

MANUFACTURING RESILIENCE

DRIVING RECOVERY TOWARDS NET ZERO



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WHAT DOES A RESILIENT FUTURE MANUFACTURING SECTOR LOOK LIKE?

DIGITAL & INDUSTRY 4.0

Companies use big data, machine learning, 3D printing, 5G, and other technology to improve efficiency.

GREEN SKILLS

A locally focused, employer-led, post-16 education system has closed skills gaps and developed the green skills required to meet net-zero.

ACTION PLAN

1. Introduce a national advice and support service to develop resilience in industry, building on the Government's successful Made Smarter pilot.
2. Accelerate the timescale for delivery of a world-beating product standards and consumer labelling system.
3. Mandate training on climate change and decarbonisation within Local Skills Improvement Plans.
4. Make the Green Jobs Taskforce permanent and extend its membership to deliver on the Prime Minister's 10 point plan for a green industrial revolution.

NON-LABOUR PRODUCTIVITY

Improved energy and resource efficiency have reduced exposure to climate-related shocks.

UPSKILLING

Workers in twentieth-century, carbon intensive industries now work in the green economy.

CIRCULAR ECONOMY

Businesses have rejected traditional 'take-make-waste' models in favour of a system that keeps materials in use and regenerates natural systems.

Foreword by Inquiry Chair and Vice-Chairs

From vaccines to ventilators, the UK's manufacturing sector has been of vital importance throughout the pandemic in serving the country with the things it needs. However, compared with many other parts of the economy, the sector has been disproportionately impacted by supply disruption and reduced demand for goods.

This inquiry by the Manufacturing Commission therefore comes at a critical time for the industry as external shocks such as public health crises, financial disruption, and extreme weather events are predicted to increase in frequency over the next decade. Looking to the future, climate related events and their impact will only worsen if we do not take decisive action now. The Commission has explored how Government and business can build resilience to these events, including adoption of digital technology, improving resource efficiency, and development of a more devolved and employer-led skills system.

Throughout the evidence sessions that have informed this inquiry, we have been inspired by accounts from UK manufacturing businesses that have adapted to the challenges of the pandemic. We have heard from companies who have repurposed their production lines, forged new collaborative partnerships, and embraced circularity in order to remain competitive. It is vital, therefore, that we provide these businesses with the resources to make these successes permanent. That's why we have recommended development of a national advice and support service, building on the Government's successful Made Smarter pilot, to facilitate and develop resilience within manufacturing businesses up and down the country.

Investing in resilience will also help the manufacturing sector deal with the impacts of a far larger challenge – the climate crisis. The Government has outlined its intentions for a green recovery through the Prime Minister's 10 Point Plan for a Green Industrial Revolution, BEIS' Industrial Decarbonisation Strategy and the Treasury's Plan for Growth. As the UK prepares to host the 26th UN Climate Change Conference, we must act swiftly to deliver on our net-zero target and cement our position as a global leader in green technology.

Given our combined experience in business, academia, and policy-making, we are acutely aware of the importance of a strong manufacturing sector to provide high-quality jobs, level-up the economy, and mitigate the impacts of climate change. As we look beyond the pandemic and begin to focus on recovery, the Government must put manufacturing at the centre of its plans for a green economy.

This inquiry has been informed by a range of expert opinions from stakeholders across the manufacturing sector. In particular, we would like to thank our generous sponsors: Enginuity, The ERA Foundation, and the High Value Manufacturing Catapult for their support.

Inquiry Chair



Lord Bilimoria of Chelsea CBE, DL

Crossbench Peer, Founder and Chair of Cobra Beer, President of the CBI, and Chancellor of the University of Birmingham

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Inquiry Vice-Chairs



Jack Dromey MP
(Labour)

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Sarah Olney MP
(Liberal Democrat)

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Mark Pawsey MP
(Conservative)

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Professor John Latham CBE

CEO and Vice-Chancellor, Coventry University Group

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Executive summary

The Covid-19 pandemic has disrupted almost every aspect of the UK's manufacturing sector, from procurement and staffing to supply chains and fulfilment. Businesses were impacted three times over as lockdown restrictions reduced on-site productivity, overseas supply chains broke down, and countries all over the world entered recession, leading to plummeting demand. However, at the same time as many sectors suspended operations and furloughed staff, the UK manufacturing sector was tasked with continuing to deliver essential goods, such as food, Personal Protective Equipment (PPE), and medical supplies, including domestic production of the Oxford-AstraZeneca vaccine.

Alongside this challenge, the Government has legislated for the United Kingdom to reach net-zero greenhouse gas emissions by 2050. Currently the country is not on track to meet its 4th and 5th carbon budgets, which set emissions reduction targets for the period between 2023 and 2032. Under the recently published 6th carbon budget, the UK will need to deliver a 78% reduction in carbon emissions by 2035, and the manufacturing sector has a crucial role to play in decarbonising if this is to be achieved.

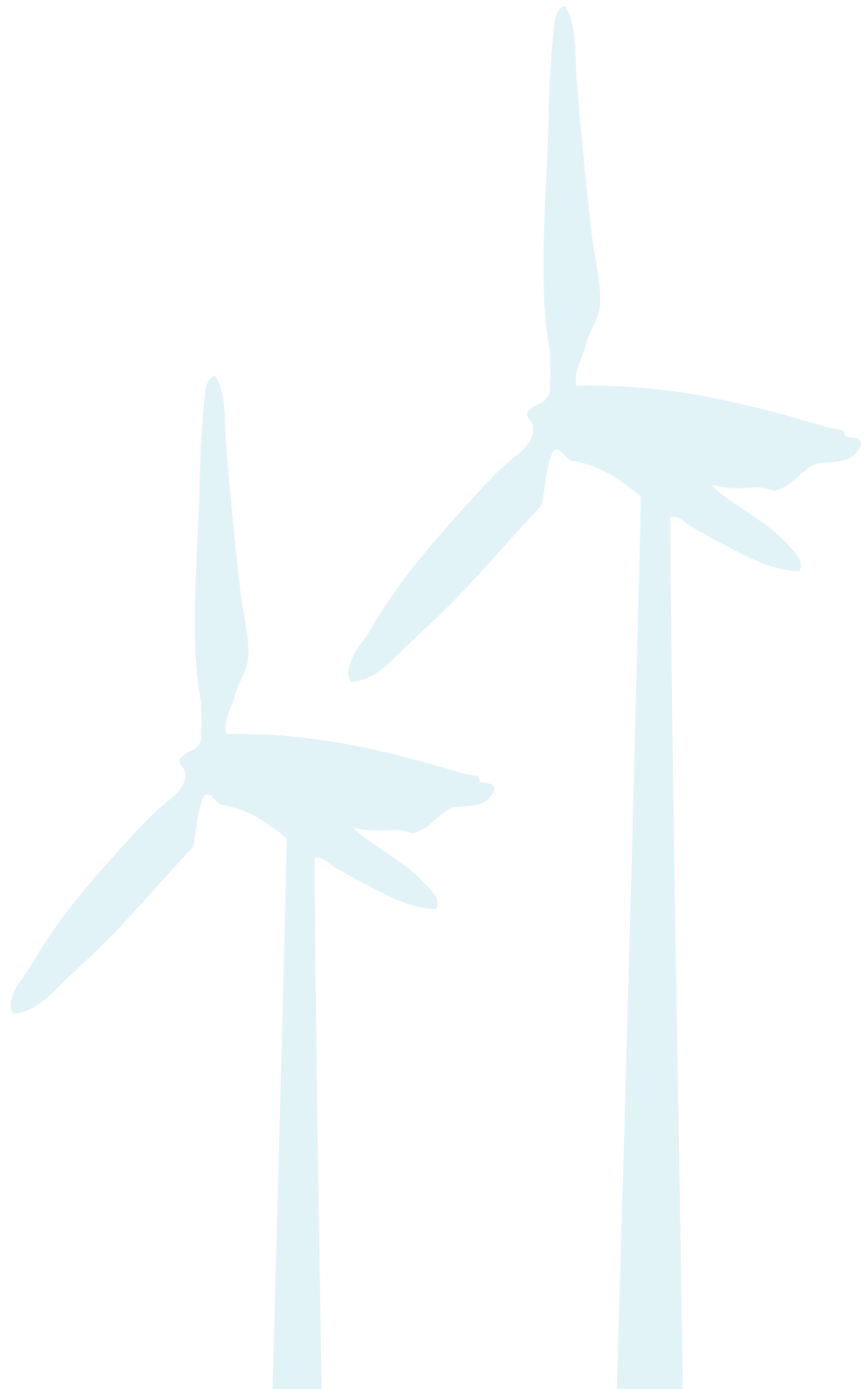
This inquiry has focussed on how the manufacturing sector can adapt to these challenges and become more productive, resilient, and sustainable as it builds back from the pandemic.

Chapter 1 reviews the vulnerabilities identified within UK manufacturing over the last eighteen months and explores how businesses can build resilience. The firms that appear to have fared best through the pandemic were those that adapted to the new environment quickly and were able to repurpose production in reaction to changing demand. These companies also focused on the creation of long-term, intrinsic value that will allow them to become resilient to a wide range of external shocks. In particular, businesses that prioritised non-labour efficiency – i.e. increasing the value derived from every tonne of material, litre of water, and kilowatt of energy that goes into the production process - appear to have been best insulated against commodity price volatility and supply chain disruption. It is essential, therefore, that the sector learns the lessons from these high performers in order to mitigate the impacts of future disruption.

Resilience and sustainability go hand-in-hand. **Chapter 2** explores how improving efficiency can help the manufacturing sector deliver on the Government's net-zero target. This will not be easy, particularly as many production processes, such as for chemicals, cement, glass, and steel are energy-intensive and difficult to decarbonise. The Government's Industrial Decarbonisation Strategy provides an indicative roadmap for how this can be achieved, especially within the UK's regional industrial clusters, which will be the first to benefit from emissions reduction technology, such as carbon capture, usage, and storage, and hydrogen fuels. However, dispersed sites will need to decarbonise through more traditional means, such as by enhancing energy and resource efficiency or embracing the principles of circular economy. We have therefore made a number of recommendations to Government on how businesses can achieve this, including through finance options, tax incentives, and development of a world-leading product standards and labelling system.

The manufacturing sector will be crucial in developing the technology that will help other sectors to decarbonise, such as low carbon fuels, renewable energy, battery technology, and carbon capture, usage, and storage. **Chapter 3** explores how 'skills gaps', currently present throughout the sector, can be closed through high-quality post-16 technical education focussing on science, technology, engineering, and maths in the context of a green economy. Thankfully, many of these 'green skills' that will be required in future already exist in existing industry and are easily transferrable to new, 'green' sectors. However, a more devolved and employer-led system would ensure that these skills are developed where they are needed most and allow an equitable transition away from carbon-intensive industries. A good example of this is the current shift of workers from oil and gas to offshore wind on Scotland's east coast. The Government's recent proposals for reform of technical education and training provide an opportunity to deliver these changes and put information around climate change and environmental stewardship at the heart of the tertiary education system.

The implications of both Covid-19 and the climate crisis mean that UK manufacturing faces an uncertain future. However, with the right help from Government, it will be possible to rise to these challenges and ensure that the sector is not only resilient to future disruption, but can set an example to the world on how to decarbonise, whilst continuing to provide the products that society wants and needs.



Recommendations

Business, Energy & Industrial Strategy

Building Resilience page 15

Recommendation 1: A national advice and support service should be established as an independent resource to help the UK's manufacturing sector become more resilient to external shocks. The simplest way to do this would be to extend Made Smarter into a national service, building on its remit for advancing digitalisation, innovation, and skills. The national service should include development of best practice in resource efficiency and supply chain management, promote on-shoring where practical, encourage development of digital supply networks, and facilitate transition to a circular economy.

Getting Consumers to Choose Low Carbon page 25

Recommendation 3: The timescale set out within the Industrial Decarbonisation Strategy for understanding the emissions embodied within industrial products should be accelerated. A fully-operational reporting system should be developed to facilitate introduction of mandatory product standards and consumer labelling by 2025.

Department for Digital, Culture, Media & Sport

Broadband page 15

Recommendation 2: Government should recommit to its election pledge of delivering gigabit-capable broadband to every home and business by 2025. A delivery strategy should be developed including allocation of funding and a revised schedule for hard-to-reach premises.

Business, Energy & Industrial Strategy/Department for Education

Green Jobs Taskforce (Membership) page 31

Recommendation 7: The Green Jobs Taskforce should become permanent and its membership should be expanded to work with the newly-established Skills and Productivity Board and the National Manufacturing Skills Task Force.

Green Jobs Taskforce (Remit) page 36

Recommendation 10: The remit of the Green Jobs Taskforce should be extended to oversee the ongoing transition from carbon-intensive to high quality green jobs that is fair for all, in accordance with the Prime Minister's Ten Point Plan. The Taskforce should draw on experience from industry, academia, the third sector, and labour organisations.

Department for Education

Recommendation 8: Providers should receive multi-year funding budgets in order to deliver high-quality training that is targeted to address local skills gaps. Multi-year funding is critical to allow colleges to invest in equipment and facilities that are aligned with local employer-need. In particular, courses should focus on higher technical and vocational skills, to help drive innovation in green technology.

Recommendation 9: Delivery of Local Skills Improvement Plans should mandate training on climate change and decarbonisation to give learners a broad understanding of how their industry can help to meet the UK's net-zero target and promote environmental stewardship. This could be delivered with support from the Institute for Apprenticeships and Technical Education's existing Green Apprenticeships Advisory Panel.

Treasury

Recommendation 4: Government should use the power of loans, grants, and public procurement to incentivise businesses to adopt environmental management systems that help to improve energy and resource efficiency.

Recommendation 5: The forthcoming UK infrastructure bank should have a clear net-zero mandate. Priority should be given to financing for initiatives and funding for new technology that will help promote decarbonisation and delivery of net-zero greenhouse gas emissions by 2050.

Recommendation 6: The recently introduced corporation tax super-deduction, to allow companies to claim 130% capital allowances on all plant and machinery assets, should only be available to investment that reduces a business' carbon emissions. The allowance should be reviewed at the end of its two-year term, with a view to extension beyond March 2023.

1. Resilience

We will not be able to rise to the enormous challenges of combatting Covid-19, mitigating the impacts of climate change, and levelling up the economy without a resilient manufacturing sector. Neither should we fall behind competitor countries that are investing massively in their manufacturing sectors.

Jack Dromey MP, Commission Vice-Chair, Roundtable 4

The Covid-19 pandemic has had an unprecedented impact on the UK economy. Annual GDP for 2020 fell by 9.9% - the largest decline on record¹, unemployment peaked at 5.1%², and the Government deficit reached its highest ever level in peacetime. At the onset of the first lockdown, most sectors were encouraged to work from home and furlough staff where necessary. However, the Secretary of State for business wrote to UK manufacturing companies, urging them to keep production open and supply chains moving³.

Despite this, the manufacturing sector has suffered disproportionately, with an overall fall in production of 4.2% (February 2021 vs February 2020)⁴. Restrictions on travel meant that the aerospace and automotive industries have been particularly hard-hit, with year-on-year engine production down by 99.5% in April⁵ and overall vehicle registrations for 2020 down by 39.5%⁶.

The pandemic has exposed vulnerabilities in the manufacturing sector, especially with regard to the fragility of supply chains and reliance on China and East Asia for production. This was brought to light at the beginning of the pandemic as it emerged that production of Personal Protective Equipment (PPE) had been outsourced and 'just-in-time' practices meant that the UK had stockpiled just 7 days' worth of aprons and less than a day's worth of gowns⁷.

However, across the manufacturing sector, there are many examples of how businesses have demonstrated adaptability and resilience to combat the threats posed by Covid-19. Firms collaborated to solve challenges, such as the acute demand for ventilators; engaged with the public to form 'citizen supply chains'; and accelerated deployment of innovative solutions, such as 'no-touch' technology to limit the spread of the virus.

Disruptive events are becoming more frequent. The Government's 2013 Future of Manufacturing Project⁸ identified an age of disruption, experimentation and radical technology characterised by impacts from environmental and geopolitical events. This time is now upon us, and it is unlikely that there will be an extended period of stability before the next major shock. It is, therefore, essential that manufacturing businesses plan for this kind of disruption if they are to remain competitive.

This chapter explores how the manufacturing sector can build resilience to external shocks, not only to public health crises, but also to wider issues, such as the implications of leaving the EU, financial shocks, the climate crisis, or even unforeseen and highly unpredictable 'black swan'⁹ events.

¹ GDP monthly estimate, UK: December 2020, Office for National Statistics, February 2021

² Employment in the UK: February 2021, Office for National Statistics, February 2021

³ Letter to those working in manufacturing in the UK from Alok Sharma, Secretary of State for Business, Energy and Industrial Strategy, April 2020

⁴ Coronavirus and the impact on output in the UK economy: February 2021, Office for National Statistics, February 2021

⁵ UK engine production declines 99.5% in April as coronavirus lockdown halts manufacturing (article), The Society of Motor Manufacturers and Traders, May 2020

⁶ New car registrations fall by 39.5% as showroom closures stifle demand, Society of Motor Manufacturers and Traders, February 2021

⁷ The supply of Personal Protective Equipment (PPE) during the Covid-19 pandemic, National Audit Office, November 2020

⁸ The future of manufacturing: a new era of opportunity and challenge for the UK, Government Office for Science, October 2013

⁹ The black swan: the impact of the highly improbable, Taleb, N. N., February 2010

1.1. Defining Resilience

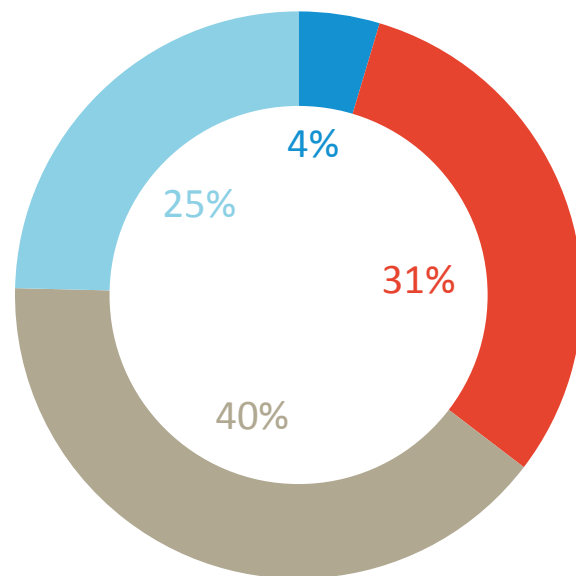
The concept of resilience can be applied in a number of different disciplines including psychology, ecology, and the built environment. In the context of manufacturing, resilience can be defined as the “ability to manufacture a constant quality at reasonable costs and production time, despite disturbances and uncertainties”¹⁰. When measuring against these criteria of quality, cost, and production time, the pandemic is likely to have affected almost all UK manufacturing businesses.

Figure 1:

“How prepared was your business for disruption associated with the 2020 COVID-19 pandemic?”

(survey response, n=65)

- Very well prepared
- Well prepared
- Somewhat prepared
- Unprepared



The majority of the respondents in our survey felt some level of preparedness for the disruption caused by the pandemic, but a quarter did feel unprepared to an extent. Resilience is, therefore, something that should not be overlooked when companies are planning for the future.

¹⁰ Manufacturing resilience: towards resilience management in production engineering (Medium article), Trauth, D., April 2019

1.2. Weaknesses

The pandemic has acted as a stress test exposing vulnerabilities in the UK manufacturing sector, many of which became apparent in spring 2020 as businesses struggled to meet demand from the NHS for PPE and medical equipment. Weaknesses highlighted to this inquiry include the following:

Offshoring production – Since the early 1970s, the UK manufacturing sector has reduced in size from around 30% of GDP to below 10%¹¹ and is now smaller than those of France, Italy and Germany¹². During this time, offshoring has been seen as a way to cut production costs and remain competitive. However, this has led to a ‘race to the bottom’ on price and often leaves businesses with reduced control over quality, cost, and timescales.

Reliance on overseas supply chains – Modern supply chains represent sophisticated networks where goods move back and forth between companies, sectors, and countries. However, this complex global nature of supply chains means that they are now more exposed than ever to both supply-side and demand-side risks. The onset of the pandemic led to the closure of many Chinese factories and displacement of workers, which had knock on-effects for UK Original Equipment Manufacturers (OEMs) with global supply chain exposure. By March 2020, 89% of UK manufacturing businesses were either experiencing or anticipating difficulties in sourcing parts from overseas¹³.

Production strategies – Many UK OEMs, such as those in the automotive industry, rely heavily on ‘just in time’ production, where component deliveries are organised to maximise production efficiency. However, these practices leave businesses vulnerable to disruption, especially where components are bespoke and the final product, such as a car, cannot be completed without them.



¹¹ Manufacturing unlocked: how to make a revival in manufacturing a reality, John Mills Institute for Prosperity, February 2021

¹² UK Manufacturing: the facts 2019/20, Make UK, September 2019

¹³ YouGov survey of 244 manufacturers, Make UK, March 2020

1.3. Strengths

Despite the difficulties faced during the pandemic, the manufacturing sector has adapted to support demand for essential products and services. Businesses that acted proactively, leveraged their network of contacts, and engaged with their workforce appear to have proved most resilient to disruption.

Collaboration – The benefits of working together rapidly became apparent during the pandemic, and businesses collaborated not only with their competitors but also with the NHS, universities, and supply chain partners in the interest of the common good.

For example, under the leadership of the High Value Manufacturing Catapult's CEO, Dick Elsy, an industrial consortium was rapidly assembled to tackle the UK's shortage of ventilators. Businesses across the aerospace, automotive, and medical sectors shared staff, materials, and expertise to develop two ventilator designs based on existing technology. The Ventilator Challenge consortium succeeded in delivering over ten years' worth of ventilator stock in just ten weeks.

Elsewhere, members of Cambridge's Makespace manufacturing community collaborated with the clinical engineering team at Cambridge University Hospitals NHS Foundation Trust to respond to the overwhelming demand for medical visors. The two parties worked together to deliver a visor specification that was acceptable to the hospital's procurement team, without obtaining the usual 'CE' European Conformity marking for product safety. They made these designs available as open source files so that other companies, such as Display Mode (see below), could reproduce them at scale to meet demand¹⁴.

Adaptation – Across the country, rather than shutting down production, many firms adapted and repurposed their businesses to meet demand for materials in short supply. In the case of PPE, these items were often either donated or provided at-cost. However, in some instances, manufacturing companies found that they were able to generate whole new profitable lines of business by embracing this change.

One example of a business that adapted particularly well was Northamptonshire-based Display Mode, who manufacture displays and fixtures for the retail market. As the lockdown closed stores across the country Display Mode experienced a significant drop in sales. Rather than shutting down production and furloughing staff, they repurposed their business to produce visors for the NHS. They identified open-source designs and used their existing expertise in working with plastics to develop a product that could be rapidly supplied to healthcare professionals. Little-used equipment such as roller presses became valuable assets as they scaled up production from their initial capacity of 10,000 units per week. Display Mode have now delivered more than 7 million visors¹⁵.

Learning – The pandemic has forced many manufacturing businesses to embark upon a rapid journey of learning and change – developing new supply chains, processes, and even products themselves. In many instances, companies turned to digital technologies to help find solutions to the problems created by Covid-19. For example, the use of sensors to relay real-time information on production to remote staff has reduced the need for face-to-face interaction on the shop floor.

¹⁴ The power of repurposing: how smaller manufacturers helped the UK withstand Covid-19's first wave (article), Institute for Manufacturing, December 2020

¹⁵ The power of repurposing: case studies (article), Institute for Manufacturing, December 2020

1.4. Overseas Comparisons

When considering how Government can support businesses to build resilience and recover from the impacts of Covid-19, it is useful to compare the UK's response to that of its overseas peers. The University of Cambridge's Institute for Manufacturing Education and Consultancy Service has undertaken a review of international manufacturing policy responses to the pandemic¹⁶. The work identified that policy responses could be classified into three key focus areas.

Firstly, governments have focussed on **ensuring continuing operation of manufacturing businesses** by providing direct financial aid and fiscal support, such as VAT deferral and tax exemptions, to help companies stay in business and retain employees. This included Germany's €50 billion in non-refundable grants for business and the self-employed¹⁷, Singapore's \$2.3 billion support package to shore-up cash flow and retrain employees¹⁸, and the USA's \$500 billion in loans to large companies as part of the country's first stimulus package¹⁹.

Secondly, governments have **mobilised manufacturing towards critical supplies**, formally promoting the production of PPE and in-demand medical equipment. For example, Japan provided subsidies for businesses willing to repurpose their production lines to manufacture PPE²⁰ and China offered loans for development of goods critical to the pandemic response²¹. Countries have also simplified procedures for importing materials necessary for domestic SARS-CoV-2 testing²² and cut red tape to allow a wider range of suppliers to produce medical equipment²³.

Finally, programmes have been established to support **post-crisis manufacturing growth**. These included programmes to boost investment, productivity, and skills development, such as subsidies offered for online vocational training in China²⁴. Many countries also produced guidelines for manufacturing businesses covering employee health and workplace safety.

More recent international responses have promoted on-shoring, investment in supply chain resilience, and development of centres of excellence and innovation²⁵. For example, the Japanese Government provides subsidies for businesses to on-shore manufacturing and diversify their production across the Association of Southeast Asian Nations²⁶. Japan also provides subsidy funding that covers up to 75% of the costs of repairing and upgrading damaged supply chains, including investment in digitalisation and teleworking. Finally, centres of innovation will play a key role in recovery from the pandemic. For example, the German Fraunhofer Institute, Europe's largest application-orientated research organisation, provides support to companies in the medical and life sciences sector and assists manufacturers in development of PPE.

¹⁶ Covid-19: International manufacturing policy responses – a preliminary review of international approaches to supporting the manufacturing supply chains and workforce, University of Cambridge Institute for Manufacturing Education and Consultancy Services, April 2020

¹⁷ Fifty billion euros in emergency aid for small businesses (press release), German Federal Ministry for Economic Affairs and Energy, March 2020

¹⁸ Stabilisation and support package, Government of Singapore, March 2020

¹⁹ Here's what's in the \$2 trillion virus stimulus package (article), Bloomberg, March 2020

²⁰ Measure for supporting SMEs affected by novel coronavirus to be taken, Japanese Ministry for Economy, Trade, and Industry (press release), February 2020

²¹ Notice on the implementation of temporary postponement of the repayment of principals and interests for small, medium and micro enterprise loans (press release), China Banking and Insurance Regulatory Commission, March 2020

²² Simplification of the administrative procedures for chemical substances related to Covid-19 (press release), Korean Industrial Environment Division, March 2020

²³ Enforcement policy for ventilators and accessories and other respiratory devices during the coronavirus disease 2019 (Covid-19) public health emergency, United States Food and drug Administration, March 2020

²⁴ China's support policies for businesses under covid-19: a comprehensive list (article), China Briefing, March 2020

²⁵ Covid-19: International manufacturing policy responses (update), University of Cambridge Institute for Manufacturing Education and Consultancy Services, September 2020

²⁶ Emergency economic measures to deal with Covid-19, Japanese Cabinet Office, April 2020

1.5. Building Resilience

Risk management is an important part of resilience planning for any business. However, many of the shocks that have had the most profound impact on the manufacturing sector, such as the 2008 financial crisis or the recent Covid-19 pandemic, were not identified as high-probability events. Even within the UK's 2020 National Risk Register, pandemics and high consequence infectious disease outbreaks were given between a 0.4% and 5% chance of occurring within the next year²⁷.

Businesses' efforts to build resilience must therefore go beyond traditional risk management exercises. This is easier said than done, as firms tend to focus on the most likely disruptions, such as short-term price fluctuations and supply chain security²⁸. Good resilience planning should centre on changes that are mutually beneficial to the business, its employees, its customers, and the environment. This often involves embracing sustainable ways of operating through, for example, reducing consumption of raw materials to limit exposure to fluctuation in commodity prices or by investing in nature-based infrastructure to limit the effect of extreme weather events such as flooding. Sustainability in manufacturing is explored in more detail within the following chapter, however, the following options for improving resilience were commonly cited in this inquiry:

Prioritising resource efficiency over labour efficiency – Non-labour productivity focusses on increasing the value derived from every tonne of material, litre of water, and kilowatt of energy that goes into the production process. Over the last two decades UK manufacturers have focussed on cutting jobs and increasing labour productivity, rather than reducing non-labour costs. However, resource costs are typically five-times higher than labour costs for the average manufacturing business²⁹. The benefits of increased non-labour productivity are therefore numerous, including reduced carbon emissions, material costs, and waste. Furthermore, businesses that prioritise non-labour efficiency also improve resilience by reducing their exposure to price volatility of raw materials and insulate themselves against supply-side shocks.

On-shoring – Returning manufacturing processes to the UK can help to address the challenges identified in section 1.2 and improve resilience. Given the relatively high cost of doing business in this country, along with other challenges such as skills shortages, it is unlikely to be economical to on-shore all parts of existing global supply chains. In many cases, however, it makes sense to return production to the UK or diversify supply chains across different geographies in order to reduce reliance on a single region (commonly east Asia), gain greater control over production costs, and increase efficiency. Government can also play a role, in providing certainty to business by backing technologies key to the green agenda. For example, the Government's commitment to produce enough electricity to power every home in the country via offshore wind³⁰ will help to drive inward investment and also create new jobs. Decision-making processes about the benefits of on-shoring can be polarising and complex, as traditional cost-benefit analysis often inadequately accounts for externalities such as the impact on communities or the environment.

²⁸ National risk register, HM Government, December 2020

²⁹ The business case for resilience, Arcadis, July 2019

³⁰ Lean and clean: building manufacturing excellence in the UK, Green Alliance, October 2017

RECOMMENDATION 1:

A national advice and support service should be established as an independent resource to help the UK's manufacturing sector become more resilient to external shocks. The simplest way to do this would be to extend Made Smarter into a national service, building on its remit for advancing digitalisation, innovation, and skills. The national service should include development of best practice in resource efficiency and supply chain management, promote on-shoring where practical, encourage development of digital supply networks, and facilitate transition to a circular economy.

Telecoms investment – The UK has a history of slow adoption of high-speed broadband, and in 2019, Ofcom reported that full-fibre broadband (i.e., installing fibre-optic cable from the provider directly into the premises) was available to only 10% of homes³¹. The UK also ranks amongst the worst European performers in terms of connection speed³². Rollout of full-fibre broadband will be a major prerequisite for the future success of the manufacturing sector, especially as businesses become increasingly reliant on digital communications for remote working. The Government's original pledge to deliver nationwide gigabit broadband (offering the fastest connections averaging over 1 gigabit per second) by 2025 has been replaced with a target of 85% coverage, set out in the National Infrastructure Strategy³³. The National Infrastructure Commission regards this current target as "challenging but achievable"³⁴. However, given the importance of digital connectivity in the post-Covid-19 economy, this strategy risks leaving behind businesses in hard-to-reach premises. Looking further ahead, the speed and flexibility of the 5G network will have additional benefits for manufacturing including the use of Internet of Things (IoT) and sensor technology to monitor performance in real-time. It will be important to develop a strong 'backbone' to the current fibre-optic network to ensure that there is capacity within the system for successful roll-out of 5G in future.

RECOMMENDATION 2:

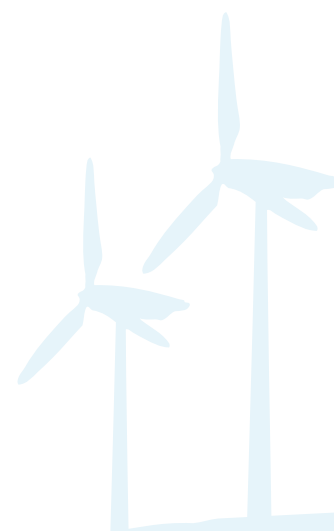
Government should recommit to its election pledge of delivering gigabit-capable broadband to every home and business by 2025. A delivery strategy should be developed including allocation of funding and a revised schedule for hard-to-reach premises.

³¹ Connected nations 2019 UK report, Ofcom, December 2019

³² Worldwide broadband speed league 2020, Cable, 2020

³³ National infrastructure strategy, HM Treasury, November 2020

³⁴ Annual monitoring report 2021, National Infrastructure Commission, February 2021



Digitalisation – By embracing developments in technology associated with the fourth industrial revolution such as big data, Internet of Things, 3D printing, and machine learning, the manufacturing sector could achieve efficiency gains of 35% and see overall growth of between 1.5-3%³⁵. The largest productivity gains, and subsequently the greatest impacts on regional economic performance, are likely to be achieved by tackling low adoption rates of digital technology in SMEs. Industrial Digital Technologies (IDTs) such as robotics, artificial intelligence, and additive manufacturing are largely mature. However, they are still not being used widely enough to raise the competitiveness of the UK manufacturing sector as a whole.

A shift from traditional supply chains to Digital Supply Networks (DSNs) can also help manufacturing businesses gain greater end-to-end oversight and be more responsive to changes in supply and demand³⁶. DSNs can use technology such as remote sensing and artificial intelligence to create bespoke, intelligent networks that react and adapt to new information in real time. Adopting DSNs can improve resilience by reducing material and transport costs, improving efficiency, and increasing responsiveness.

People – There is a significant body of evidence demonstrating the correlation between employee satisfaction and productivity³⁷. Evidence submitted to this inquiry identified that businesses who communicated their pandemic response strategy to employees and sought feedback from staff were able to adapt to new ways of working most effectively. Corporate culture that promotes trust and transparency between management and employees is therefore likely to result in the most robust response to wider external shocks and limit staff turnover.

³⁵ Is UK industry ready for the fourth industrial revolution?, Boston Consulting Group, January 2017

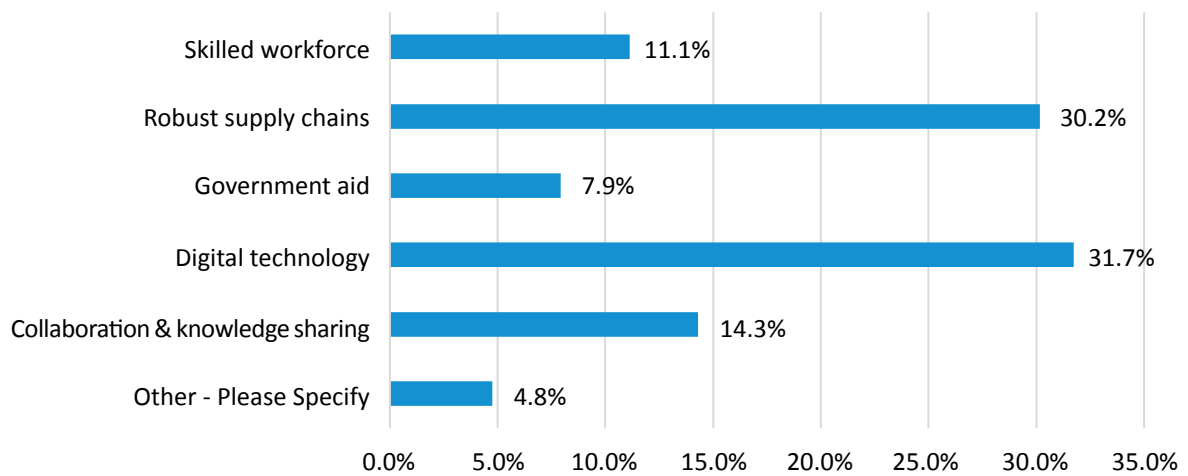
³⁶ Manufacturing supply chains – the evolution from supply chains to networks and potential disruptors, Make UK, May 2020

³⁷ Employee wellbeing, productivity, and firm performance, CEP discussion paper no. 1065, Krekel, C. et.al., March 2019

Figure 2:

“What do you consider the biggest factor in helping your business adapt to disruption and external shocks in future?”

(survey response n=63)



The role of digital technology was cited most frequently when businesses were asked to consider the biggest factor in helping them to adapt to disruption associated with the pandemic, closely followed by access to robust supply chains. Other factors specified include an agile workforce, a robust financial position, and low overheads.

1.6. Importance of R&D

Research and Development (R&D) budgets are among the first places where businesses look to economise during times of hardship. However, many of the technologies that will help the manufacturing sector to build resilience and decarbonise are not yet fully developed. The Manufacturing Commission's 2020 inquiry, *Level Up Industry*³⁸, highlighted that the UK spends well below the Organisation for Economic Co-operation and Development (OECD) average of 2.4% of GDP on R&D, and we welcome the Government's target to increase UK R&D investment to this level by 2027. The Commission previously recommended that, to maximise this increase in R&D spending, Government should create an innovation network to bring together Government agencies, centres of innovation, universities, and businesses. The benefits of collaboration between these bodies should be designed into the operation of the new Advanced Research and Innovation Agency (ARIA) being created to support R&D and high-risk innovation.

Investment in R&D is also not equitable across the country – regions with higher overall private sector investment in R&D, such as the West Midlands, North West and Yorkshire and Humber, tend to be underserved by public R&D investment, which predominantly goes to the 'golden triangle' areas of South East England. Ahead of the next Comprehensive Spending Review, Government should consider where public R&D investment is directed and whether investment could be more effectively deployed to leverage private sector investment across all regions of the UK.

Later this year, Policy Connect's Higher Education Commission will report the findings of their current inquiry, which explores how R&D activity can be increased throughout the UK. The work aims to outline a policy plan to help achieve the Government's 2.4% ambition whilst reducing long-standing regional economic disparities and unlocking innovative solutions to help industry decarbonise.

³⁸ *Level up industry: strengthening regional manufacturing*, Policy Connect, March 2020

2. Transitioning to a globally competitive, decarbonised, and sustainable manufacturing sector



If every manufacturing business matched the most efficient operator in its own sector, companies, on average, would be 24% more profitable, would generate 30% more jobs, and would report a 9% reduction in greenhouse gas emissions.



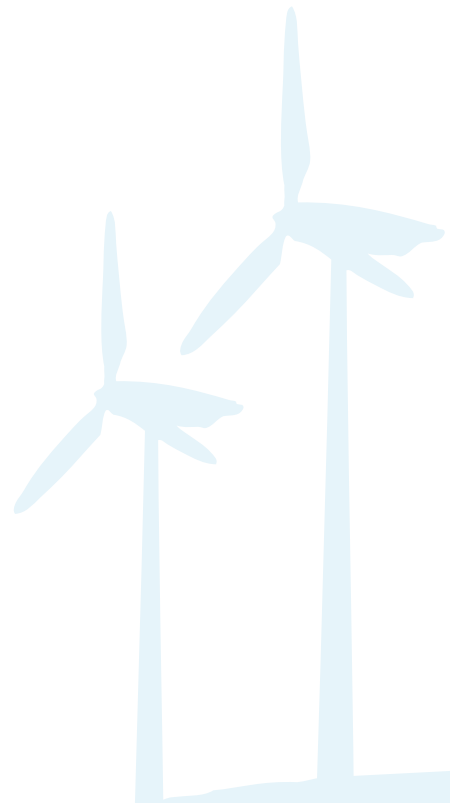
Professor Steve Evans, University of Cambridge Institute for Manufacturing, Roundtable 1

Greenhouse gas emissions from manufacturing were 60 MTCO₂e in 2018³⁹ and the sector is facing an unprecedented challenge to reach net-zero by 2050. However, manufacturing is essential to the UK's social and economic prosperity, producing everything from the food we eat and the cars we drive to the steel that goes into new buildings and the chemicals used in our pharmaceutical industry. The manufacturing sector must continue to be able to produce the things that society wants and needs, whilst consuming a fraction of the material and energy needed to do so.

Earlier this year, the Government published its Industrial Decarbonisation Strategy (IDS)⁴⁰, which sets out how industry can decarbonise in line with net-zero while remaining competitive and without pushing emissions abroad. The Strategy details how carbon emissions from industry should be reduced by two-thirds by 2035 and by at least 90% by 2050, with the remaining offset by technology, such as carbon capture, usage, and storage.

However, energy intensive manufacturing industries including chemicals, glass, oil, iron, and steel are hard to decarbonise and contribute over half of the UK's industrial emissions⁴¹. These industries are predominantly located within industrial 'clusters' at Grangemouth, Teeside, Humberside, Merseyside, South Wales and Southampton. The IDS includes a strong focus on reducing emissions from clustered sites, which will be achieved through a combination of fuel switching, energy efficiency, and carbon capture, usage, and storage.

This chapter explores how businesses can become more sustainable and carbon-neutral, with a particular focus on 'dispersed' sites that fall outside of the UK's six industrial clusters.



³⁹ The sixth carbon budget: manufacturing and construction, Committee on Climate Change, December 2020

⁴⁰ Industrial decarbonisation strategy, Department for Business, Energy, and Industrial Strategy, March 2021

⁴¹ Industrial decarbonisation strategy, Department for Business, Energy, and Industrial Strategy, March 2021

2.1. Challenges

When submitting evidence to this inquiry, manufacturing businesses regularly cited the UK's **high industrial energy costs** as a barrier to international competitiveness. In particular, electricity, which has seen associated carbon emissions fall by two-thirds over the last decade⁴², is priced significantly higher in the UK than in Europe. Higher costs for items produced domestically can drive investment overseas and lead to 'carbon leakage', should overseas nations have less ambitious emissions reduction policies. This disparity in production costs should be addressed, and the Government has committed to consulting on the affordability and fairness in the UK's energy system. Although a detailed examination of industrial energy costs was outside the scope of this inquiry, the All Party Parliamentary Manufacturing Group have been working with the UK Energy Intensive Users Group in order to further develop recommendations on how energy intensive manufacturing businesses can decarbonise while remaining competitive.

Manufacturers also cited challenges associated with **competition from carbon-intensive products manufactured overseas**, which are currently often cheaper than low-carbon domestic alternatives. It will therefore be important to understand the carbon emissions 'embedded' within imported products, so that consumers can better understand the implications of their purchasing decisions and so 'green' products that are manufactured in the UK can be championed. Understanding embedded carbon would also allow the development of a product labelling scheme similar to that for the energy efficiency of home electronic equipment, as recommended in section 2.3.

When considering global competitiveness, manufacturing businesses based in the UK, but with global exports, have suffered from a relatively **strong pound** during the late twentieth and early twenty-first centuries. This has disproportionately affected the manufacturing sector, given its reliance on machinery and raw materials, over and above the more widely incurred costs relating to wages, overheads, interest, and tax that are linked to the exchange rate of the local currency. The relative strength of the pound has implications for economic growth and average incomes. This is something for Government to consider, especially in their ambition for increased exports of green technologies such as electric vehicles, wind turbines, and heat pumps.

The manufacturing sector traditionally relies on equipment with long replacement cycles and so it will be crucial to ensure that **replacement assets** are as efficient and possible and compatible with low carbon fuels of the future. This can be particularly challenging for smaller businesses outside the UK's industrial clusters, where the timeline for access to low-carbon heat, power, and infrastructure is more uncertain.

Access to finance was regularly reported as a barrier to improving efficiency, particularly in the wake of the pandemic as businesses face key choices over where to direct internal investment. Manufacturers surveyed as part of the West Midlands Green Manufacturing Commission⁴³ cited "lack of funding to invest in transitioning to green production technologies" as the number one barrier for both their businesses and the sector in general. Accelerating uptake will be important, given that energy efficiency improvements are anticipated to achieve emissions reductions of 4 MtCO₂e per year by 2050⁴⁴, and technologies with low payback times are already available in the market⁴⁵. Measures include heat recovery, process upgrades, equipment upgrades, and integration/clustering. In particular, replacement of inefficient pumps, motors, and compressors was identified as an area where payback times can be especially quick. However, companies struggle to access transition finance, particularly SMEs with low credit scores. Even when finance options are available, firms tend to prioritise replacement of equipment based on age and performance, rather than efficiency.

⁴² UK energy sector has "fastest rate of decarbonisation in the world", Smart Energy International (article), February 2020

⁴³ Survey for West Midlands Green Manufacturing Commission, January 2021

⁴⁴ Sixth carbon budget, manufacturing and construction, Committee on Climate Change, December 2020

⁴⁵ Reducing industrial energy demand in the UK: a review of energy efficiency technologies and energy saving potential in selected sectors, Chowdhury, J. I. et al., Renewable and Sustainable Energy Reviews, 2018

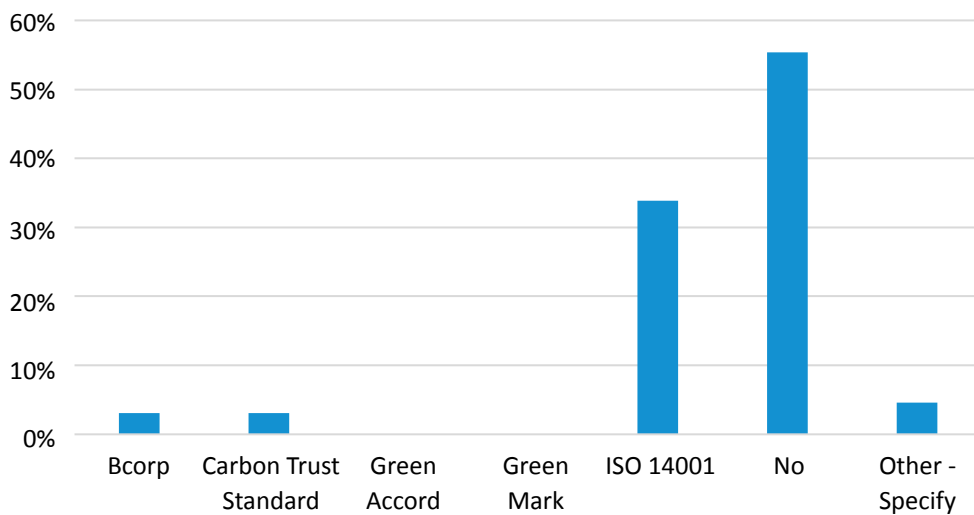
Although not directly related to the manufacturing process itself, businesses reported challenges associated with the **efficiency of existing industrial buildings**, which currently represent a major source of carbon emissions. Reconfiguring and retrofitting buildings can not only improve energy efficiency, but can also increase productivity and staff wellbeing. However, where buildings are leased, this is difficult to do and requires negotiation between the business and landlord on a case-by case basis.

Finally, businesses have reported a **lack of capacity to develop sustainable ways of working** and a **lack of expertise** within management to do so. Budgets for investment in new equipment are often siloed and separate from those associated with business energy costs, which can lead to procurement of machinery that is more expensive to run and less energy efficient in the long term. Where businesses are actively trying to improve their environmental performance, the options for green accreditation and management systems can be overwhelming. For example, the ISO 14001 Environmental Management System helps businesses reduce their environmental impact, including energy and water consumption. However, the ISO 50001 Energy Management System is also aimed at improving sustainability, but focusses more narrowly on reducing energy use. Indeed, the majority of respondents in our survey did not hold any accreditation for sustainability.

Figure 3:

“Does your business hold any kind of accreditation for sustainability?”

(survey response n=29)



2.2. Benefits of Embracing Sustainability & Circular Economy

The benefits of **energy efficiency** to manufacturing businesses are well documented and a vital first step to improving energy efficiency is to measure use. However, many businesses do not view this as a priority – a recent survey by Make UK showed that over 95% of manufacturers do not even use half-hour meters. Actions to improve energy efficiency can often be ‘low-regret’, i.e. those that need to happen anyway and have short payback times. For example, electric motors found in industrial equipment, such as pumps, fans, compressors, and conveyors, contribute to 65% of industrial energy use worldwide⁴⁶. Simply replacing these motors with ones that include variable speed drives allows equipment to be run at an appropriate capacity for the task – a pump or fan running at 80% speed can use half the energy of the same product at full capacity⁴⁷. Beyond initial energy savings, installation of variable speed drives can also reduce the amount of maintenance that equipment requires, saving on lost production time.

Alongside energy efficiency, improving **material and resource efficiency** will be crucial to decarbonisation of the manufacturing sector, especially as production of raw materials accounts for 19% of carbon emissions globally⁴⁸. Research by Green Alliance estimates that improving resource efficiency in UK construction, vehicles, food and drink, electronics, and textiles could deliver savings of nearly 200MtCO₂e over the three carbon budgets to 2032. Improving resource efficiency also provides an opportunity to level-up parts of the UK that currently have below average productivity. These regions typically have larger manufacturing economies and improving resource efficiency will therefore have a bigger impact and help to close the UK’s productivity gap⁴⁹. As detailed within section 1.5, improved resource efficiency helps to improve resilience, by reducing exposure to fluctuations in commodity prices and risks from climate change-related events, such as water supply during times of drought or supply chain impact following storms and floods. Finally, resource efficiency can have wider environmental benefits, such as reduced demand for natural resources, reduced carbon emissions associated with mining and extraction of materials, and reduced waste generated as part of the manufacturing process.

The **circular economy** is based on the principles of designing out waste, keeping materials in use, and regenerating natural systems. If resource efficiency is concerned with putting less in, the circular economy can be thought of as getting more out, through product reuse, repair, recycling, and remanufacturing. Embracing the circular economy is not only of benefit to both businesses and consumers, it is also essential to the Government’s plans for a Green Industrial Revolution⁵⁰. For example, plans to quadruple offshore wind capacity will require significant amounts of the rare earth metals neodymium and dysprosium used in turbine construction. However, the UK has little or no native deposits of these metals and would therefore have to rely on virgin materials sourced from East Asia in huge quantities. Recycling of waste electronic items, which often contain rare earth metals, could offer a potential solution to this problem, as opposed to reliance on carbon-intensive overseas supply networks. The All Party Parliamentary Manufacturing Group is proposing to undertake further work associated with the challenges and benefits of moving to a circular economy in its forward programme.

⁴⁶ Identification of Technoeconomic Opportunities with the Use of Premium Efficiency Motors as Alternative for Developing Countries, Energies, Gomez, R, J et. Al, July 2020

⁴⁷ Energy efficiency: the benefits to business, Business Green, November 2012

⁴⁸ Lean and clean: building manufacturing excellence in the UK, Green Alliance, October 2017.

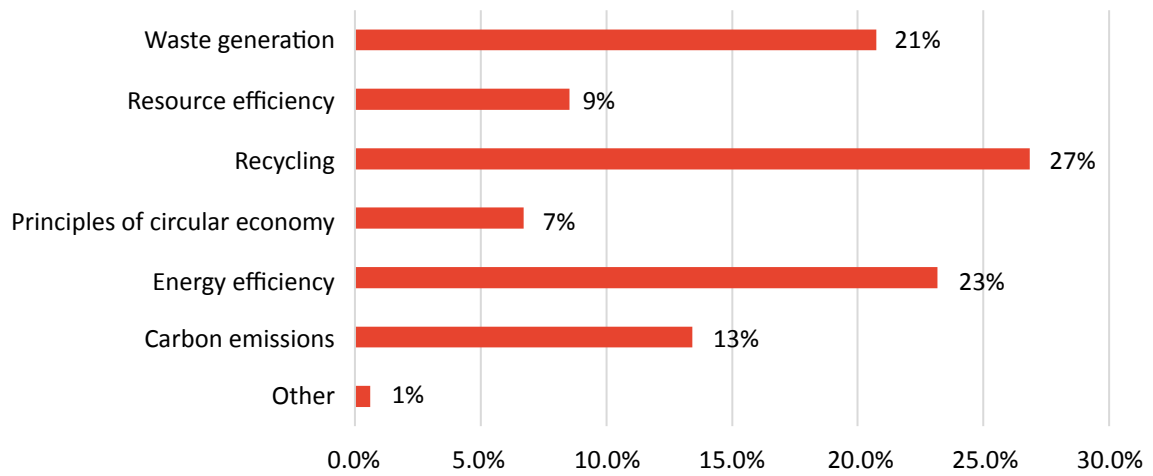
⁴⁹ Lean and clean: building manufacturing excellence in the UK, Green Alliance, October 2017.

⁵⁰ The ten point plan for a green industrial revolution, Prime Minister’s Office, 10 Downing Street, November 2020

Figure 4:

“Does your business incorporate, monitor, or report any of the following metrics to improve sustainability?”

(survey response n=52)



Almost all of the responding businesses in our survey collected some kind of data on sustainability. Those businesses that didn't cited financial constraints as the reason.

Embracing these principles of sustainability and circularity can have broader positive implications for businesses associated with public perception and brand reputation. Consumer-facing manufacturing businesses are facing increased scrutiny around environmental stewardship (e.g. in how they source their materials and package their products). Conversely, firms that have changed their business practices to better incorporate the circular economy have received positive media coverage, such as recent furniture rental models from John Lewis and Ikea⁵¹.

⁵¹ John Lewis kick-starts furniture leasing trials as Ganni unveils rental-only collection (article), Edie, August 2020

CASE STUDY – University of Cambridge & AB Sugar

Responding to anticipated changes to the EU Common Agricultural Policy and competition from overseas imports, AB Sugar implemented a phased programme of change at its sugar factory in Wisington, Cambridgeshire.

Initially, AB Sugar installed a combined heat and power system, which harnessed the steam used in the sugar manufacturing process to generate an additional 50MW of power to sell back to the electricity grid. What followed was a transformation of the factory, which took place over 25 years. Glasshouses were installed at the site to make use of the surplus heat, CO₂ and water from the refining process. These were originally used to grow tomatoes and the company became the UK’s largest domestic tomato producer, before switching to production of medicinal-grade cannabis. The company also turned its attention to the molasses syrup generated during the sugar production process and constructed a biochemical facility to separate out compounds such as betaine, which were sold as a nutrient to the fish feed industry and as a shampoo foaming agent in the cosmetics industry. Once again, the sugar factory became one of the largest producers of betaine in the world. AB Sugar also invested in a fermentation plant to convert various sugar streams into alcohol and was the first producer of bioethanol to the UK transport market. The CO₂ from the fermentation process was also captured and sold as an industrial gas. Finally, topsoil, washed from sugar beet as it entered the factory, was turned from a waste into a product for landscaping purposes.

As a result of all of these changes, the factory has become known as a ‘no waste biorefinery’ and is now one of the most efficient sugar beet factories in Europe, although the challenge of achieving complete carbon neutrality remains to be solved. During this real life transformation, The University of Cambridge Institute for Manufacturing collaborated with AB Sugar. Now, the underlying principles of industrial symbiosis are taught to undergraduates so that future generations of scientists and engineers can apply the principles of circularity to their own waste streams across many other industrial sectors.

Figure 5:
The Wisington integrated bio-refinery

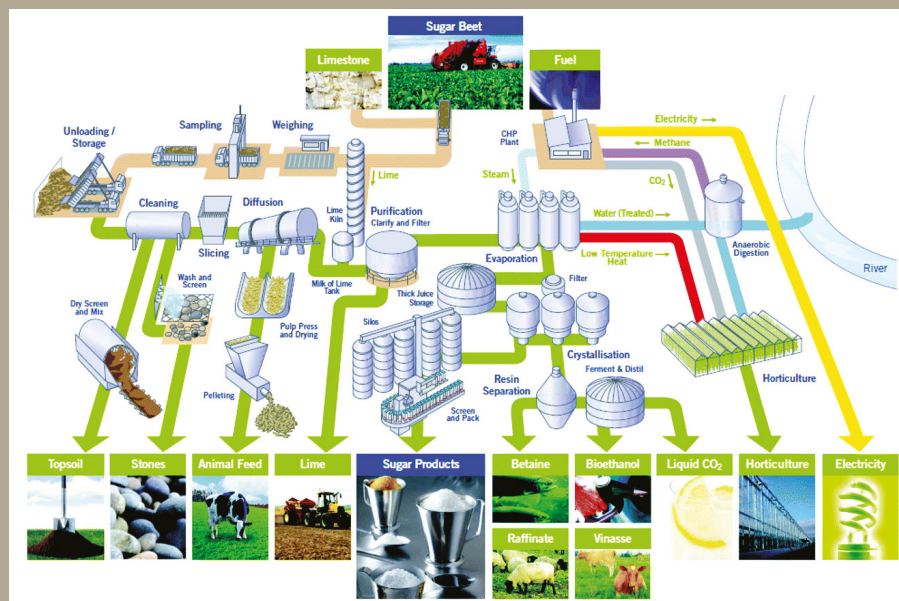


Image credit:
University of
Cambridge Institute
for Manufacturing
/AB Sugar

2.3. Solutions

As detailed in section 2.1, international competition from low cost, carbon intensive products can lead to carbon leakage. However, Government can support demand for low-carbon products without significantly impacting the cost to end-users⁵². The Government's Industrial Decarbonisation Strategy sets out a strategy for supporting decarbonisation of intermediary industrial products and for helping consumers to make informed choices about the environmental impact of buying decisions. The first step in this process is for businesses to start to collect data so that they can better understand the emissions associated with individual products, rather than their operations as a whole. Secondly, standards will need to be developed to distinguish low carbon products from those with higher embodied emissions. For example, manufacturers that met predefined, low carbon, product standards would receive accreditation to demonstrate this. Finally, manufacturers will be encouraged to meet these standards on either a voluntary basis, or by setting mandatory upper limits on emissions used during production. These standards and limits would then be tightened over time.

Alongside commitments on product standards, the Government is considering expanding the scope of existing product labelling, which has been successfully used to inform consumers on the energy consumption of home electronic equipment, to provide information on embodied emissions. This could create a 'virtuous circle' whereby introduction of labelling informs customers and increases consumer demand for greener products, which, in turn, incentivises manufacturers to accelerate the switch to low-carbon production. Domestic products with the lowest embodied emissions could be awarded a certificate to demonstrate their green credentials, similar to the 'Red Tractor' used in food production.

The Government's timeline for this process commits to a call for evidence on data collection for development of low-carbon industrial products within the next two years. Proposals for development of products standards and consumer labelling span the next decade with mandatory standards introduced from 2030 onwards. We consider that this timescale lacks ambition, especially as understanding emissions embodied within imported products will be important when negotiating trade deals following the UK's exit from the European Union.

RECOMMENDATION 3:

The timescale set out within the Industrial Decarbonisation Strategy for understanding the emissions embodied within industrial products should be accelerated. A fully-operational reporting system should be developed to facilitate introduction of mandatory product standards and consumer labelling by 2025.

Energy management systems and green accreditation programmes can help businesses of all sizes to become more energy and resource efficient. However, as detailed above, it can be confusing and time-consuming for businesses, especially SMEs, to decide which system is right for them. New voluntary standards, such as ISO 50005, can help SMEs by adopting a phased approach to implementation. Within the Industrial Decarbonisation Strategy the Government "encourages" businesses to adopt energy management systems and is "supportive" of new voluntary standards. However, there remains no direct incentive from Government to adopt them.

⁵² Industrial decarbonisation strategy, Department for Business, Energy and Industrial Strategy, March 2021

RECOMMENDATION 4:

Government should use the power of loans, grants, and public procurement to incentivise businesses to adopt environmental management systems that help to improve energy and resource efficiency.

Access to finance and tax incentives will be crucial for manufacturing businesses to make the investment necessary to decarbonise. Within the Industrial Decarbonisation Strategy, the Government considers how dispersed manufacturing sites can become more efficient through “funding schemes and finance options”, although the Strategy does not provide any further detail. We strongly recommend that net-zero should be prioritised within funding and tax incentives for business of all sizes; else this will be a lost opportunity to build back better.

RECOMMENDATION 5:

The forthcoming UK infrastructure bank should have a clear net-zero mandate. Priority should be given to financing for initiatives and funding for new technology that will help promote decarbonisation and delivery of net-zero greenhouse gas emissions by 2050.

RECOMMENDATION 6:

The recently introduced corporation tax super-deduction, to allow companies to claim 130% capital allowances on all plant and machinery assets should only be available to investment that reduces a business’ carbon emissions. The allowance should be reviewed at the end of its two-year term with a view to extension beyond March 2023.

Notwithstanding tax incentives proposed above, investment in new machinery and equipment can represent a significant investment for manufacturing businesses. Industrial equipment therefore tends to have long replacement cycles and if equipment is installed before supporting low-carbon infrastructure is available, such as carbon capture, usage, and storage or green hydrogen technology, then this can lead to costly retrofit requirements. Replacing assets with carbon neutral alternatives or with equipment that is ‘low carbon ready’ will be crucial to helping the manufacturing sector decarbonise. This may require finance options to be targeted to fund replacement of the most inefficient equipment rather than the oldest.

3. Skills



Without our engineers, scientists, and technicians we will never hope to achieve meaningful emissions reduction within the manufacturing sector. Skills associated with these roles are fundamental to achieving net-zero, without seeing a diminution in our quality of life.



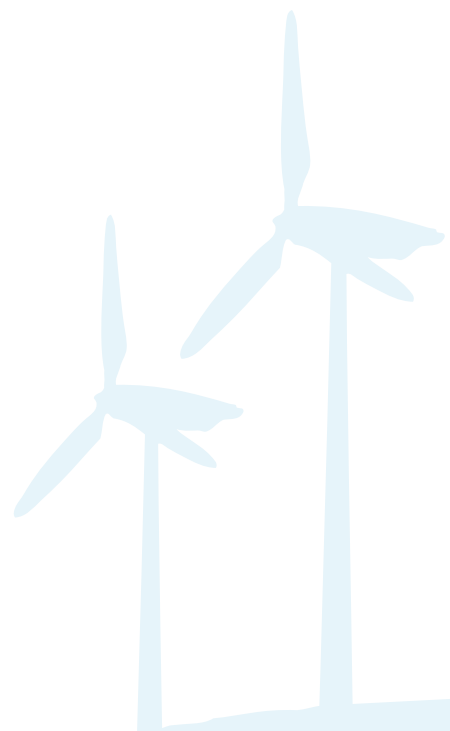
Rosa Wilkinson, High Value Manufacturing Catapult, Roundtable 2

Alongside the challenges that the manufacturing sector faces associated with reducing emissions, it is also responsible for creation of the products and technologies that will help other sectors to decarbonise. These include low carbon fuels, renewable energy, battery technology, remanufacturing processes, lightweight materials, and emissions reduction infrastructure such as carbon capture, usage, and storage. It is vital that these green technologies are developed to help accelerate decarbonisation across the rest of the economy.

However, employers are struggling to recruit workers with the skills that they need. Even before the pandemic, 63% of UK businesses were reporting skills shortages⁵³ and 'skills gaps' within the manufacturing sector were cited as a barrier to achieving net-zero. For example, the Prime Minister's Ten Point Plan for a Green Industrial Revolution⁵⁴ aims to install 600,000 heat pumps in buildings per year by 2028. However, research has indicated that there are major inadequacies in vocational education and training for heat pump installers and only a small minority of installers have relevant qualifications for heat pump installation at NVQ level⁵⁵.

Skills shortages come at significant cost to the economy. In 2019 businesses spent £4.4 billion on recruitment, temporary staff, increasing salaries to attract desired talent, and training to boost the skills of existing employees⁵⁶. Furthermore, research by the Confederation of British Industry anticipates that nine out of every ten employees in the UK will need to reskill by 2030, at an additional cost of £13 billion a year.

This chapter reviews the challenges that the manufacturing sector faces in developing the green skills required to deliver on net-zero.



⁵³ Business barometer, The Open University, July 2019

⁵⁴ The ten point plan for a green industrial revolution, 10 Downing Street, November 2020

⁵⁵ Residential heat pump installations: the role of vocational education and training, Gleeson, C. P., Building Research and Information, September 2015

⁵⁶ Business barometer, The Open University, July 2019

3.1. The Current Skills Landscape

The post-16 skills landscape in England is complex and comprises a mixture of market-based and Government supported provision. Skills providers include a range of organisations including Further Education (FE) colleges, community learning organisations, independent training providers, and Institutes of Technology. In addition to learners, providers, and Government, employers also seek to influence the skills system in order to develop the workforce necessary for their commercial success. The skills system comprises a plethora of stakeholders and funding, commissioning, and regulatory bodies, all of which have been subject to frequent policy change over the last 40 years. Indeed, the Institute for Fiscal Studies recently noted that the skills sector has been in an “almost permanent state of revolution”⁵⁷.

Policy Connect’s recent report, *England’s Skills Puzzle*⁵⁸, explores the challenges currently facing the skills system in detail. These include the difficulties that employers encounter in developing skills provision within their local area, the unintended consequences created as a result of existing funding arrangements, and the collective failure of the system to promote and encourage lifelong learning. In particular, the research identified that skills policy remains highly centralised and that skills provision is often not designed around the requirements of local labour markets. The inquiry also drew attention to the lack of funding for Further Education in England. For example, in 2017/18 the FE budget for England was £8 billion lower than the Higher Education budget, despite catering for twice the number of learners⁵⁹.

Earlier this year, the Government launched its *Skills for Jobs* white paper⁶⁰, which set out proposed reforms to post-16 technical education and training. The white paper acknowledged existing skills gaps, particularly within higher technical education, and the challenges that employers face in developing skills to meet local labour market demands. It also highlighted problems with current funding structures for FE providers that incentivise delivery of lower-value courses, which can be easily filled, rather than encouraging competition on quality. Proposed reforms include giving employers a central role in developing qualifications and training, greater clarity around provision of funding for providers, and a lifetime skills guarantee, which would include a lifelong loan entitlement to help people acquire new skills throughout their careers. However, only 25% of respondents in our survey were convinced that these reforms were sufficient to address current skills gaps within the sector.

⁵⁷ 2019 Annual report on education spending in England, Institute for Fiscal Studies, September 2019

⁵⁸ *England’s skills puzzle: piecing together further education, training, and employment*, Policy Connect, February 2020

⁵⁹ *Treating students fairly: the economics of post-school education*, House of Lords Economic Affairs Committee, June 2018

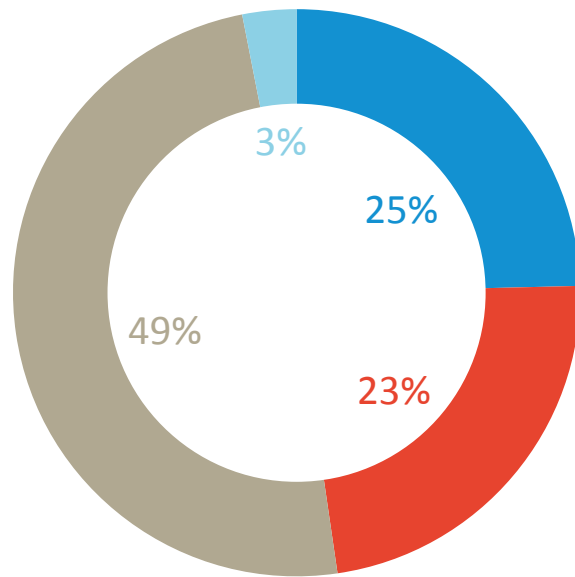
⁶⁰ *Skills for jobs: lifelong learning for opportunity and growth*, Department for Education, January 2021

Figure 6:

“To what extent do you agree that the Government’s ambitions for reforms to post-16 technical education and training set out in the Skills for Jobs White Paper are sufficient to address current skills gaps across the manufacturing sector?”

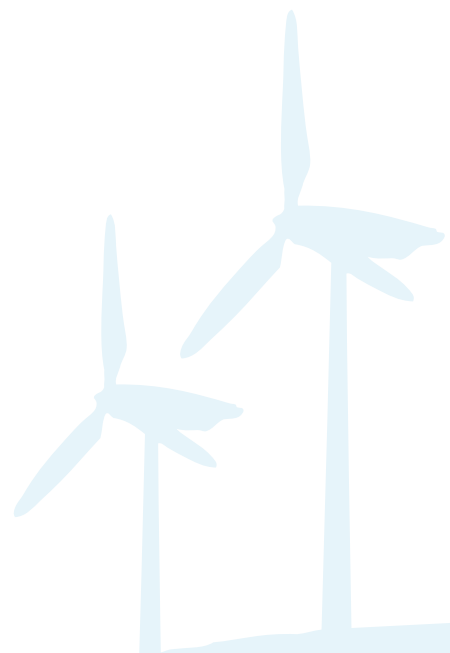
(survey response, n=65)

- Agree
- Disagree
- Neith agree or disagree
- Strongly disagree



Prior to publication of the Further Education White Paper a consortium of organisations from across the manufacturing sector had written to the Secretary of State for Education to highlight the skills crisis within all parts of the industry. This resulted in creation of the National Manufacturing Skills Taskforce⁶¹, whose membership includes Make UK, Enginuity, and the High Value Manufacturing Catapult. The Taskforce aims to work in partnership with Government to ensure that the sector can both attract and retain the skills that it needs to build back from the pandemic and remain competitive in future.

⁵¹ John Lewis kick-starts furniture leasing trials as Ganni unveils rental-only collection (article), Edie, August 2020



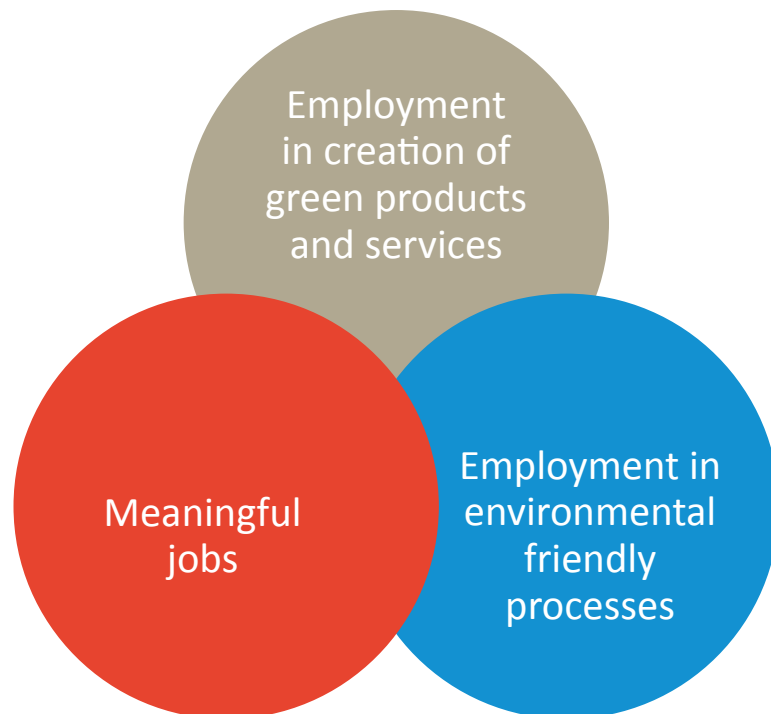
3.2. Green Jobs & Green Skills

Since February 2020 the number of payroll employees has fallen by 693,000, with the largest drop in employment seen at the start of the pandemic⁶². Although this situation is improving, it does provide an opportunity to create the conditions for new, 'green' jobs that provide meaningful employment, create environmental benefit, and help to achieve the UK's net-zero target.

The International Labour Organization defines green jobs as “decent jobs that contribute to, preserve, or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging, green sectors such as renewable energy and energy efficiency”⁶³. These jobs could be associated with production of low carbon products or services. For example, the Government anticipates that development of zero-emission vehicles alone will create 40,000 new roles by 2030⁶⁴. Alternatively, green jobs may be associated with development of environmentally friendly processes in existing businesses, such as retrofitting machinery and buildings to use less energy or developing systems for improved resource efficiency. The Government should work to deliver jobs that fall into these areas (see below) as part of its plan to build back better from the pandemic.

Figure 7:

The International Labour Organisation defines Green Jobs as those which fall into the hatched area.



⁶² Labour market overview UK, Office for National Statistics, March 2021

⁶³ What is a green job? (article), International Labour Organisation, April 2016

⁶⁴ The ten point plan for a green industrial revolution, HM Government, November 2020

In November 2020 the Government set up the Green Jobs Taskforce, with the ambition of creating two million good quality, green jobs by 2030. We consider this a realistic target, given the potential for 694,000 jobs in climate change mitigation (in England⁶⁵) and 517,000 in the circular economy (throughout the UK⁶⁶) over this period. The taskforce aims to promote the skills needed now for a green recovery, develop a long-term plan for delivery of a net-zero economy, ensure a diverse workforce in green jobs, and support workers in transitioning industries, such as oil and gas.

RECOMMENDATION 7:

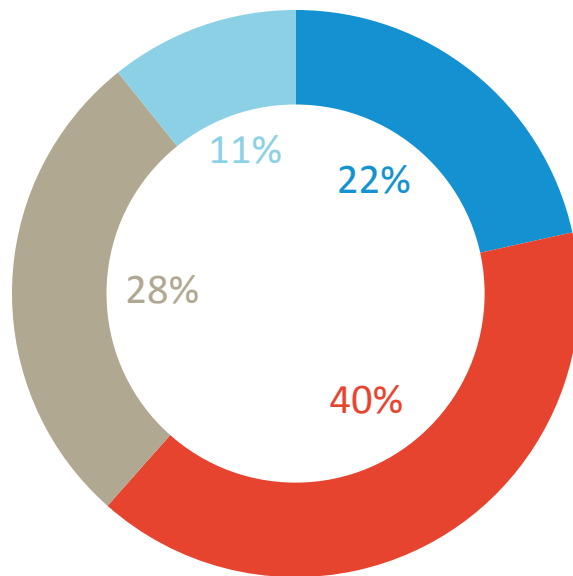
The Green Jobs Taskforce should become permanent and its membership should be expanded to work with the newly-established Skills and Productivity Board and the National Manufacturing Skills Task Force.

Figure 8:

“To what extent do you agree that the UK’s current workforce has the skills required to deliver on the Government’s target of net-zero greenhouse gas emissions by 2050?”

(survey response, n=65)

- Agree
- Disagree
- Neith agree or disagree
- Strongly disagree



It should also be recognised that even within existing industry, employees will have ‘green skills’ i.e. those required to adapt products, services, and processes to meet the needs of a low-carbon economy⁶⁷. For example, heating engineers, currently qualified to install and maintain gas boilers within homes and businesses, are only likely to require minor retraining to deliver on Government targets for domestic heat pump installation or development of hydrogen as a heat source in industry. However, in our survey, over half of respondents felt that the current workforce lacks the skills required to deliver on net-zero. As recommended above, formalisation of the Government’s Green Jobs Taskforce as a permanent body could ensure that green skills within the existing workforce are deployed most effectively, in order to close these skills gaps.

⁶⁵ Local green jobs – accelerating a sustainable economic recovery, Ecuity Consulting for Local Government Association, April 2020

⁶⁶ Employment and the circular economy: job creation in a more resource efficient Britain, Green Alliance and WRAP, January 2015

⁶⁷ OECD Green growth studies: greener skills and jobs - highlights, Organisation for Economic Cooperation and Development, February 2014

CASE STUDY – Determining Future Skills Needs

In 2020, Engenuity and the High Value Manufacturing Catapult jointly embarked on a project to determine the future skills needs for the engineering and manufacturing sectors. Spurred by significant technological developments, the process integrates expert and technologist knowledge with advanced machine learning to determine these sectors' future requirements and map the journey from where we are now.

The data driven approach integrates existing skills databases, such as O*NET. This platform generates a comprehensive list of occupations, against which relevant skills are mapped. Individuals can then be identified as either 'starters', who may be embarking on a career and have a set of relevant interests, or 'changers', who already possess the skills themselves. Once these interests and skills have been identified, then they can be matched to other occupations in order to see where career moves or upskilling might be suitable.

The platform has several benefits, especially in the context of the Government's net-zero target and the creation of green jobs. Firstly, it can be used to identify skills that are commonplace within existing industries, which may be in high demand to develop green technology, such as electric vehicles, hydrogen, and carbon capture, usage, and storage. Secondly, employers can use the platform to identify the skills that they have in-house, that could allow them to diversify into new markets. As indicated above, heating engineers currently occupied in installation and servicing of gas boilers could have the skills required to deliver on the Government's ambition to install 600,000 heat pumps per year by 2028. Finally, the platform can be used to identify where gaps exist in green skills in order to allow new apprenticeship standards to be developed in these areas. The project will be completed later this year and could be used as a tool when making policy decisions on green jobs.

Image credit: Engenuity



3.3. Setting Long Term Targets

Many of the technologies that will be required to deliver net-zero within hard to decarbonise or foundation industries are either in their infancy (e.g. carbon capture, usage, and storage, small modular reactors, and direct air carbon capture) or have not yet been invented⁶⁸. It is therefore essential that reforms to post-16 education consider the long term requirements for development of a green economy. However, England's FE system has been subject to frequent policy reform over the last two decades that has left delivery bodies fragmented and has undermined their ability to plan their activities effectively. The Education Policy Institute identified over twenty-five significant reforms to FE pathways within the last fifteen years including the rise in compulsory participation age from sixteen to eighteen and the introduction of the apprenticeship levy⁶⁹.

In the same way that the Committee on Climate Change monitors the country's progress against its net-zero target, there must be a framework for delivery of long-term targets on skills provision and productivity. This is challenging because the skills required to develop the green technology of the future are uncertain and continually changing. However, the Government's recently formed Skills and Productivity Board will be well-placed to deliver this oversight and previous research by Policy Connect⁷⁰ has recommended that the Government should legislate to put the Board on a statutory basis as a non-departmental body.

At the provider level, institutions are hampered by allocation of yearly budgets, which prevents them from planning their course delivery for the long-term⁷¹. In particular, this system disincentives provision of courses that are harder to fill and more expensive to deliver, such as engineering, but will be essential to the development of future green technology. The Government has proposed to consult on new, multi-year funding arrangements to enable a more strategic approach to FE provision. This would help to solve current weaknesses in the system, but is yet to commence.

RECOMMENDATION 8:

Providers should receive multi-year funding budgets in order to deliver high-quality training that is targeted to address local skills gaps. Multi-year funding is critical to allow colleges to invest in equipment and facilities that are aligned with local employer-need. In particular, courses should focus on higher technical and vocational skills, to help drive innovation in green technology.

Government can further help providers plan for the long term by regulating on standards, to give industry better certainty on the types of skills that will be required in the low-carbon economy of the future. For example, the Government has recently consulted on its proposed Future Homes and Future Buildings Standards, which will set energy efficiency standards for domestic and non-domestic buildings by 2025. Accelerating these standards, along with wider legislation on 'low-regret' technologies that will be required to deliver net-zero, will give confidence to business to create jobs and invest in apprenticeships to comply with new regulation. It would also give certainty to providers wanting to deliver associated training and development opportunities.

Government should therefore work with combined authorities and Local Enterprise Partnerships (LEPs) in order to formalise the nature of the green economy across the regions of the UK, particularly within 'low regret' sectors such as energy and buildings. This could be considered as part of the current LEP review.

⁶⁸ Half of emissions cuts will come from future technology, says John Kerry, Guardian, May 2021

⁶⁹ Further education pathways: securing a successful and healthy life after education, Education Policy Institute, November 2019

⁷⁰ England's skills puzzle: piecing together further education, training, and employment, Policy Connect, February 2020

⁷¹ Independent review of college financial oversight, Dame Mary Ney DBE, October 2019

3.4. Creating a Local, Employer-Led, Green Skills System

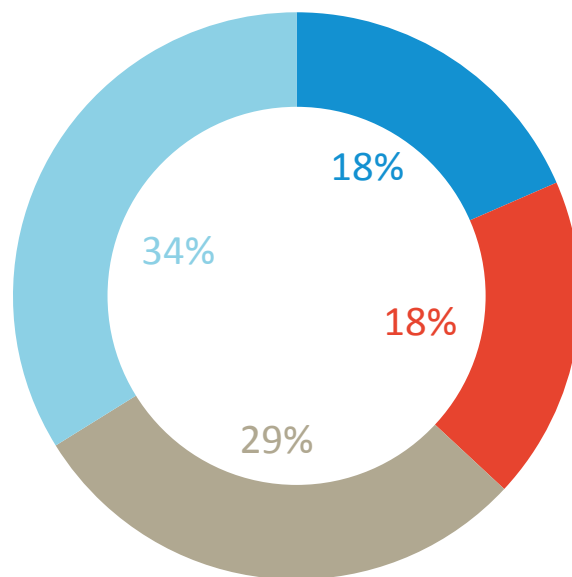
It is essential that employers are able to operate at the heart of the skills system to ensure that education and training leads to development of the skills required to meet local labour demand. This inquiry heard from several manufacturers who were struggling to fill technical roles and found it challenging to engage with local skills providers, due to the fragmented nature of the system. Access to a skilled workforce and the ability to influence the training that local providers offer are likely to be key factors when business are considering new investment. Notably, no businesses responding to our survey felt 'extremely confident' that FE colleges and skills providers would be able to address their future skills needs.

Figure 9:

"How confident are you that further education colleges and skills providers will be able to deliver the skills required to address your business' future needs?"

(survey response, n=65)

- Not at all confident
- Quite confident
- Slightly confident
- Somewhat confident



In order to address this, the Government has proposed piloting employer-led Local Skills Improvement Plans⁷² to help providers respond to local labour market needs and avoid skills mismatches. These Plans must be developed by a representative body for the specified area and draw on the priorities of employers to summarise the skills, capabilities, and expertise that are required locally. Once the Plans have been approved by the Secretary of State for Education, then providers are tasked with development of associated education and training. Local Skills Improvement Plans should be informed by priorities set by the recently formed Skills and Productivity Board and build on the work of Skills Advisory Panels, established by Mayoral Combined Authorities and Local Enterprise Partnerships. In this model, businesses would be represented by local business membership organisations such as Chambers of Commerce. However, The National Manufacturing Skills Task Force will also be well placed to inform the development of Local Skills Improvement Plans, given its broad membership, which includes trade associations, skills bodies, and unions.

⁷² Skills and post-16 education bill, Department for Education, May 2021

RECOMMENDATION 9:

Delivery of Local Skills Improvement Plans should mandate training on climate change and decarbonisation to give learners a broad understanding of how their industry can help to meet the UK's net-zero target and promote environmental stewardship. This could be delivered with support from the Institute for Apprenticeships and Technical Education's existing Green Apprenticeships Advisory Panel.

The Government has also proposed to align post-16 technical education and training with employer-led standards in order to give businesses confidence that the skills being developed will meet their needs. In the same way that the Institute for Apprenticeships and Technical Education (IfATE) works with employers to define the content of apprenticeships, a similar system is proposed for wider advanced technical education. Alongside Local Skills Improvement Plans, these reforms would offer an opportunity to ensure that training on climate change, the circular economy, and environmental protection are put at the heart of future standards.

The benefits of involving employers in a meaningful way in the development of apprenticeships and technical education are clear, however, an exclusively employer-led approach can lead to training that is insufficiently broad and focusses on individual or solely short-term priorities. Furthermore, SMEs often lack the capacity to engage in development of training and therefore courses tend to focus disproportionately on the needs of larger businesses. It is therefore important that the development of training is collaborative and includes contribution from all relevant stakeholders including the National Manufacturing Skills Task Force, combined authorities, LEPs, Skills Advisory Panels, providers, and businesses of all sizes.



3.5. Upskilling the Workforce Everywhere

Although the Government's net-zero target and Ten Point Plan for a Green Industrial Revolution will create new job opportunities as part of a green economy, it will also lead to reduced demand for jobs in traditional, carbon intensive industries. Parts of the country reliant on industries such as coal, oil, and gas will be disproportionately affected and job losses in these sectors across the north of England are likely to total 28,000 by 2030⁷³. There will also be regions that will not immediately benefit from the new infrastructure directed to the UK's industrial clusters and businesses in these areas risk getting left behind. Action needs to be taken to ensure this risk is effectively managed and that we do not end up with 'wastelands'; this will be a critical element of delivering on the Government's 'levelling up' agenda.

The concept of a 'just transition' can be described as "the transition towards a low-carbon and climate-resilient economy that maximises the benefits of climate action while minimising hardships for workers and their communities"⁷⁴. These principles should be kept in mind when developing low carbon investment and infrastructure to ensure that the green economy is fair for all. Carbon intensive industries have typically developed over decades and are usually large regional employers, leading to significant disruption when they close. This is particularly relevant in Scotland, which is home to 75% of the UK's oil and gas extraction jobs⁷⁵ and Scotland's Just Transition Commission serves to advise Ministers on these challenges.

However, there is room for optimism, especially given that the areas of the UK reliant on transitional industries are often home to the skills required within to develop green technology. For example, transitioning from oil and gas to offshore wind in Scotland, from traditional automotive to electric vehicle manufacture in northeast England, and development of sustainable aviation fuel as part of the Humberside 'Jet Zero' plan. These green jobs, in particular those associated with the circular economy, are less well developed than carbon intensive industries and therefore typically provide a greater number of new jobs, per unit of turnover. Indeed, within northern England alone, 46,000 jobs could be created within the low-carbon power sector by 2030⁷⁶, many of which would draw upon existing regional skills.

RECOMMENDATION 10:

The remit of the Green Jobs Taskforce should be extended to oversee the ongoing transition from carbon-intensive to high quality green jobs that is fair for all, in accordance with the Prime Minister's Ten Point Plan. The Taskforce should draw on experience from industry, academia, the third sector, and labour organisations.

⁷³ Risk or reward? Securing a just transition in the north of England, Interim report, Institute for Public Policy Research, October 2018

⁷⁴ Climate justice: there are no jobs on a dead planet, frontlines briefing, International Trade Union Confederation, March 2015

⁷⁵ Green Jobs: call for evidence, Environmental Audit Committee, November 2020

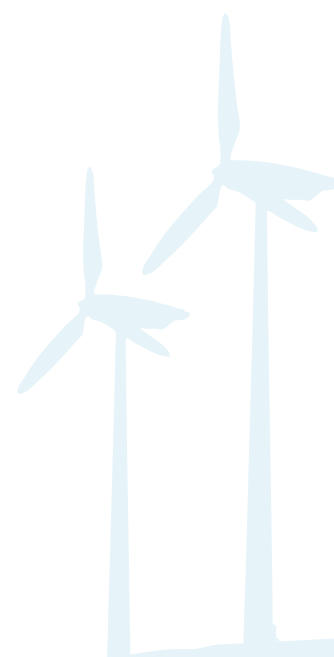
⁷⁶ Risk or reward? Securing a just transition in the north of England, Interim report, Institute for Public Policy Research, October 2018

Where people do find themselves out of work, routes to retraining and upskilling must become easier. The Government's recent proposals for a Lifetime Skills Guarantee are welcome, which will offer adults the opportunity to retrain later in life and will include a lifelong loan entitlement to allow individuals access to the equivalent of four years' worth of student loans for level 4 to 6 qualifications. However, upskilling the workforce to meet the needs of the future green economy is of critical importance, especially as the UK remains off-track to meet its net-zero target. Current proposals to wait until 2025 to introduce the lifelong loan entitlement risks widening existing skills gaps. Education and training linked to green skills should be prioritised within any pilot testing and trials of the scheme.

The proposed Lifetime Skills Guarantee should be accompanied by access to high quality careers information, advice, and guidance. Research by Policy Connect's Skills Commission has recommended that Government should maintain a long-term, ambitious, careers strategy, which harnesses the expertise of employers alongside educators and careers leaders. This will ensure that careers information, advice, and guidance is relevant, up-to-date, and helps people to achieve the skills and qualifications they need. These insights will remain essential over the next two decades as the world of work continues to change rapidly, and the UK transitions to the low carbon economy.

4. Conclusion

Given UK manufacturing's invaluable response to the Covid-19 crisis, it is unfortunate that the sector has been amongst the hardest hit. Many companies forced into bankruptcy were old enough to remember the last pandemic of this scale, back in 1918. However, for every business that has failed, there are examples of those that have shown adaptability and resilience to prosper. By embracing the principles discussed in this report, such as adoption of digital technology, energy and resource efficiency, circular economy, and development of green skills, the manufacturing sector can stand ready to weather future disruption, help to combat the climate crisis, and continue to provide the country with the things that it needs.



Commissioners

Lord Karan Bilimoria, CBE, DL Cross Bench Peer, Founder and Chair of Cobra Beer, President of the CBI and Chancellor of the University of Birmingham (Chair)

Mark Pawsey, Member of Parliament for Rugby (vice chair)

Jack Dromey, Member of Parliament for Birmingham, Erdington (vice chair)

Sarah Olney, Member of Parliament for Richmond Park (vice-chair)

Professor John Latham, Vice Chancellor and CEO, Coventry University Group (vice chair)

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Dr. Beverley Nielsen, Associate Professor and Senior Fellow, Birmingham City University

Keith Robson, Executive Secretary, The ERA Foundation

Professor David Seall, Visiting Professor and Deputy Chair of the Supervisory Board, Surrey Business School

Lynn Tomkins, Chair, Skills 4 UK and Policy Connect Board Member

Steve Turner, Assistant General Secretary, Unite the Union

Methodology & Contributors

Work on this inquiry began in 2020 following two scoping sessions held in September and October, which were kindly chaired by Lord Bilimoria and Mark Pawsey MP respectively.

This project draws on third party research from a large number of organisations, as well as primary data collected following a call for evidence, online survey and through one-to-one interviews with experts across industry, academia, Government, and NGOs. In addition, Lord Bilimoria Chaired four evidence sessions, which focussed on the following topics:

Roundtable 1: Resilience – 12th January 2021

Roundtable 2: Skills – 27th January 2021

Roundtable 3: Sustainability and circular economy – 23rd March 2021

Roundtable 4: Report recommendations – 14th April 2021

Policy Connect would like to thank all the individuals and organisations that participated in this inquiry. Our particular thanks to our Chair Lord Bilimoria and Vice Chairs, Mark Pawsey MP, Jack Dromey MP, Sarah Onley MP, and Professor John Latham for their leadership and dedication to the Commission's work. A full list of contributors is outlined below. The views in this report are those of the author and Policy Connect. Whilst these were informed by the listed contributors, they do not necessarily reflect the opinions of these organisations.

Roundtable Sessions

- ADS Group
- Association of Chartered Certified Accountants
- Bathroom Manufacturers Association
- Birmingham City University
- Brennan and Partners
- Cardiff University
- City and Guilds
- Confederation of Paper Industries
- Coventry University
- Cummins
- Department for Business, Energy, and Industrial Strategy
- Engineering UK
- Enginuity
- ERA Foundation
- Gambica
- High Value Manufacturing Catapult
- Institute for Apprenticeships and Technical Education
- Institution of Engineering and Technology
- John Mills Institute for Prosperity
- Made in Britain
- Make UK
- Manufacturing Technologies Association
- Mueller Industries

- Nissan
- Optima UK
- Roman Showers
- Skills 4 UK
- Tata Steel Europe
- Techworks
- Travis Perkins
- Unite the Union
- University of Sheffield
- Victoria Page Communications
- Warwick Manufacturing Group

Written Submissions

- Unite the Union
- Coventry University
- John Mills Institute for Prosperity
- Gambica
- Institution of Engineering and Technology Midlands Manufacturing Network
- Made in Britain

Additional Interviews

- Beatrice Barleon, Head of Public Affairs and Policy, Engineering UK
- Charlie Farr, Chairman, Save Money Cut Carbon
- Chris McDonald, CEO, Materials Processing Institute

- David Archer, Chairman, IET Midlands Manufacturing Network
- Dr. Dean Stroud, Senior Lecturer, Cardiff University
- Gary Punter, Visiting Fellow, University of Cambridge Institute for Manufacturing
- Jack Semple, Secretary, Engineering and Machinery Alliance
- Dr. Jacqueline Hall, Head of Policy and Strategy, Enginuity
- Phil Henry, Built Environment Development Director, Genuit
- Professor Robert Lee, Director, Centre of Legal Education and Research, University of Birmingham Law School
- Scott Wilkins, Industry Manager, City and Guilds
- Stewart Edmondson, CEO, UK Electronics Skills Foundation

Survey

The anonymous online survey was conducted between March and May 2021- thanks to all who took part. The survey was open to all, but specifically aimed at manufacturers in the UK. The data presented are based on the informal views of the manufacturing community and are therefore not a representation of the general population.

About this report

The Manufacturing Commission

The Manufacturing Commission is run by Policy Connect's Industry, Technology and Innovation team. The Commission brings together Parliamentarians, leading figures from across the manufacturing sector and academics to undertake high-level research into UK manufacturing policy making recommendations to government and industry. The Commission is currently chaired by Lord Bilimoria CBE DL.

The logo for the Manufacturing Commission, featuring the word "manufacturing" in a light blue sans-serif font above the word "Commission" in a smaller, darker blue sans-serif font, all contained within a blue rectangular background.

The Industry, Technology, and Innovation Team

The Industry, Technology and Innovation team at Policy Connect provides the secretariat for the All-Party Parliamentary Groups for Manufacturing; Design & Innovation; and Data Analytics. The team focusses its work around building innovative industries and public services that tackle key societal challenges in productivity, clean growth and information.

Policy Connect

Policy Connect is a cross-party think tank with four main policy pillars which are: Education & Skills; Industry, Technology & Innovation; Sustainability; and Health & Accessibility.

We specialise in supporting parliamentary groups, forums and commissions for which Policy Connect provides the secretariat and delivers impactful policy research and event programmes. Our collaboration with parliamentarians through these groups allows us to influence public policy in Westminster and Whitehall. We are a social enterprise and are funded by a combination of regular annual membership subscriptions and time-limited sponsorships.

We are proud to be a Disability Confident and London Living Wage employer, and a member of Social Enterprise UK.

The logo for Policy Connect, featuring the word "policy" in white lowercase letters on a red rectangular background, followed by the word "connect" in white lowercase letters on a grey rectangular background.

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- Claudia Jaksch, Policy Connect
- Floriane Fidegnon, Policy Connect
- Liz North, Policy Connect
- Alice Webster, Policy Connect



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