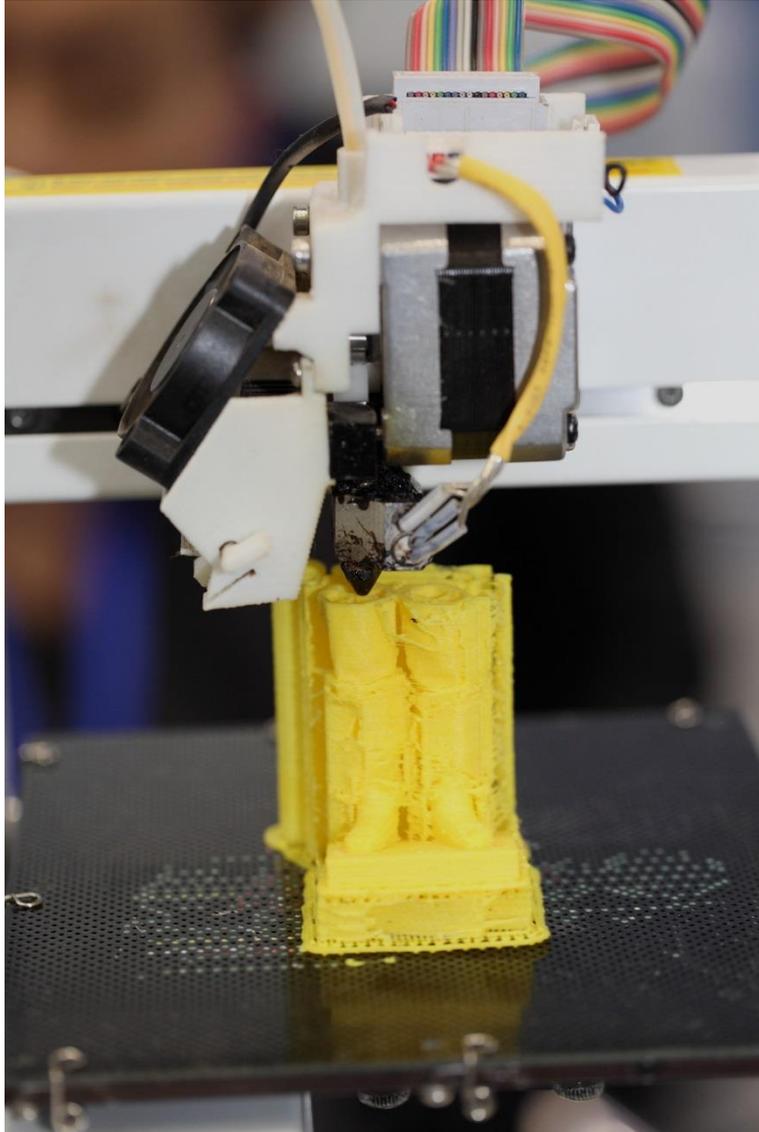
Research methodology

- The research adopted a mixed-methods approach. Existing sector data and literature on skills and performance issues was supplemented by primary research with employers and stakeholders.
- The primary research took place during January and February 2015. In total, 53 employer interviews were conducted.
- In parallel, secondary data sources and literature were also analysed. Key data sources included: UK Employer Skills Survey; the Labour Force Survey; Working Futures, Annual Business Enquiry; and the Annual Survey of Hours and Earnings.

This presentation has six main sections:



What is advanced manufacturing?



Advanced manufacturing is broadly '*manufacturing that is intensive in its use of capital and knowledge and requires a high level of technology utilisation and Research and Development (R&D)*'. It can apply to all manufacturing industries, but is most commonly associated with high-tech industries.

How is the sector defined?

For the purpose of the study, we defined the sector as high-tech and medium-high tech manufacturing industries, such as:

- Automotive
- Pharmaceuticals
- Chemicals
- Electronics and electrical manufacture
- Manufacture of other transports (aerospace)
- Scientific research and developments

The advanced manufacturing workforce today

The advanced manufacturing sector comprises of **29,000 enterprises** in the UK, which employ approximately **1.3 million people**

Advanced manufacturing employers generated over **£72 billion of GVA** in 2013

The sector has a predominantly male workforce – only **26% of the workforce is female.**

The sector has a high skilled workforce. **Nearly half (44%) hold qualifications at Level 4 or above.**

19% of advanced manufacturing employers report skills gaps compared to 15% for the economy as a whole

Advanced manufacturing employers were also **more likely to report hard to fill vacancies** compared to the economy as a whole (9% versus 5%)

There are a range of structural and technological developments driving advanced manufacturing

Translating innovation into growth

- The UK, along with other Western European countries, lead the way in patent applications. However, investment in new products is lower than among competitors.
- A key challenge faced by employers is accessing finance and investment to bring new products to market.
- This is increasing the importance of business skills in senior manager roles in order to ensure employers can make 'the business case' for new investment.

Increasing investment in R&D

- The ability to develop new products and processes requires significant investment in R&D.
- This is increasing demand for high quality science and engineering graduates to enter the sector.
- Across the sector, there is growing collaboration between industry and universities to co-invest in new technologies. Skills in R&D are therefore not only required among employers but also among research institutions

Meeting low carbon legislation

- The Kyoto protocol and EU 2020 strategy set targets for the UK to reduce carbon consumption in the next few years.
- This is driving innovation in lightweight products and equipment to reduce energy and water consumption.
- Employers consequently need to invest in ensuring their workforce are aware and able to position themselves to take advantage of new developments.

Maximising export opportunities

- Taking advantage of overseas markets is an important contributor to growth. Advanced manufacturing employers export a higher proportion of goods than other manufacturing employers.
- However, some employers struggle to take advantage of overseas markets due to a lack of local networks or a lack of familiarity with different regulatory frameworks

Transformative enabling technologies

- Recent enabling technologies are increasing the pace of technological developments and creating new business opportunities for employers.
- Key technologies include:
 - Additive manufacturing (3D printing)
 - Composites
 - Nanotechnology
 - Plastic electronics
 - Silicon electronics
 - Biotechnology
- Employers need to ensure they have the skills to take advantage of these new technologies

Each key occupation requires specific skills

Production managers and directors in manufacturing

- *Production managers and directors in manufacturing are responsible for managing the production line and monitoring efficiency and quality. In small companies, many production managers and directors in manufacturing are owner-managers. It is the largest occupation group in advanced manufacturing.*

Biological scientists and biochemists

- *Biological scientists and biochemists are responsible for developing biological products and conducting research and trials on new products. The occupation is common in the pharmaceuticals and chemical manufacturing industries. A high proportion of biological scientists and biochemists also work outside the manufacturing sector in scientific research and development and the health sector.*

Production and process engineers

- *Production and process engineers are responsible for technical aspects of the production process, dealing with system and product design, production optimisation and quality assurance. The occupation is common in the chemicals, computer and electronics, and other transport (including aerospace) industries.*

Metal working production and maintenance fitters

- *Metal working production and maintenance fitters are responsible for building and maintaining machines for production lines. The occupation is associated with sites of leading edge technology and in vehicle production lines. It is the third largest occupational group in advanced manufacturing and is common in the automotive and other transport industries.*

Assemblers of electronics and electrical components

- *The assembler role includes component assemblers, radio assemblers, solderers and wirers and technical operators in circuit board manufacture. It is the 16th largest group in advanced manufacturing and a role particularly likely to be affected by new advanced technology products such as 3D printing, plastic electronics and nanotechnology.*

New technologies are increasing demand for IT and design skills, as well as requiring senior managers to be more 'outward facing'



- The general shift to shorter, more tailored production runs, driven by both customer demand and the availability of more flexible production technology, is increasing demand for design skills.
- Across the sector, the increasing use of design packages and bespoke software in the manufacturing process is also requiring sector workers to have greater 'IT literacy' and skills in utilising specific CAD/CAM and CNC machining software.
- Regulation and the growing trend for outsourcing production of more complex products are increasing the importance of the business aspects of production managers/directors in manufacturing' role.

Some employers are experiencing skills and performance gaps as a consequence of advanced technologies

- Some employers are experiencing significant challenges in recruiting highly skilled professionals. However, a few have overcome these issues by recruiting apprenticeships who and supporting them to progress in the sector.
- Employers are also experiencing difficulties in ensuring senior staff have both the technical and business skills to drive developments in new technology and manage an increasingly complex and fragmented supply chain.
- There is a strong willingness across the sector of training staff 'on-the-job'. However, for roles such as assemblers, employers have experienced difficulties in recruiting staff with the right attitudinal skills to succeed in the company.



Recent forecasts suggest that the advanced manufacturing sector is expected to grow significantly

Recent EU projection predicts the global advanced manufacturing market will double in size to £750 billion by 2020, largely driven by growth in 3D printing and robotics.

The number of high-skilled jobs in the sector is projected increase, but the growing automation of production processes will likely lead to a reduction in elementary and machine operative roles.

The importance of R&D will increase demand for workers with higher degrees and specialisms. The search for high-performing staff will make the UK workforce more international in nature.



The skills required for key occupations are also likely to change significantly in future



Production manager and directors in manufacturing: These jobs may in future be split into two distinct roles. One role will focus on quality assurance and regulation, while the other will focus on the design. In addition, within large employers the role may also become more focused on supply chain management, purchasing, contract negotiation and large-scale project management.



Biological scientists and biochemists: New digital technologies will make clinical trials less labour intensive, which will free workers to concentrate on R&D. Although demand for workers will increase, some jobs will be created in research facilities, which will increasingly be working in partnership with employers.



Production and process engineers: The increasing complexity of the production method and growing use of sub-contracting is expected to require production and process engineers to possess increased skills in project management and maintaining quality across multiple manufacturing sites.



Metal working production and maintenance fitters: Software development skills will become an increasingly important in future. In addition, the role of maintenance fitters may become more service-focused, as manufacturers outsource more complex machine calibration and system setting tasks.



Assemblers: Roles are expected to decrease in future, as new products will require less preparation and can be more easily assembled. However, this would be balanced by an increase in jobs for technicians to operate machine tools.

In the context of these current and future challenges, occupational and professional standards have a role to play in the sector

Manufacturing employers have a slightly lower than average awareness of NOS. However, when pressed, employers generally understood that key sector training, such as apprenticeships, were based upon a consistent set of national standards.

As a performance management tool, NOS was considered a useful starting point, but generally required substantial tailoring before they could be applicable to employers' work environments. NOS were, however, generally considered to be a crucial tool in ensuring consistency in training standards, particularly apprenticeships.

This demonstrates a tension between low- and high-specificity NOS. The former is widely considered important by employers for training, as it ensures that training is 'future-proofed' against changing technology standards. However, the technology-independent nature of NOS limits its application to a workplace environment.

There are a range of potential actions that could improve the sector's capability to take advantage of new technologies

- Employers need to invest in developing workforce capacity in design/CNC software.
- Employers should assess the benefits of offering apprenticeships and ensure clear pathways to higher-level technical and professional roles.
- Universities and vocational training providers need to ensure technology skills are embedded in a wide range of STEM-related programmes, alongside leadership and management and supply chain management skills.
- Continued investment by government in collaboration between HE and industry will help the sector mitigate risks with pursuing business development / innovation.
- It is important to foster links that support skills development beyond traditional industry silos, and to conduct more research on good practice in engaging SMEs in R&D and disseminate this across the sector.



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