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AMRC
Advanced Manufacturing
Research Centre

Economic Impact Analysis Final Report



September 2022

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Executive Summary

Overview

The University of Sheffield Advanced Manufacturing Research Centre (AMRC) provides world-leading research, innovation and training to the high-value advanced manufacturing sector. For over 20 years, the AMRC has made a major contribution to transforming the UK's industrial and economic performance, delivering step changes in productivity, increasing competitiveness, developing new products and processes and training new talent.

Part of the High Value Manufacturing (HVM) Catapult network of research centres, the AMRC has a physical presence in South Yorkshire, Lancashire and North Wales. In South Yorkshire, the AMRC's operations are located on the site of the former Orgreave colliery and coking works, which is remembered for the 'Battle of the Orgreave' where police and picketing miners clashed during the miners' strikes of 1984. Since founding in 2001, the AMRC has played a key role in transforming the once industrial wasteland into an attractive location for advanced manufacturing businesses, drawing major inward investors such as Boeing, Rolls-Royce and McLaren to the area, and helping the local economy to emerge from the decline of its traditional industrial strengths of coal and steel.

Purpose

In 2021 the AMRC celebrated 20 years of innovation, impact and investment. To reflect on the centre's economic contribution during the first 20 years of operation - and explore how it can continue to support the economic agenda at a local and national level - Lichfields was appointed to undertake a comprehensive analysis of the impacts attributable to the AMRC. The resulting Economic Impact Analysis report represents the first exercise of its type directly commissioned by the AMRC.

The report seeks to capture the fullest possible range of economic benefits attributable to the AMRC. As such, it quantifies the centre's contribution by considering the direct, indirect and catalytic impacts generated by its activities, as defined below:

- **Direct impacts:** those impacts directly attributable to the AMRC and its activities;
- **Indirect impacts:** those impacts realised by partner organisations as a result of research led by AMRC; and
- **Catalytic impacts:** impacts in the wider economy influenced or supported by the activity of the AMRC.

A summary of the key effects considered in the report and how they map across to the three impact typologies is provided in the graphic overleaf.



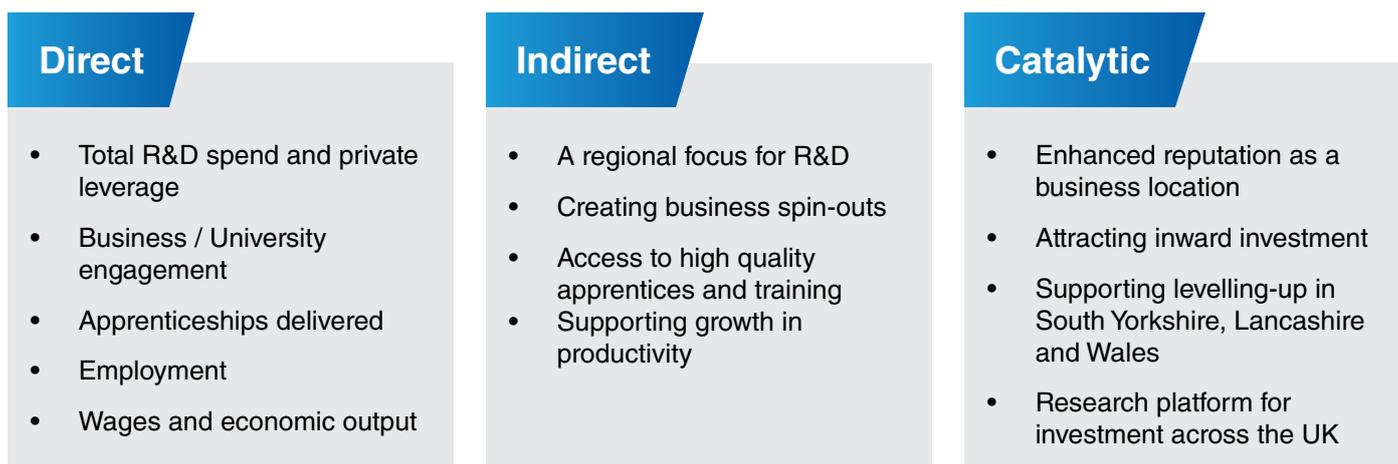


Figure 1: Direct, indirect and catalytic effects | Source: Lichfields

Impact

Innovation and R&D

The AMRC's purpose is to support industry to be more productive, more globally competitive and meet the fundamental challenges around sustainability as the manufacturing sector strives for net zero.

Interviews with the AMRC's partners identified a clear sense that the centre delivers a high level of additionality - by unlocking innovation activity that could not otherwise take place. The AMRC adds value to partners' innovation efforts by:

- De-risking innovation;
- Unlocking coordination benefits (to improve the leverage of R&D expenditure);
- Providing access to dedicated R&D space;
- Providing access to an unrivalled breadth of industrial expertise; and
- Accelerating the commercialisation of research.

In 2019/20 the value of innovation activity undertaken by the AMRC totalled £32.1 million. In addition, the centre unlocked a further £55.6 million of private sector leverage or match funding - supporting the UK Government's aim to double the value of private sector investment in R&D by 2030.

More widely, the AMRC is committed to working alongside industry and academia to drive forward innovation activity. Between 2017/18 and 2019/20, the centre provided support to an average of 1,100 private sector businesses each year (with 42% of this activity taking place with Small and Medium Enterprises). The latest available

data shows that the AMRC worked with 29 different UK universities and five European universities in a single academic year. This reflects the AMRC's commitment to collaborating on the best and most interesting research that is material to the challenges faced by industry.

Education and Skills Development

The University of Sheffield AMRC Training Centre in Rotherham provides the manufacturing industry in South Yorkshire and beyond with access to a pipeline of highly skilled workers needed to drive growth. The centre's strong ties with industry and tailored approach to delivery ensure that courses respond to the sector's evolving needs.

Interviews with clients of the AMRC Training Centre indicated that the added value offered by the training centre with respect to education and skills development is underpinned by:

- A flexible approach to recruitment (with businesses able to identify their own apprentices or be 'matched' with existing AMRC Training Centre learners);
- The AMRC Training Centre Entrance Exam, which provides confidence in the core skills/knowledge of learners;
- The profile and credibility of the AMRC, which allows the training centre (and therefore companies) to attract a large pool of high-quality learners;
- Access to a real-world manufacturing environment and the latest technologies; and
- An approach to training which develops learners with a high level of maturity and professionalism.



Since opening in 2013, the AMRC Training Centre has delivered more than 1,700 apprenticeships. Residents of South Yorkshire account for approximately 80% of all apprentices, demonstrating the important contribution the training centre makes to upskilling local residents and ensuring that local businesses can access suitably qualified workers. In addition, the training centre helps to support improved social mobility and inclusion, with almost 50% of all learners from South Yorkshire living in areas of high deprivation¹ during their apprenticeship.

The AMRC Training Centre is committed to promoting diversity and inclusion and has supported 130 female apprentices and 100 apprentices from Black, Asian and Minority Ethnic (BAME) communities to date. In 2019, the AMRC was presented with its first Athena SWAN Charter Bronze Award for advancing gender equality.

Employment

In 2021/22, the AMRC supported 1,250 Full-Time Equivalent (FTE) jobs at the UK level. This includes: 520 direct FTE jobs (i.e. those employed directly by the AMRC); and a further 730 indirect and induced FTE jobs (i.e. those employment opportunities supported in the wider economy as a result of supply chain and wage expenditure).

The direct jobs supported by the centre are broken down as follows:

- 443 FTE jobs at the AMRC (including 41 at the AMRC North West and 30 at the AMRC Cymru); and
- 77 FTE jobs at the AMRC Training Centre.

The lower job figures attributable to AMRC North West and AMRC Cymru reflect the fact that these facilities are currently less mature than those in South Yorkshire. It should be noted, however, that both locations have experienced strong growth in employment in recent years - reflecting the strength of demand for the support offered by the AMRC at the national level and in each facility's respective local economy. In addition, both AMRC North West and AMRC Cymru are underpinned by ambitious growth strategies which seek to replicate the labour market impact of the AMRC in South Yorkshire.

An analysis of the AMRC's wage bill indicates that, on average, FTE workers earn an annual salary of £45,800. This exceeds the average salary of a full-time worker at the UK level by 19% and at the South Yorkshire level by 46% and clearly highlights the high value, high productivity nature of the AMRC workforce. Furthermore, it is estimated that the economic output of the centre's 520 direct FTE employees (measured in terms of Gross Value Added) is in the order of £55.8m per annum.

Contribution to Levelling Up

The AMRC's profile and reputation positions it as a signature asset for South Yorkshire, supporting the area's efforts to attract inward investment from advanced manufacturers. This, in turn, has helped to create high value, high productivity jobs in the local economy.

The benefits of locating close to the R&D, innovation and training capabilities offered by the AMRC have attracted a cluster of advanced manufacturing occupiers to the Advanced Manufacturing Park, in Rotherham, and the neighbouring Sheffield Business Park. This includes globally significant businesses with strong ties to the AMRC including Boeing, McLaren and Rolls-Royce. In total, it is estimated that £260m of investment has been attracted across both sites - at least in part - by the presence of the AMRC, resulting in the creation of 600 jobs.

"The AMRC is a key attractor of Foreign Direct Investment and an important part of South Yorkshire's pitch to prospective investors. Some of the biggest investments into the area over the last 10 to 15 years would not have taken place without the AMRC."

Rachel Clark, Director of Trade and Investment, South Yorkshire Mayoral Combined Authority

The success of the AMRC has been so pronounced that it is now recognised as an exemplar for the HVM Catapult and a successful model which other localities have sought to replicate with a view to levelling up their own economies. This can be seen in the decisions to bring forward both:

- **AMRC North West:** established following an approach by the Lancashire Local Enterprise Partnership (LEP) to the AMRC to deliver a facility as part of a strategy to catalyse investment in, and development on, the Samlesbury Enterprise Zone; and
- **AMRC Cymru:** established to leverage the AMRC's technical expertise to support the delivery of Airbus UK's 'Wing of Tomorrow' programme. In the face of uncertainty regarding future trade relationships post-Brexit, the programme was seen as critical to safeguarding 6,500 jobs at Airbus' site in Broughton and thousands more in the supply chain.

¹Defined for the purposes of this report as the 30% most deprived Local Super Output Areas nationally

1.0 Introduction

The University of Sheffield Advanced Manufacturing Research Centre (AMRC) is part of High Value Manufacturing (HVM) Catapult. It is a network of world-leading research and innovation centres working with advanced manufacturing companies around the globe. The centre - which has a physical presence in South Yorkshire, Lancashire and North Wales – makes a major contribution to transforming the UK’s industrial and economic performance by delivering step changes in productivity, increasing competitiveness, developing new products and processes and training new talent.

In 2021 the AMRC celebrated 20 years of innovation. Over this time, the centre has become a world leader in research-led innovation within a range of advanced manufacturing sectors across 11 ‘core capabilities’. To reflect on the centre’s economic contribution during the first 20 years of operation - and explore how it can continue to support the economic agenda at a local and national level - Lichfields was appointed to undertake a comprehensive analysis of the impacts attributable to the AMRC. The study focuses on the impacts of the AMRC across the UK economy as a whole, whilst also recognising the important contribution that the centre makes at the regional and local level. The output is this Economic Impact Analysis report which represents the first exercise of its type directly commissioned by the AMRC.

Structure

The remaining sections of this report are structured as follows:

- **Section 2** provides an overview of the AMRC and its development to date;
- **Section 3** summarises the centre’s contribution to innovation and R&D activity and the economic benefits that flow from this;
- **Section 4** considers the impact of the AMRC Training Centre’s work in relation to education and skills development;
- **Section 5** outlines the centre’s contribution to levelling-up the UK economy – both through attracting Foreign Direct Investment and by ‘exporting’ the AMRC model to other parts of the UK to catalyse their regeneration;
- **Section 6** details the employment and wage impacts attributable to the AMRC; and
- **Section 7** provides a summary of the key messages presented in the preceding sections.



2.0 About the AMRC

Overview

Initially established in 2001, the University of Sheffield AMRC now also forms part of the HVM Catapult (see below summaries). The centre represents a cluster of world-class centres for industry-focused R&D technologies and training/skills development focussed on high value manufacturing sectors. It has developed a global reputation for helping companies to overcome manufacturing challenges and has become an exemplary model for collaborative research involving universities, academics and industry.

The AMRC is located on the site of the former Orgreave colliery and coking works, which is remembered for the 'Battle of the Orgreave' where police and picketing miners clashed as part of the miners' strikes of 1984. The colliery closed in the early 1990's leaving behind a legacy of high unemployment and deprivation in the local economy as well as a vacant and heavily contaminated site.

In 1995, British Coal Opencast gained permission to remediate the land to make it suitable for redevelopment. The AMRC has established itself as a key anchor tenant of the wider Advanced Manufacturing Park (AMP) which covers the former colliery.

The AMP - has proved an attractive location for advanced manufacturing businesses. So much so that there are now more people employed on the Park than at the Orgreave colliery and coke works during its peak. The former Sheffield Airport site, located adjacent to the AMP, has also been redeveloped as Sheffield Business Park, with occupiers including Boeing and the AMRC's Factory 2050 and recently announced investment by ITM Power. Taken together, the redevelopment of the AMP and Sheffield Business Park provide a powerful demonstration of what can be achieved in areas scarred by lost industry and limited opportunity, with the necessary vision, partnership working and financial support.

The AMRC has played a key role in helping the local economy to emerge from the decline of its traditional industrial strengths of coal and steel. This has been achieved not just through the activity undertaken at the AMP. It has also been supported by the AMRC's wider contribution to the competitiveness of the South Yorkshire advanced manufacturing sector which has served to: raise the area's profile as an investment location; strengthen local supply chains; and support the innovation and training needs of local manufacturing businesses. More recent investments in Lancashire and North Wales (at AMRC North West and AMRC Cymru) are beginning to deliver similar benefits in their respective local economies.

University of Sheffield

The University of Sheffield was founded more than 100 years ago through the aspirations and financial support of the people of Sheffield. This strong connection to the city and region is intrinsic to the University and through working collaboratively with partners, it continues to contribute to regional recovery and transformation.

The University is one of the 24 universities that make up the Russell Group of leading research-led institutions. Members of this group are committed to maintaining the very best research, an outstanding teaching and learning experience and unrivalled links with business and the public sector.

In the most recent Research Excellence Framework (REF) results in 2021, 92% of the University of Sheffield's research was rated in the highest two categories of world-leading or internationally excellent.

The University of Sheffield's innovation assets, including the AMRC, its sister centre, the Nuclear AMRC and its award-winning AMRC Training Centre have catalysed a dense clustering of high value manufacturing companies across the Sheffield/Rotherham border. This clustering has led to significant investment from global companies such as Rolls-Royce, Boeing and McLaren.

High Value Manufacturing Catapult

The AMRC is a member of the High Value Manufacturing (HVM) Catapult. Established in 2011, the HVM Catapult is a network of leading manufacturing and process research centres, backed by the UK's innovation agency, Innovate UK.

The HVM Catapult serves to bridge the gap between business and academia, helping to turn great ideas into reality by providing access to world-class research and development facilities and expertise that would otherwise be out of reach for many businesses in the UK.

Its role is to help: grow businesses and the contribution of manufacturing to the UK economy; investigate innovative technologies; scale up new products and processes; work with academic partners to build on research in the UK; shape manufacturing policy; and work with government and other bodies to develop training and skills to meet industry needs.



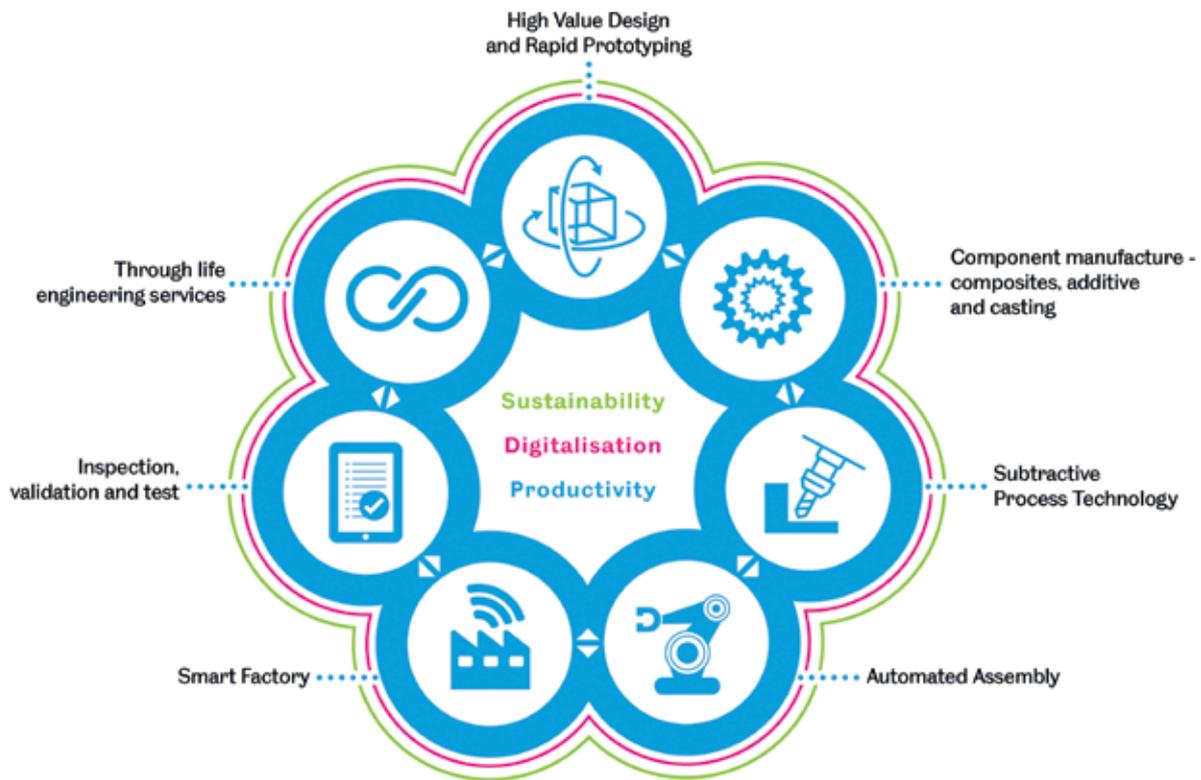


Figure 2.1: Summary of AMRC Technical Capabilities | Source: University of Sheffield AMRC

Activity

The AMRC operates across a range of advanced manufacturing sectors including: aerospace; automotive and transport; construction; energy; food and drink; and medical.

The work led by the AMRC focusses on R&D, rather than production, and provides access to industry-leading equipment and expertise for experimental production runs. Research at the centre is undertaken at a higher Technology Readiness Level (TRL) than most universities. Academic research typically takes place at TRL 1-2, whereas most of the centre's activity is classed as TRL 3-6. As a result, it aims to occupy the space between fundamental, university-based R&D and the point at which innovation is sufficiently mature to be adopted by industry. Facilities are used to develop new processes and technologies, which - if successful - are scaled up to improve the productivity of manufacturing business. This is critical in supporting the commercialisation of new technologies and hugely attractive to industry.

Figure 2.1 provides a summary of the breadth of the AMRC's technical capabilities, from full product lifecycle to through-life engineering services.

Geographical Coverage

The AMRC was originally established in South Yorkshire and has developed from a single 1,200sq.m facility (AMRC 1) to become a campus of eight purpose-built, interdependent translational research centres comprised of almost 23,000sq.m of space (with a further 10,500sq.m of floorspace across the AMRC North West and AMRC Cymru sites as discussed below). This includes:

- **The AMRC Factory of the Future (4,200sq.m):** focused on machining research and home to an array of state-of-the-art machining centres and manufacturing equipment. Designed to allow partner companies to develop and trial new technologies and processes before introducing them to their own factories;
- **The AMRC Factory 2050 (4,500sq.m):** the UK's first state-of-the-art factory dedicated to collaborative research into reconfigurable digitally assisted assembly, manufacturing and machining technologies powering Industry 4.0;
- **The AMRC Composite Centre (1,887sq.m):** cutting edge facility for advanced composite manufacturing research and development; including research into automated production, composite machining, novel materials and processes, and dry fibre technologies;



- **The AMRC Design Prototyping and Testing Centre (2,759sq.m):** uses in-house high-precision machining processes, additive manufacturing, fabrication, advanced analytical tools and clean room facilities to develop everything from conceptual designs to next generation prototypes;
 - **The AMRC Press Building (800sq.m):** purpose-built (small workshop) facility to house composite press and auxiliary equipment;
 - **The AMRC Knowledge Transfer Centre (2,146sq.m):** dedicated conference and meeting space to help the AMRC share with UK manufacturers the innovative tools and technologies developed in its main workshops; and
 - **The AMRC Training Centre (5,464sq.m):** established to train the next generation of world leading engineers. The AMRC Training Centre works with employers to identify and provide the skills required to enable manufacturing companies to compete globally.
- Whilst the AMRC has its origins in South Yorkshire, it is widely recognised as an exemplar model of applying R&D expertise to stimulate investment and economic development. As a result, the AMRC works with other universities, regional and devolved Government and major industrial partners to apply its model of translational R&D in areas where there is an established or growing manufacturing industry with prominent R&D needs. This partnership approach has resulted in the AMRC establishing a presence in Lancashire (AMRC North West, which founded in 2018 and opened a 4,500sq.m facility in 2022) and Wales (AMRC Cymru, a 6,000sq.m facility which opened in 2019). Further details on each facility and their current/anticipated economic impact are provided in Section 5.0.
- All three AMRC locations are shown in Figure 3.1 (see page 10).

Timeline of Development

Since opening in 2001, the AMRC has experienced rapid growth. This has been underpinned by significant investment in new facilities - allowing the centre to reach new sectors and technologies and to establish a presence in Lancashire and North Wales. The bullet points below provide an overview of the key milestones in the development of the AMRC over this period:

- **2001:** University of Sheffield AMRC with Boeing established;
- **2004:** AMRC 1 opened;
- **2008:** AMRC Factory of the Future opened;
- **2011:** founding member of the High Value Manufacturing Catapult;
- **2012:** AMRC Knowledge Transfer Centre, AMRC Composites Centre and Nuclear AMRC opened;
- **2013:** AMRC Training Centre and AMRC Design Prototyping and Testing Centre opened;
- **2017:** AMRC Factory 2050 opened;
- **2018:** Boeing Sheffield (£40m investment) and McLaren Composites Technology Centre (£50m investment) opened
- **2019:** AMRC Cymru opened; and
- **2022:** AMRC North West opened.

3.0 Innovation and R&D

The AMRC's purpose is to support industry to be more productive, more competitive and to help explore the fundamental challenges around sustainability as the manufacturing sector strives for net zero.

The centre has made a significant contribution to the innovation efforts of some of the UK's most strategically important and high value sectors, including aerospace, automotive and transport, energy and nuclear.

Added Value of the AMRC

Interviews with AMRC partners identified a clear sense that the centre plays an important role in unlocking innovation activity that would not otherwise take place. The additionality of the AMRC is considered in greater detail in the case studies presented within this section. In general terms, however, a number of key themes were identified by partners when discussing how the AMRC adds value to their innovation/R&D efforts:

- **De-risking innovation:** the centre provides access to skills, expertise and technologies that partners may not benefit from internally. Often the level of investment required to test/prove a product or process without the AMRC's support would be too great to justify given that there is no guarantee of success;
- **Co-ordination benefits:** the AMRC brings together partners with aligned research interests to jointly fund innovation activity. This, coupled with the centre's ability to unlock match funding from research grants, means that partners can leverage much greater research value for a given level of R&D expenditure;
- **Access to dedicated R&D space:** using the AMRC's purpose-built facilities to outsource innovation activity can help to minimise disruption to production lines. It removes the need to allocate time on the 'shop floor' to prove or improve processes which can impact upon a business' ability to meet production targets;
- **Breadth of expertise:** membership of the AMRC includes businesses from right across the ecosystem for a particular process or technology. This allows the centre to bring together experts in every stage of the process (i.e. tool manufacture, cutting, heating, lubricants/coolants) to work collaboratively on innovation; and
- **Commercialisation:** partners are offered opportunities to support research projects which reflect real world problems. By helping to develop a solution, partners create new business opportunities for themselves - often with major global businesses. In addition, partnering with the AMRC is seen as a kitemark of quality, which helps to open doors to potential new clients.



Case Study: Heraeus

Heraeus is a multinational organisation headquartered in Germany, with a manufacturing and research presence on the Science Park in Cambridge. The Cambridge site employs 150 staff and has traditionally manufactured Flash lamps for a range of uses, including pulsed energy sources within solid-state laser cavities and also in medical aesthetics. Heraeus was prompted to explore alternative Flash lamp applications by significant interest from new markets wanting to explore Flash technology in different application areas, such as composites manufacture. They recognised that, utilising their core competencies in Flash lamp and electronics design, they could deliver complete system solutions to those markets.

Early research in the composites field uncovered the Flash lamp's ability to heat composite materials with high levels of power, flexibility and control. More recently, the Flash lamp heating technology is being applied to the manufacture of hydrogen storage tanks. The shift towards decarbonisation means that demand for hydrogen storage tanks is set to grow rapidly in future, creating a significant market opportunity for Heraeus.

Working with the AMRC, Heraeus undertook feasibility trials to develop and prove the hydrogen tank manufacturing process. The AMRC was able to provide access to technology (including a state-of-the-art filament winding system) that was fundamental to the success of those trials. Access to the right equipment played a key role in de-risking the process without the need for Heraeus to spend c.£500,000 on machinery.

Following the successful completion of the feasibility trials, the AMRC was able to put Heraeus in contact with a leading European manufacturer of hydrogen storage tanks. This meant that Heraeus was able to gain traction with the industry - and accelerate the commercialisation of the technology.

“AMRC’s links to industrial partners have allowed us to commercialise our new technology more quickly than expected.”

Dr David Williams (Composites Consultant) Heraeus

Collaborating on Innovation

Collaboration is at the heart of the AMRC model. Collaboration with business, academia and Government to drive productivity growth through innovation. In this way, the centre makes a clear and significant contribution to the strategic economic aims of the: South Yorkshire Mayoral Combined Authority (SYMCA); Lancashire Local Enterprise Partnership (LEP); Welsh Government; and UK Government².

The following paragraphs provide a summary of the innovation activity led by the centre and the outputs which flow from this.

Partnerships with Industry

The AMRC has almost 120 member organisations³, ranging from internationally renowned manufacturers such as Boeing, Rolls-Royce and Airbus to local SMEs. Figure 3.1 provides an overview of the location of the centre's UK-based member organisations. This shows that there is a strong cluster of manufacturing businesses in South Yorkshire that benefit from the R&D activity led by the AMRC. A number of these businesses have been encouraged to establish a presence in South Yorkshire as a result of their relationship with the AMRC, bringing additional jobs, investment and economic output to the area (see Section 5.0). The map also illustrates the important contribution that the centre makes to the wider national economy, with members based in almost all regions of England and Wales.

The AMRC operates a two-tier membership structure. Member companies pay an annual subscription, with a third of the associated revenue supporting generic research activity steered by the AMRC Technical Board and the remaining two thirds directly scoped and driven by the funding member. The resulting intellectual property from all member funded activity is owned by the University of Sheffield but with each member having free access to all outcomes on a non-exclusive licence for exploitation. This model ensures that for a Tier 1 member paying an annual subscription of £200,000, they are receiving approximately ten times the value of their membership subscription. In addition, the AMRC's resources are available to all manufacturing businesses – allowing non-members to access the centre's R&D and training capabilities.

²The SYMCA's Strategic Economic Plan, the Lancashire LEP's Local Industrial Strategy, Welsh Government's Economic Action Plan and the UK Government's Levelling Up Fund White Paper all identify the need to increase levels of R&D expenditure and to increase levels of productivity

³June 2022



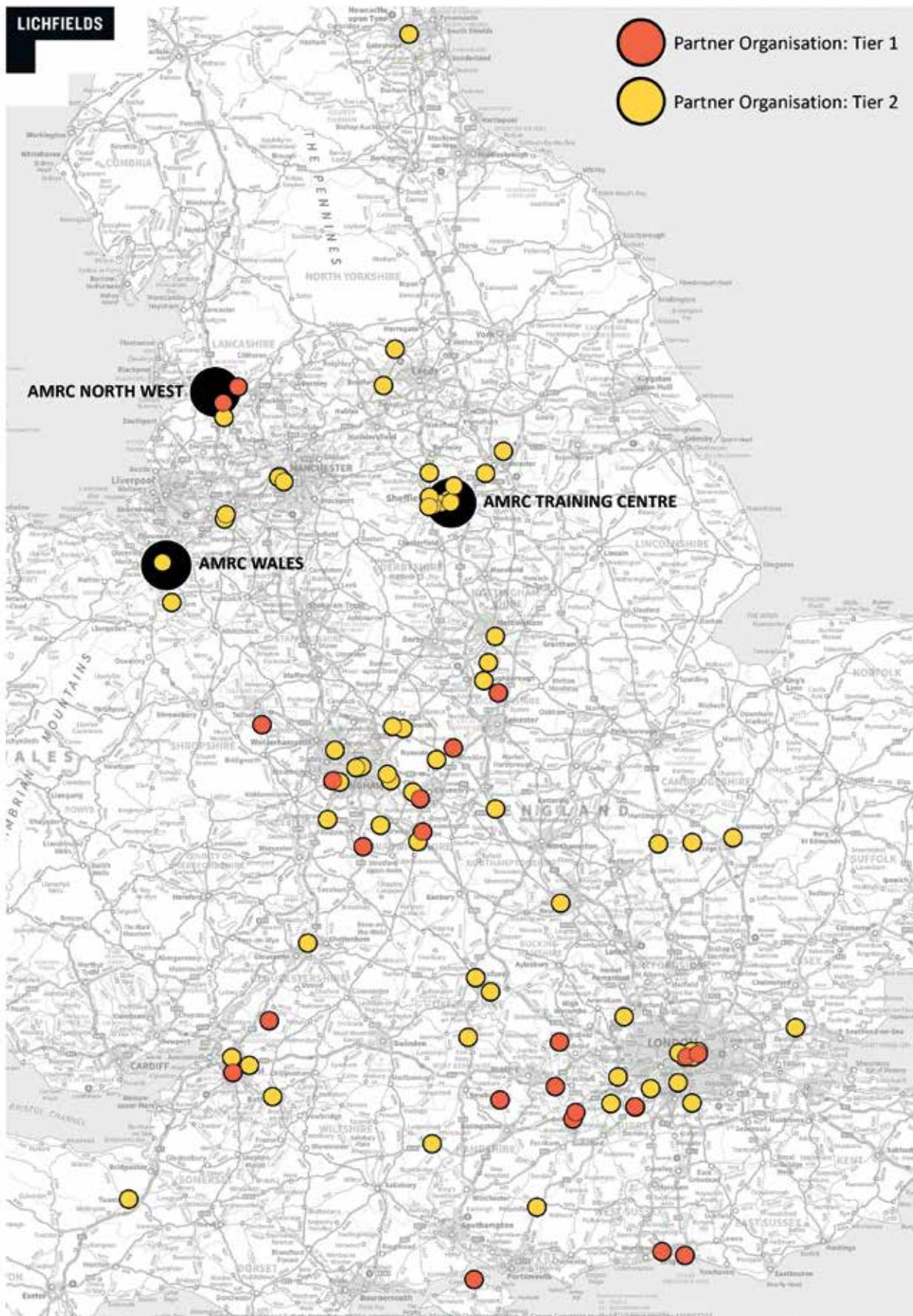


Figure 3.1: Location of AMRC Members (UK-based) | Source: AMRC / Lichfields analysis
 NB: data relates to Members' Headquarters addresses (rather than individual sites/facilities)



Figure 3.2 provides a summary of the AMRC’s engagements with private sector businesses between 2017/18 and 2019/20. This shows that the centre provided support to more than 3,305 businesses over the three-year period - an average of 1,100 per annum. The scale of engagement with the private sector reflects the commercial R&D focus of the AMRC making its activities more relevant and attractive to business. In 2019/20, an estimated 1,205 business engagements took place, exceeding the three-year average.

Approximately 42% of the activity captured in Figure 3.2 took place with Small and Medium Enterprises (SMEs). This corresponds to almost 1,400 business engagements in a three-year period. The AMRC’s commitment to working with SMEs is particularly important because it arguably offers the greatest potential to generate economic additionality. SMEs are far less likely to have access to the necessary resources or expertise to lead on high value innovation projects. It therefore follows that there is a greater risk of R&D projects failing to take place at all without the AMRC’s support.

It should be recognised that the AMRC operates as a national facility. As a result, its innovation activity delivers economic benefits across a much wider area. This includes work to improve products and processes which are implemented in factories across the UK or result in new manufacturing facilities being established elsewhere in the UK - creating new investment, employment opportunities and economic output. This was recognised in a previous research report published by the Centre for Cities⁴, which stated that:

“The AMRC is explicitly a national asset as part of the UK Catapult system of research collaboration with industry, as many of the benefits it produces in Sheffield City Region [now the South Yorkshire Combined Authority area] are felt around the country. As national Catapult facilities, the AMRC and Nuclear AMRC work with firms across the UK. Research at the AMRC is linked to new production facilities in Sunderland and Broughton in North Wales.”

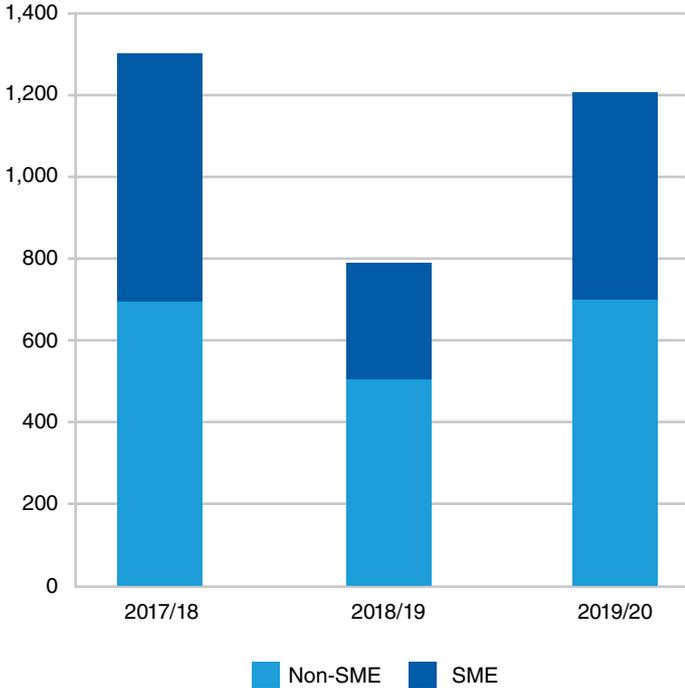


Figure 3.2: Private Sector Business Engagement
Source: AMRC / Lichfields analysis

⁴Parks and innovation Lessons from Sheffield’s Advanced Manufacturing Park, Centre for Cities (2019)

Partnerships with Academia

The AMRC's approach to collaborating with academia is shaped by a desire to engage with the best and most interesting research that is material to the challenges faced by industry. As such, whilst the centre has strong ties with the University of Sheffield, it works with universities from across the UK and internationally. The value of this collaboration is to bring the latest research to bear on industrial challenges and feedback to academic researchers on the challenges faced by business. In this way, the centre's partnership working drives further improvements in how the AMRC progresses solutions for those businesses and organisations it works with.

The latest available data shows that the AMRC worked with 29 different UK universities and five European universities in a single academic year. This data fails to reflect, however, the multiple projects and streams of activity delivered.



Value of Innovation Activity

Over the two-year period 2018/19 to 2019/20, it is estimated that the AMRC was involved in more than 740 projects with private sector partners.

Data provided to Lichfields by the AMRC shows that income used to fund R&D activity totalled £32.1 million in 2019/20. This is up from £29.0 million in 2017/18, representing a 10.7% increase.

The 2019/20 figure was comprised of the following sources of income:

- **Commercial income (£13.7 million):** income from both the AMRC's membership model and discrete R&D projects commissioned by commercial operators;
- **Catapult revenue (£12.2 million):** funding to invest in (skills and technology) capabilities with a clear industrial application. These capabilities, in turn, lead to additional opportunities to capture both commercial and grant funded work; and
- **Grant funding (£6.2 million):** funding linked to individual projects that the AMRC is involved in to support specific technology elements (or through leveraging the centre's networks with industry).

In addition to the above, the centre unlocked £55.6 million of private sector leverage or match funding in 2019/20 (and £59.6 million the preceding year). This represents additional innovation activity undertaken in the UK and which the AMRC helped to catalyse as a result of:

- The centre's ability to utilise its HVM Catapult budget to stimulate activity; and
- The confidence of industrial partners in the relevance of the R&D programme and the capabilities of the centre.

It should be noted that the centre's ability to leverage private sector funding for R&D activity can make an important contribution to the aims of the South Yorkshire Strategic Economic Plan (which seeks to increase investment in R&D to 2.4% of the area's economic output by 2027) and the Levelling Up Fund White Paper (which aims to increase domestic investment in R&D outside the Greater South East by 40% to 2030 and to double the value of private sector investment).



Sector Focus

The R&D activity led out of the AMRC is focused on high value manufacturing across a range of strategically important sectors. As illustrated in Table 3.1, the aerospace and defence sectors account for the largest share of activity (by value) - as well as cross-sector projects - albeit with some fluctuation year-on-year in the proportionate contribution of each.

The table also highlights that the AMRC is targeting a more diverse spread of activity by 2027. This is to be pursued by increasing the proportionate shares attributable to the rail, automotive and medical sectors (relative to 2021 levels).

Sector	2019	2021	2027 Target
Aerospace	42%	25%	30%
Cross-Sector	31%	21%	20%
Defence	16%	45%	30%
Rail	5%	2%	5%
Automotive	2%	2%	6%
Medical	1%	1%	5%
Other	3%	4%	4%

Table 3.1: Commercial R&D Order Book by Sector | Source: AMRC

Benefits of Innovation

The AMRC’s contribution to innovation activity can play an important role in delivering improved economic performance at the local, regional and national level. Two of the key mechanisms through which this is achieved are:

- Supporting growth in productivity; and
- Supporting growth in the business base through ‘spin-outs’ from AMRC research.

Productivity Growth

By improving products and processes adopted by high value manufacturing businesses, the innovation led by the AMRC helps to drive productivity improvements in the sector. This - in turn - contributes to high levels of economic output.

Case Study: Footprint Tools

Footprint Tools is based in Hillsborough, Sheffield and employs 13 members of staff. The business manufactures hand tools for the utility and construction trades. In 2017, Footprint Tools was considering outsourcing production of their number one selling product to Asia, which would have resulted in the loss of jobs in South Yorkshire, unless they were able to improve the efficiency of their existing site.

The introduction of robotics, to automate the production of Footprint Tools’ top selling product, was identified as a potential solution. With no experience or expertise in the field, Footprint Tools approached the AMRC to assist. The AMRC reviewed the current manufacturing process for linepins (a high volume, low value product) and then developed and tested an automated programme.

The project has transformed the efficiency of linepin production - with 150 workdays saved each year, a resource that Footprint Tools has been able to redeploy onto higher value processes elsewhere in the factory. By increasing the speed and reliability of production too, Footprint Tools has been able to better manage the flow of stock to distributors, resulting in a 40% increase in the volume of sales.

“Access to the AMRC’s robots and expertise helped to de-risk the project. It could not have come forward without AMRC support.”

Timothy Jewitt (Director) Footprint Tools

Spin Outs

Innovation also creates opportunities to grow the business base through spin outs - businesses created as a result of the commercialisation of R&D activity. Spin outs from the University of Sheffield (across all departments) have increased in recent years (from two in 2017/18 to seven in 2020/21) having previously been constrained by difficulties in accessing early capital.

The recent improvement in performance has been supported by a change in the University's strategy - placing greater emphasis on the commercialisation of Intellectual Property - and the establishment of Northern Gritstone to increase the availability of capital and shorten investment timescales. Northern Gritstone is an investment company founded by the Universities of Leeds, Manchester and Sheffield to increase the pipeline of university spin outs.

The positive impacts of this change in approach are beginning to emerge with the enhanced performance of spinouts, particularly in the context of the AMRC. Two spin out businesses have been established as a result of research projects led out of the centre, both in 2020/21: FourJaw; and Productive Machines (see summaries opposite and overleaf).

Case Study: FourJaw

FourJaw has developed and brought to market a manufacturing analytics hardware/software platform. Its services provide factories with real-time visibility of their shop floor, allowing them to reduce downtime and boost productivity.

FourJaw currently has ten staff and annual subscription revenue of £150,000 (April 2022). The ambition is to grow the firm to 20 staff and £600,000 annual subscription revenue by the end of the year.

The AMRC and the University of Sheffield both played critical roles in equipping the founders of FourJaw with the necessary skills to establish the business. This included:

- The AMRC sponsoring Chris Iveson, founder and chief executive officer, through an Executive MBA;
- The AMRC allowing Robin Hartley, founder and chief technical officer, to work exclusively on incubating the underlying idea into a business opportunity whilst employed by the centre⁵; and
- The University of Sheffield providing mentoring, funding and introductions to prospective investors.

"FourJaw would not exist without the AMRC."

Chris Iveson (founder and Chief Executive Officer)
FourJaw



⁵Supported by a Royal Academy of Engineering Enterprise Fellowship which funded Robin's salary for 12 months



Case Study:
Productive Machines

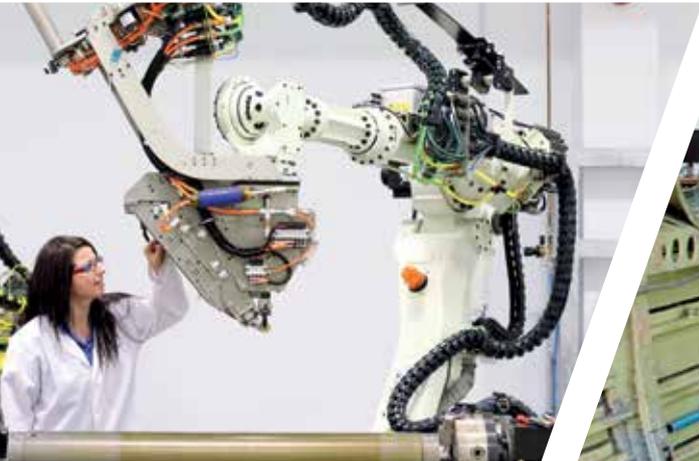
Productive Machines is an Industry 4.0 deep-tech company. It helps machining companies to produce parts cheaper and faster while minimising waste.

Productive Machines is currently a six-person organisation, but is fundraising for a seed round, with a view to becoming a 20-person organisation by the end of 2023.

The technology employed by Productive Machines was initially developed at the AMRC by Dr Erdem Ozturk. Previously a senior technical fellow in the AMRC’s machining dynamics team, Dr Ozturk is the co-founder and managing director of Productive Machines. The AMRC has also hosted a demonstration day for potential investors, providing them with the opportunity to see the technology being used on a machine tool.

“During my time at AMRC I grew and learned as an ‘intrapreneur’ while developing state-of-the-art technologies. This set me on the path to founding Productive Machines and helped me to develop the skills I need to succeed as an entrepreneur.”

Dr Erdem Ozturk (founder) Productive Machines



4.0 Education and Skills Development

The University of Sheffield AMRC Training Centre opened in 2013 to provide partners and the wider South Yorkshire manufacturing industry with access to a pipeline of highly skilled workers needed to drive growth. The training centre delivers a range of courses including advanced apprenticeships, degree apprenticeships and Continuous Professional Development (CPD). The centre's strong ties with industry and tailored approach to delivery ensure that courses respond to the changing needs of the sector.

The training centre provides a real-world manufacturing environment, offering learners the opportunity to gain hands-on experience of equipment that is used in industry every day. In addition, apprentices benefit from access to all of the resources available to students at the University of Sheffield (including student support, libraries etc).

The continued success of the AMRC Training Centre can play an important role in supporting the economic ambitions of the Government, with the Levelling Up White Paper targeting a 200,000 increase in the number of people completing high quality skills training nationally by 2030.

Added Value of the AMRC Training Centre

Interviews with clients of the AMRC Training Centre acknowledged the important role it plays in developing a high-quality workforce for local businesses. This is explored in further detail through the case studies presented in this section. In general terms, however, the added value offered by the AMRC Training Centre can be characterised as follows:

Access to High Quality Candidates

- **Flexibility of approach:** companies can identify apprentices through their own recruitment processes and direct them to the AMRC Training Centre to gain an apprenticeship. Alternatively, they can attend one of the centre's 'matching events' providing access to AMRC Training Centre apprentices seeking an employer;
- **Entrance Exam:** all apprentices must pass the AMRC Training Centre Entrance Exam before commencing their studies. This gives employers confidence that candidates hold the necessary core skills and knowledge in key disciplines, providing a platform for success;
- **AMRC profile:** the profile and credibility of the AMRC within South Yorkshire attracts a large pool of talent and high-quality candidates. Many of the SMEs Lichfields spoke to felt that this gave them access to better quality apprentices than they would be able to recruit through their own processes;

Delivery of High-Quality Training

- **First class facilities:** the AMRC Training Centre provides learners with access to a real-world manufacturing environment with the latest technology and lecturers/mentors with unparalleled industrial experience;
- **Aiding the transition:** many stakeholders felt that the AMRC Training Centre develops apprentices with greater maturity and professionalism. This was attributed to learners being treated as adults from the outset, with clear standards regarding attendance, appearance and conduct; and
- **AMRC Training Centre reputation:** stakeholders indicated that apprentices recognise the excellent reputation of the AMRC Training Centre as a large-scale, professional training provider. This leads most apprentices to respond positively to maximise the opportunity that an AMRC Training Centre apprenticeship represents.

Training Delivery

The AMRC Training Centre has delivered 1,700 apprenticeships and worked with 400 different businesses since 2013. Figure 4.1 summarises the distribution of apprenticeships delivered by qualification level. This illustrates that Advanced (Level 3) apprenticeships account for the majority of apprenticeships delivered by the AMRC Training Centre (84%). This is significantly higher than the number of Advanced apprenticeships delivered across South Yorkshire (43%) or England (46%), whilst the proportions of Higher/Degree apprenticeships are broadly comparable across the three geographies (10%, 12% and 12% respectively).

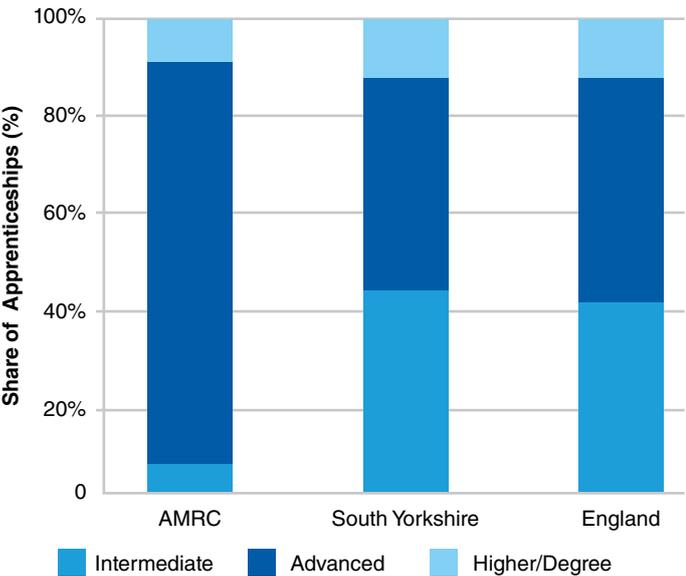


Figure 4.1: Total Apprenticeships Delivered (by Level)
Source: Lichfields analysis

The AMRC Training Centre is committed to ensuring that the UK’s advanced manufacturing workforce is as diverse and inclusive as possible. Since 2013, the training centre has supported:

- 130 female apprentices; and
- 100 apprentices from Black, Asian and Minority Ethnic (BAME) communities.

The AMRC’s work in unlocking the potential of women in engineering was recognised in 2019 with its first Athena SWAN Charter Bronze Award for advancing gender equality. The SWAN Charter was established to encourage and recognise organisations working to advance the careers of women in the fields of science, technology, engineering, maths and medicine.

The bronze award given to the AMRC recognises institutions that have a solid foundation for eliminating gender bias and developing an inclusive culture. It recognises that the AMRC is working to promote gender equality and identify and address challenges particular to engineering - including through the publication of a series of ‘Women in Engineering’ blogs. The blogs aim to raise awareness - and change perceptions - of the careers available to women in engineering.

The AMRC Training Centre also recognises that BAME communities make up a very small percentage of those working in manufacturing and engineering and is striving to promote greater racial equality in the industry. The training centre is currently working with the University of Sheffield and HeppSY to explore ways in which the barriers preventing racial equality can be addressed.

Supporting South Yorkshire’s Economy

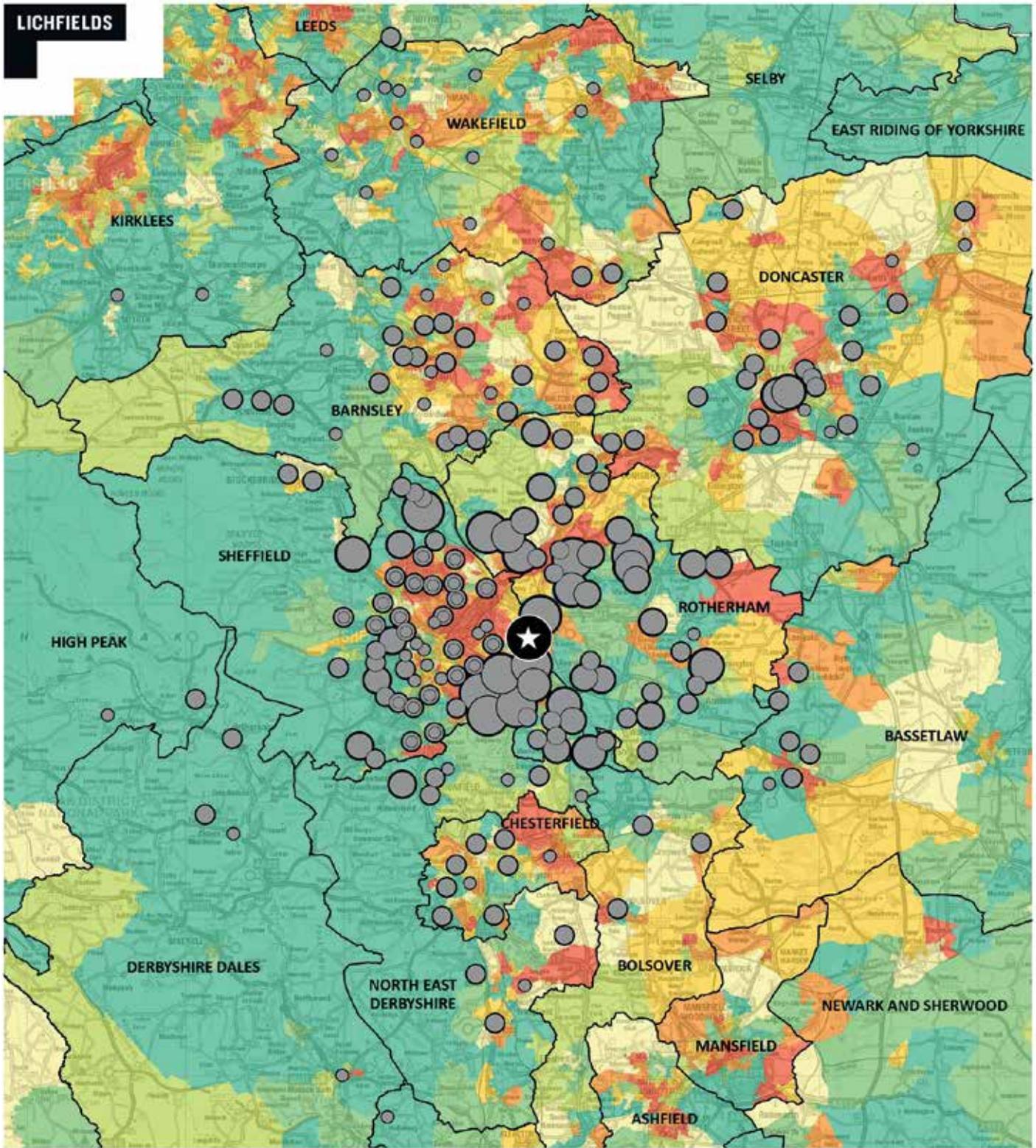
The work of the AMRC Training Centre plays an important role in supporting the prosperity of the South Yorkshire economy and can contribute to the Strategic Economic Plan’s ambition of having 30,000 more people with higher level skills by 2041. The mechanisms through which South Yorkshire residents and businesses currently benefit from activity led by the AMRC Training Centre are considered in the following paragraphs.

South Yorkshire Residents

The profile/reputation of the AMRC Training Centre means that the catchment area from which learners are drawn stretches beyond South Yorkshire into parts of Derbyshire (to the south) and West Yorkshire (to the north). Nevertheless, data provided by the AMRC shows that, since 2013, 1,365 apprentices trained by the AMRC Training Centre were based in South Yorkshire. This corresponds to 80% of all apprentices and is broken down by local authority as follows:

- 95 apprentices from Barnsley;
- 120 apprentices from Doncaster;
- 475 apprentices from Rotherham; and
- 675 apprentices from Sheffield.

The above data is summarised in Figure 4.2, which clearly highlights the contribution made by the AMRC Training Centre to upskilling South Yorkshire residents. The map also shows levels of deprivation across the catchment area, drawing upon the latest data from the English Indices of Deprivation (2019). The English Indices of Deprivation use a series of datasets to rank areas across seven domains that range from income to health. These categories in combination produce a composite measure of deprivation for each area.



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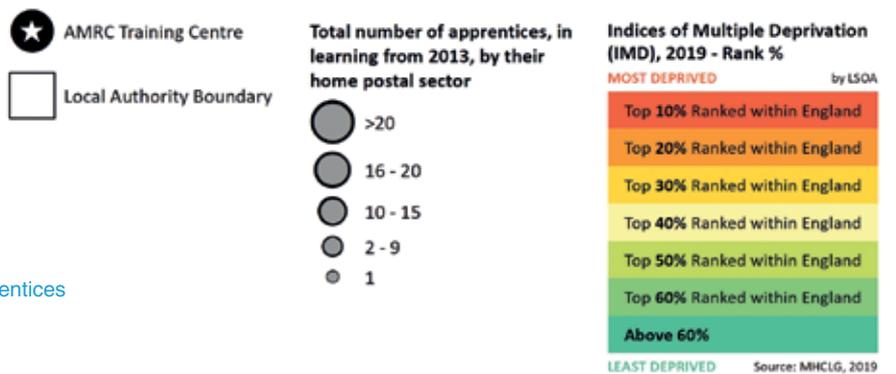


Figure 4.2: Distribution of AMRC Training Centre Apprentices
Source: AMRC / Lichfields analysis

The map illustrates that large numbers of AMRC Training Centre apprentices have been drawn from areas of high deprivation - particularly in East Sheffield and the corridor extending north east along the Lower Don Valley. Indeed, it is estimated that 21% of all AMRC Training Centre learners in South Yorkshire were based in areas ranked in the most deprived 10% nationally. This figure rises to 39% for the most deprived 20% of areas and 49% for the most deprived 30% of areas.

It is clear, therefore, that the activity of the AMRC Training Centre plays an important role in supporting improved social mobility and inclusion - a key theme of the South Yorkshire Combined Authority's Strategic Economic Plan.

The median salaries paid to Level 3 apprentices at the AMRC Training Centre are comparable to the median salary across all sectors for 16 to 17-year-olds in Yorkshire and Humber. For Level 4 to 6 apprentices, median salaries are almost 50% higher than the Yorkshire and Humber median for 18 to 21 year-olds.

Case Study: Tribosonics

Tribosonics develops sensing technology for use in challenging industrial environments, including nuclear, marine and polymer processing. The business is based in Sheffield and currently employs 30 full-time staff - many living on the east side of the city where high levels of deprivation persist.

Apprentices on Tribosonics Future Leader programme account for over a third of the workforce, with those on a technical pathway all being trained in partnership with the AMRC Training Centre. Whilst the business typically takes on two new Apprentices each year, Tribosonics' 2022 intake comprises four 'Future Leaders', a cohort which exhibits a diverse range of previous experience, skills and interests.

Prior to starting the Future Leaders programme, Tribosonics recruited junior members of staff through a traditional graduate scheme, bringing in mechanical engineering graduates from Russell Group Universities. However, since taking on their first apprentices from the AMRC Training Centre and witnessing the quality of the candidates and the training on offer, the business' recruitment efforts shifted focus from graduates to AMRC Training Centre-trained apprentices.

Tribosonics believes that the Future Leaders programme develops stronger, more rounded employees. This reflects the combination of strong academic/theoretical knowledge and practical skills developed by the AMRC Training Centre as well as the professional maturity Future Leaders gained in the workplace. Through their work at Tribosonics, the Future Leaders not only learn to apply their engineering know-how, but also gain exposure to all aspects of business including project management, data analysis, business development and commercialisation.

“Partnering with the AMRC Training Centre has been a game-changing decision in developing our world-leading team. Our Future Leaders progressing through this route are remarkable and add so much value to our business and our customers.”

Mark Wallace (Chief Operations Officer) Tribosonics

South Yorkshire Businesses

The AMRC Training Centre also helps to ensure that advanced manufacturing and engineering businesses in South Yorkshire and beyond have access to the skilled labour they need to grow. This is particularly important in the context of a recognised shortage of such workers at the national level. Research⁶ published by The Engineering Construction Industry Training Board in 2018 suggests that:

“The wider engineering workforce will need to fill 186,000 engineering related jobs every year until 2024... This demand includes a need to fill 57,000 Level 3 engineers, technicians and skilled craftsmen annually and 101,000 Level 4 or above engineers, technicians and skilled craftsmen annually. These figures include both replacement demand and growth demand.”

Data provided by the AMRC shows that the training centre has worked with approximately 400 businesses to deliver apprenticeships and Continuous Professional Development training courses since opening in 2013. It is understood that 80% of these businesses (320 firms) are based within South Yorkshire. This is broken down by local authority as follows:

- 35 businesses in Barnsley;
- 20 businesses in Doncaster;
- 90 businesses in Rotherham; and
- 175 businesses in Sheffield.

The above data is also captured in Figure 4.3. The map demonstrates a cluster of businesses located in East Sheffield and the Lower Don Valley. It also highlights that businesses from beyond South Yorkshire - particularly in Derbyshire and West Yorkshire - are looking to the AMRC to help meet their training needs (albeit in smaller numbers).

Case Study: AESSEAL

AESSEAL is a global seal manufacturer with 1,800 staff worldwide. The company has two main manufacturing plants - one in Rotherham (serving Europe and the Middle East) and another in the United States. An estimated 350 workers are based at the Rotherham plant.

For the past five years, AESSEAL has used the AMRC Training Centre as part of its training and recruitment strategy. During this time, the company has put more than 75 mechanical engineering apprentices through the AMRC Training Centre. This initially began with three to four apprentices each year but has increased significantly, with 21 apprentices for the 2021/22 academic year.

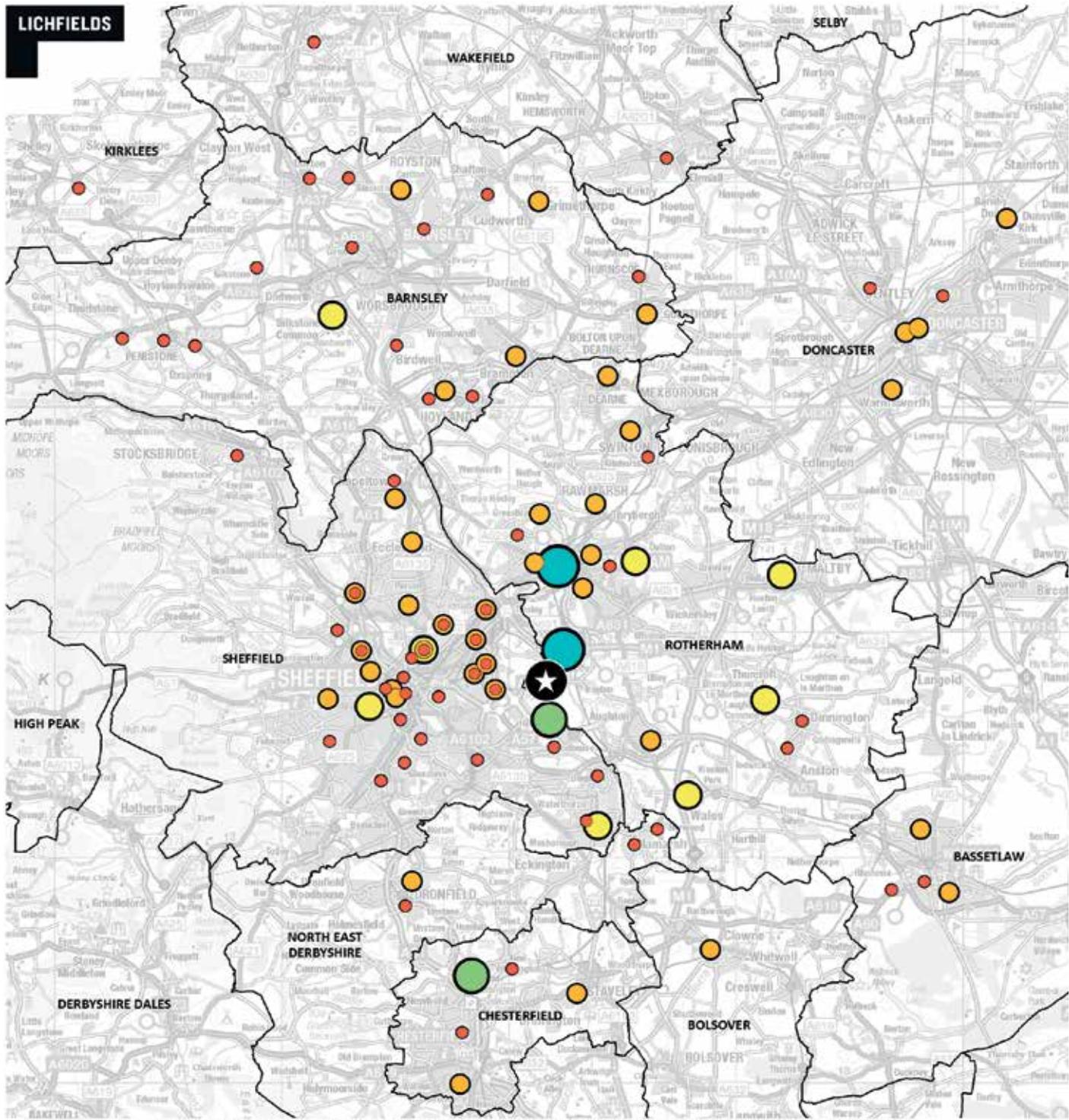
The benefit of the high-quality training provided to AESSEAL's apprentices was brought into sharp focus during Covid-19. Many senior engineers were shielding and unable to come into work as a result, reducing the number of staff on the factory floor. During this time, the company's apprentices assumed greater responsibility and played a key role in delivering month-on-month growth in sales revenues and profit throughout the pandemic.

“The AMRC Training Centre is ten times better than any other provider that we work with.”

Julia Bloomer (Learning and Development Specialist) AESSEAL

⁶Engineering Today: The Supply & Demand for Engineers in the UK (2018) ECITB





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Figure 4.3: Distribution of Businesses using AMRC Training Centre
Source: AMRC / Lichfields

- AMRC Training Centre
- Local Authority Boundary
- Total number of employees, since 2013, by postal sector**
- >15
- 10 - 15
- 5 - 9
- 2 - 4
- 1

5.0 Contributing to Levelling Up

Levelling up the UK economy is a key policy priority of the Government. Central to achieving this is the stated ambition (as set out in the Levelling Up White Paper⁷) to increase pay, employment and productivity in every area of the UK - narrowing the gap between the top performing and other areas - by 2030. The AMRC's profile and reputation positions it as a signature economic asset for South Yorkshire, supporting the area's efforts to attract inward investment from advanced manufacturers. In this way, the centre has made a valuable contribution to creating high value, high productivity jobs in the area.

The considerable economic contribution that the AMRC has made to the South Yorkshire economy is increasingly being recognised as a successful model that can be 'exported' to supporting the levelling up of other local economies. This can be seen in the recent development of AMRC North West and AMRC Cymru.

Levelling Up Through Inward Investment

The AMRC is a key tenant of the Advanced Manufacturing Park (AMP) in Rotherham, as well as the advanced Sheffield Business Park, and has played an important role in establishing the area as one of South Yorkshire's principal employment locations. The centre was the first to locate on the AMP - helping to anchor the development and establish early momentum - and now occupies eight purpose-built units (totalling almost 23,000sq.m of space) across the two sites. Demand driven by the AMRC has also, therefore, made a significant contribution to achieving a critical mass of activity.



Figure 5.1: Advanced Manufacturing Park (c. 2018) | Source: AMRC

⁷Levelling Up the United Kingdom, HM Government (2022)



In addition, the R&D, innovation and training capabilities offered by the AMRC and the benefits of locating close to the centre have helped the AMP and Sheffield Business Park to capture inward investment from other advanced manufacturing businesses. Indeed, previous research by the Centre for Cities⁸ concluded that *“the AMP is attractive to advanced manufacturing firms because it is a hub of knowledge and applied research expertise.”* In arriving at this conclusion, the document made specific reference to:

- The AMRC’s open-source research model, which shares discoveries across its network without patents;
- The face-to-face interactions with other skilled firms and researchers working on the Park (a cluster which has developed as a result of the AMRC’s initial investment); and
- The access to engineering graduates and postgraduates from the University of Sheffield and the AMRC Training Centre.

The influence of the AMRC in the successful development of the AMP is also highlighted by analysis undertaken by the centre. This work suggests that a cluster of AMRC members has developed on the Park (AMRC members account for 40% of occupants) with many more having a less formalised relationship. Furthermore, a significant proportion of occupiers (70%) had experience of engaging with the AMRC prior to moving to the AMP, which may have helped to positively influence their decision-making when considering potential locations.

“The AMRC is a key attractor of Foreign Direct Investment and an important part of South Yorkshire’s pitch to prospective investors. Some of the biggest investments into the area over the last 10 to 15 years would not have taken place without the AMRC.”

Rachel Clark Director of Trade and Investment, South Yorkshire Mayoral Combined Authority

The inward investment attracted to the two sites - at least in part - by the presence of the AMRC is summarised below and includes globally significant businesses such as Boeing, McLaren and Rolls-Royce. In total, these occupiers have brought more than 600 jobs and almost £260m of capital investment to South Yorkshire:

- **Boeing:** £40m investment, 75 jobs
- **British Steel:** £24m investment
- **McLaren:** £50m investment, 200 jobs
- **Nikken:** £10m investment, 40 jobs
- **Rolls-Royce:** £110m investment, 150 jobs
- **UK Atomic Energy Authority:** £22m investment, 40 jobs
- **X Cel Superturn:** £2.5m investment, 100 jobs

In addition to the above, ITM Power recently announced proposals to build a new gigafactory in Sheffield, representing a £55m investment and creating 300 hi-tech manufacturing jobs, whilst the Ultimate Battery Company also intends to establish a site in South Yorkshire, creating a further 500 jobs. In both instances, the presence of the AMRC and its research capabilities played an important role in helping to attract investment.

Case Study: McLaren

In 2018 the British supercar manufacturer McLaren opened the McLaren Composites Technology Centre on the Advanced Manufacturing Park, creating 200 jobs. Prior to South Yorkshire landing this major inward investment, McLaren worked with the AMRC to examine its manufacturing processes. This included exploring opportunities to develop a new factory to manufacture carbon fibre tubs.

With advice from a team led by the AMRC, McLaren took the decision to locate the facility on the Advanced Manufacturing Park. It is understood that a competitor location, in Austria, was also being considered and that - at a headline financial level the Austrian proposition was stronger.

The business case for locating in South Yorkshire, developed with input from the AMRC, focused on promoting the wider business benefits of the area. This included the local innovation ecosystem (including the expertise of the AMRC), the availability of specialist training at the AMRC Training Centre and the supply chain opportunities linked to the established cluster of advanced manufacturers in the local area. This was successful in persuading McLaren to invest £50m in developing a facility on the Advanced Manufacturing Park.

⁸Parks and innovation Lessons from Sheffield’s Advanced Manufacturing Park, Centre for Cities (2019)

The investment attracted to the AMP is generally characterised by high levels of additionality. Figure 5.2 is taken from research published by the Centre for Cities⁹ in 2019. It illustrates that more than half of all jobs on the Advanced Manufacturing Park had been created since 2012 - rather than already being present or displaced from a different location. The proportion of new employment at the Park was much higher than that identified on any of the other comparator locations considered by the study.

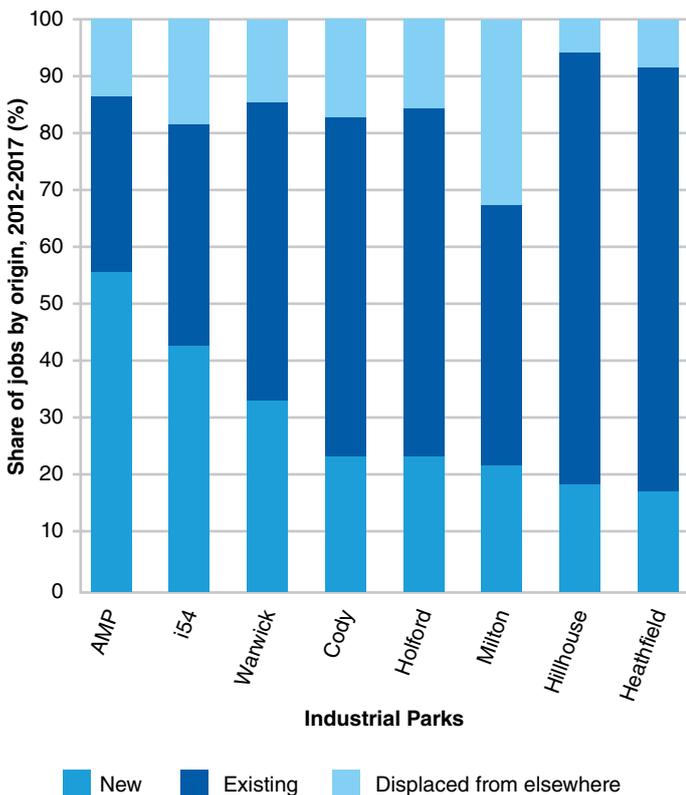


Figure 5.2: Jobs by Firm Origin | Source: Centre for Cities

Case Study:

Nikken Innovation Centre Europe

Formed in 1958 in Japan, Nikken is a world-class manufacturer of precision machine tools. In the 1980s the business established a UK base in Rotherham, selling Japanese-manufactured products into the domestic market. Nikken UK was a founding member of the AMRC and this relationship created opportunities (by collaborating on research projects) to work with and sell their products into the aerospace and automotive sectors.

The skills developed within Nikken UK in serving these sectors - and the role that the Rotherham site played in developing this area of the business - led to Nikken being recognised as an important part of the parent company's R&D infrastructure. As a result, the business delivered a second site in South Yorkshire in 2015: the Nikken Innovation Centre Europe (NICE). This £7 million investment was based on the Advanced Manufacturing Park - with the proximity to the AMRC a key consideration.

Following the UK's decision to leave the European Union, Nikken's global headquarters had some concerns that Rotherham may no longer be the optimal location from which to serve the European market. This was principally due to uncertainty regarding the impact on trade of the Rules of Origin clause. Nikken UK (together with the Department for International Trade) worked hard to promote the benefits of the Rotherham site and the business elected to remain in South Yorkshire - safeguarding 65 jobs. This decision recognised that investment in technological capabilities (through NICE and the AMRC) had been key to driving growth and that there are no facilities comparable to the AMRC elsewhere in Europe.

"Investment in NICE would not have occurred without Nikken's long-standing relationship with AMRC."

Tony Bowkett (President and Chief Executive Officer)
Nikken UK

⁹Parks and innovation Lessons from Sheffield's Advanced Manufacturing Park, Centre for Cities (2019)



Exporting the AMRC Model to Level Up

The impact of the AMRC in South Yorkshire is widely acknowledged by economic development practitioners. This includes the centre's role in helping to: promote economic growth and prosperity; attract high value jobs and investment to the AMP (and the wider economy); and retain existing, strategically important businesses by embedding them in the local innovation ecosystem and supply chains.

The success of the AMRC has been so pronounced that the approach is now recognised as a successful model which other localities have sought to replicate or 'import' to level up their own economies. This can be seen in the decision to open AMRC North West and AMRC Cymru, as outlined in the following paragraphs.

AMRC North West

AMRC North West is located on the Samlesbury Enterprise Zone (EZ), near Preston. The EZ sits adjacent to BAE Systems (one of the world's most advanced, technology-led defence and aerospace companies).

The LEP began to consider the possibility of establishing a research centre focused on aerospace (and advanced manufacturing). Following a visit to the AMRC, the LEP approached the centre with a proposal to work together and establish the AMRC North West facility on the site in the hope of replicating the success in attracting inward investment observed at the AMP in South Yorkshire.

The AMRC has had a presence in Lancashire since summer 2018, operating from temporary facilities before moving to a purpose-built research centre in 2022. AMRC North West is being supported by £34million of funding from the Lancashire LEP and Lancashire County Council, with the ambition of creating 6,000 jobs on the wider EZ site by 2035. In 2021, it was announced that the National Cyber Force (which leads the UK's military operations in cyber space against nation states, terrorists and criminals) would be locating on the EZ.

This is expected to create 2,000 high value, high productivity jobs. It is understood that the presence of AMRC North West (with its capabilities in additive manufacturing and recently established 5G testbed) played an important part in the National Cyber Force's decision to locate at Samlesbury.



AMRC Cymru

AMRC Cymru, a £20million facility in Broughton, opened in 2019. Located adjacent to Airbus UK's wing assembly site, the facility is being delivered, by the AMRC, in partnership with Airbus and the Welsh Government.

The key driver behind the decision to establish AMRC Cymru was the need to support Airbus' Wing of Tomorrow project. The Wing of Tomorrow project was launched to reduce Airbus' environmental footprint (in part by improving the fuel efficiency of aircraft). It seeks to do so by developing the next generation of wings by exploring the best materials, manufacturing and assembly techniques, as well as new technologies in aerodynamic and wing architecture.

Airbus UK employs an estimated 6,500 people at the Broughton site and supports a further 27,700 jobs in the supply chain at the national level. Ensuring that the Wing of Tomorrow programme was led from the UK – to retain the technological capabilities and expertise – was viewed as critical to safeguarding these jobs in the face of economic and political uncertainty. Indeed, the AMRC Cymru Economic Impact and Market Assessment, published in 2018, stated that:

“There is increasing competition and (following the Brexit referendum result and the uncertainty created over future trade relationships) political pressure to take the wing assembly process to other regions in Europe. If this technology capability is lost from the UK, there will be a very significant threat that operations at Broughton would cease, effectively eliminating 6,500 jobs in Broughton and many more thousand jobs across the Airbus UK supply chain over the next 10-15 years.”

Following a review of potential research partners, the AMRC was selected as the only organisation with the requisite skills, technology and resources to lead the project:

“Airbus UK itself and Government ministers have both stated publicly that the University of Sheffield AMRC is the only organisation able to lead in assisting Airbus UK and its supply chain in developing the Wing of Tomorrow.”

AMRC Cymru Economic Impact and Market Assessment (2018)

In addition to safeguarding existing jobs at Airbus, the expectation is that AMRC Cymru's research capabilities will act as a catalyst for the neighbouring Hawarden Business Park. A number of companies within the aerospace supply chain have already begun to cluster on the site and the Economic Impact and Market Assessment projects that this will continue with the development of AMRC Cymru - with Hawarden expected to be fully developed (creating 640 FTE jobs) by 2028.



6.0 Employment

The AMRC is an important employer within the South Yorkshire context, providing access to high value jobs for local residents. AMRC North West and AMRC Cymru are less mature facilities and this is reflected in the lower levels of employment they currently support. AMRC North West and AMRC Cymru are both underpinned by ambitious growth strategies, however, (see Section 5.0) and look set to replicate the impact of the AMRC in South Yorkshire in their respective local labour markets in future.

Employment

Direct Employment

Data provided to Lichfields by the AMRC shows that the direct employment supported by the centre stood at 520 Full-Time Equivalent (FTE) jobs in 2021/22. This represents a significant increase on the eight FTE jobs created when the AMRC was first established in 2001 and is testament to its success and growth over the intervening period.

Figure 6.1 provides a summary of the distribution of employment. This shows that, in 2021/22, the AMRC supported 443 direct FTE jobs (including 41 at the AMRC North West and 30 at the AMRC Cymru) whilst the AMRC Training Centre supported a further 77 direct FTE jobs.

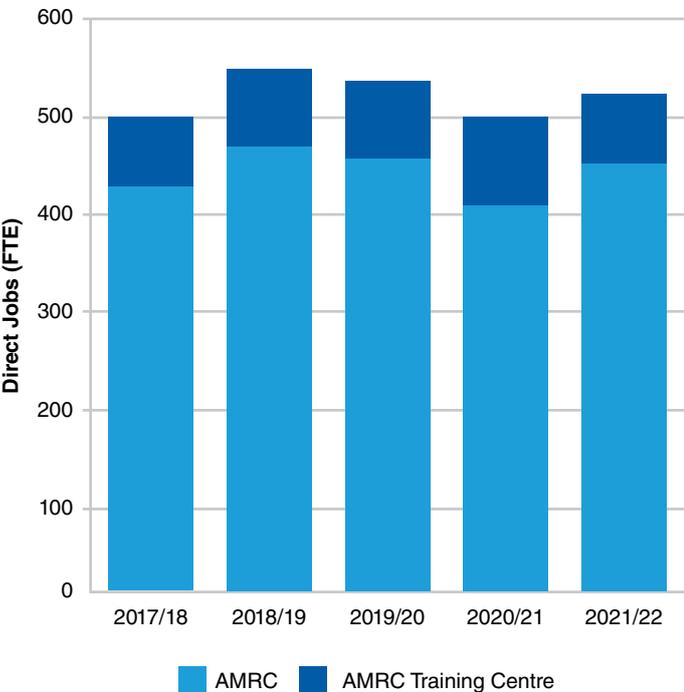


Figure 6.1: AMRC Direct Employment (FTE)
Source: AMRC / Lichfields analysis

Labour Catchment

More than two-thirds (68%) of all those employed at the AMRC (Rotherham/Sheffield) and the AMRC Training Centre live within South Yorkshire. The distribution of those direct workers supported by the centre is summarised in Figure 6.2. This highlights the existence of large concentrations of employees in the local authorities of Sheffield (43% of staff) and Rotherham (17% of staff), as well as smaller numbers of workers commuting into the centre from both Barnsley (5%), Doncaster (4%) and beyond.

Indirect Employment

The AMRC purchases goods and services from a range of suppliers (machinery, materials etc.). In turn, these suppliers purchase from businesses further down the supply chain. This activity helps to support indirect jobs across the local, regional and national economy. In addition, wage spending by these direct and indirect workers (in local shops, bars, restaurants and other facilities) helps to create induced jobs.

The relationship between the direct and total (direct, indirect and induced) employment impacts supported by an organisation is referred to as the 'multiplier effect'.

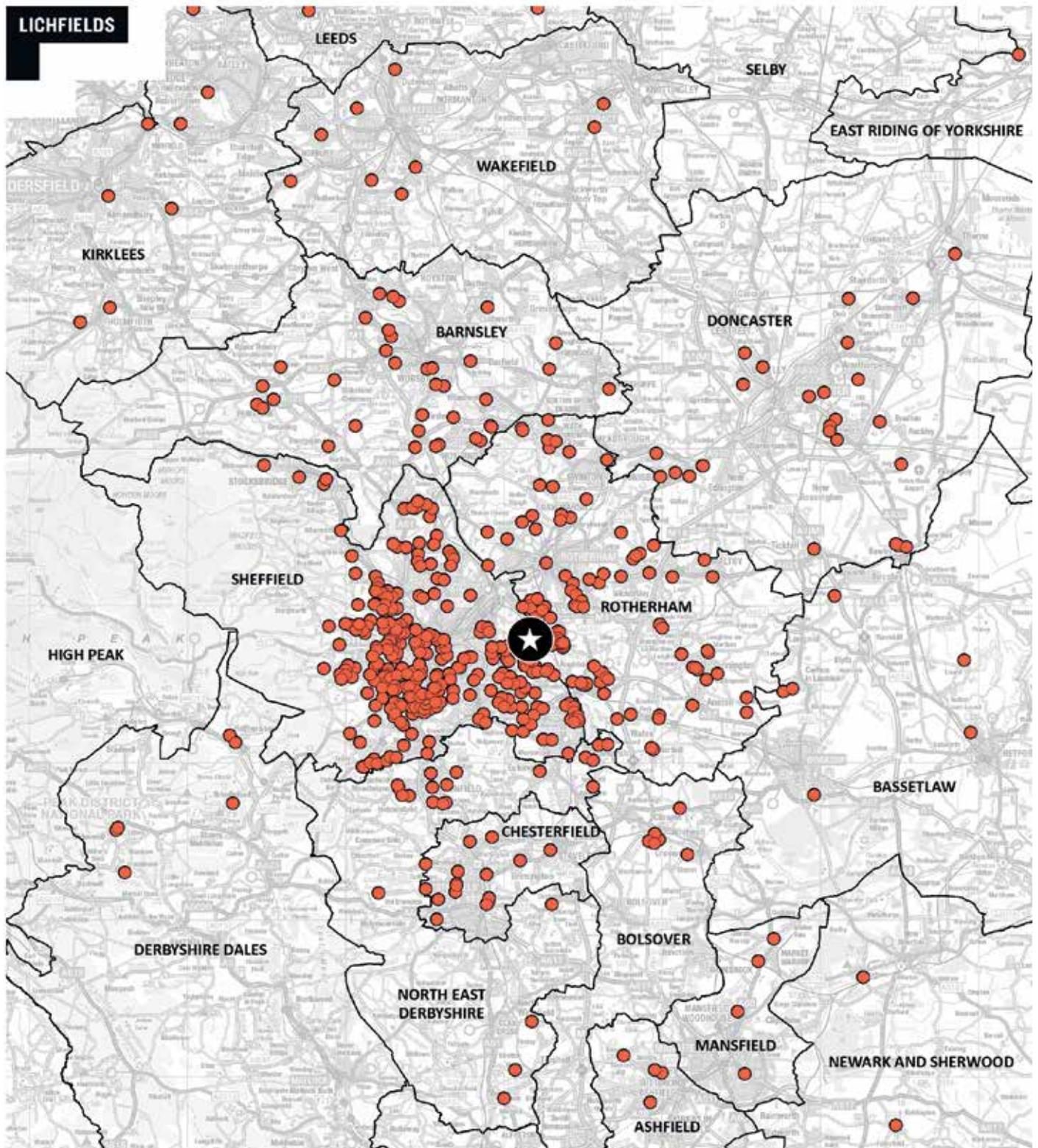
Previous research commissioned by the Association for Innovation, Research and Technology Organisations (AIRTO) considered the multiplier effect of the Innovation, Research and Technology (IRT) sector¹⁰. This is considered a reasonable proxy for the activity led by the AMRC and has been applied in previous, project-based, economic impact work undertaken on behalf of the centre¹¹. The work for the AIRTO concluded that:

“The IRT [Innovation Research and Technology] sector has an employment multiplier of 2.4. Thus, for every 100 people employed in the sector itself, another 140 jobs are supported elsewhere in the UK economy.”

Applying an employment multiplier of 2.4 to the 520 direct FTE jobs supported by the AMRC would suggest that the total employment impact of the centre could be 1,250 FTE jobs at the UK level. This is comprised of:

- 520 direct FTE jobs; and
- 730 indirect and induced FTE jobs.

¹⁰The impact of the innovation, research and technology sector on the UK economy, Oxford Economics (2014)
¹¹AMRC Cymru Economic Impact and Market Assessment (2018) and North West AMRC Economic Impact Assessment (2017)



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-  AMRC
-  Local Authority Boundary
-  Employee Home Postcode Location (December 2019)

Figure 6.2: Distribution of AMRC (Sheffield) and AMRC Training Centre Employees
Source: AMRC / Lichfields analysis



Economic Output

The jobs supported by the AMRC are highly productive, generating a greater level of Gross Value Added per worker. GVA is a measure of the difference between what is produced as output (goods and services) and the inputs (raw materials, semi-finished products etc.) used in the production of those outputs. It represents the additional value that is added through economic activity. In measuring economic growth, economists typically have regard to the quarterly (or annual) change in GVA for a given area.

The high productivity of AMRC workers reflects the centre's focus on innovation and R&D activity. Research commissioned by the AIRTO¹² concluded as follows and has been applied in previous, project-based, economic impact work on behalf of the AMRC¹³:

“The IRT [Innovation Research and Technology] sector’s productivity, at £64,100 gross value added per employee per year, was 45% higher than the UK average in 2013.”

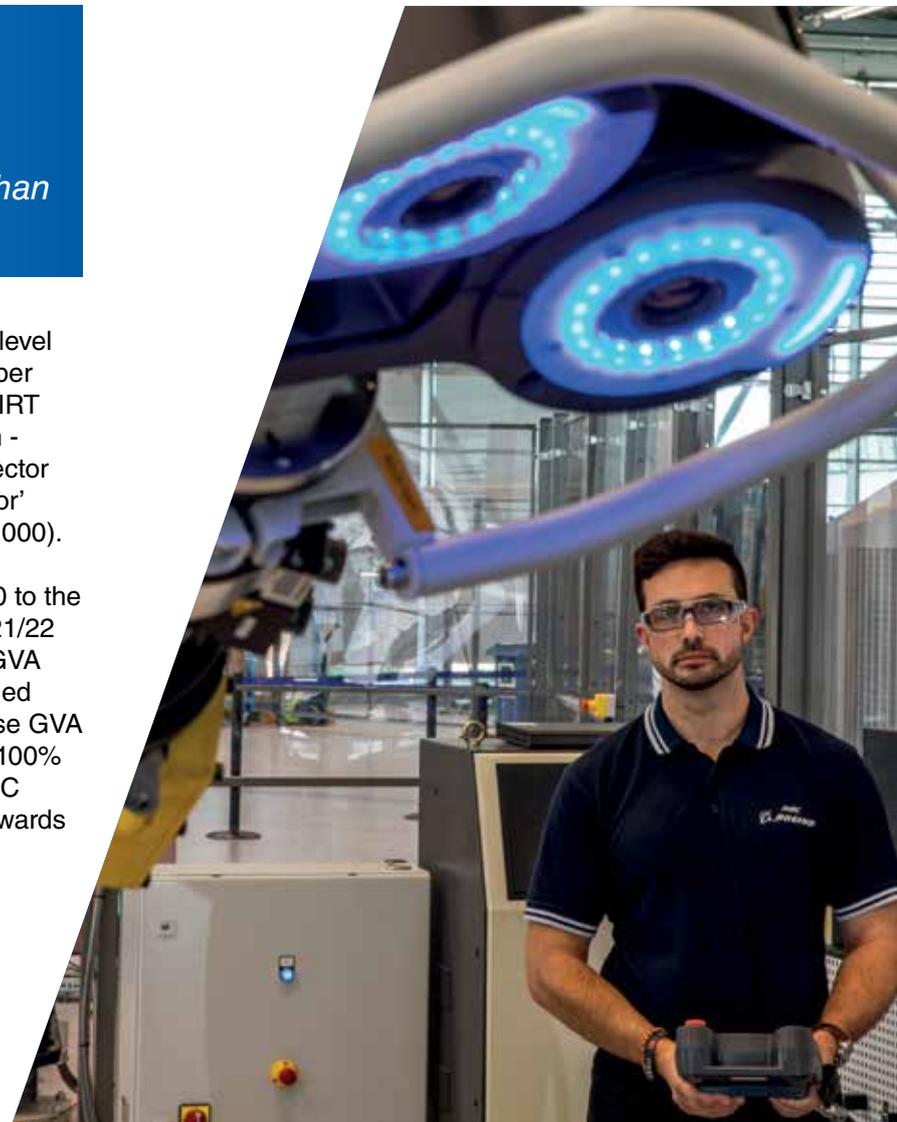
2021 data from Experian indicates that - at the UK level - the average FTE worker creates £74,100 of GVA per annum. This would suggest that the productivity of IRT workers now stands at £107,400 of GVA per annum - assuming that the sector still outperforms the ‘all sector average’ by 45%. This is almost double the ‘all sector’ average observed at the South Yorkshire level (£57,000).

Applying an average GVA per job figure of £107,400 to the 520 direct FTE jobs supported by the AMRC in 2021/22 would suggest that these workers generate direct GVA of £55.8m per annum. The South Yorkshire Combined Authority’s Strategic Economic Plan aims to increase GVA per employee across South Yorkshire from 82% to 100% of the UK average by 2040. Activity led by the AMRC can make a disproportionately large contribution towards realising this target.

Wages

In 2019/20, the total wage bill of the AMRC was in the order of £24.8m. This does not include the wages paid to AMRC Training Centre learners (see Section 4.0). This corresponds to an average annual salary of £45,800 per FTE worker.

This exceeds the average salary of a full-time worker at the UK level (£38,550) by 19% and at the South Yorkshire level (£33,160) by 46%¹⁴. It is clear, therefore, that the high productivity of AMRC workers is being reflected in high salaries. In addition, the data highlights the positive contribution made by the AMRC to the delivery of the South Yorkshire Combined Authority’s Strategic Economic Plan’s ambition to raise wages across the area with a view to closing the gap with the national average.



¹²The impact of the innovation, research and technology sector on the UK economy, Oxford Economics (2014)

¹³AMRC Cymru Economic Impact and Market Assessment (2018) and North West AMRC Economic Impact Assessment (2017)

¹⁴Based upon ‘all sector’ mean average salaries (2020) from the Annual Survey of Hours and Earnings

7.0 Summary

Figure 7.1 below provides a summary of the headline benefits attributable to the activity of the AMRC. Further detail on each is provided in the preceding chapters.



The Economic Benefits of the AMRC

The Advanced Manufacturing Research Centre (AMRC) is a world-leading research, innovation and skills development facility.

With locations in South Yorkshire, Lancashire and North Wales, the Centre makes an important contribution to the UK economy – as well as the local areas within which it operates.

The AMRC's contribution to improved economic outcomes includes:



120

The AMRC has almost 120 industrial members, ranging from internationally renowned manufacturers to local SMEs



1,100

Engagements with private sector businesses per annum (2017/18 to 2019/20)



£55.8m

Annual contribution to economic growth (Gross Value Added)



1,700+

Total number of apprenticeships delivered since 2013



46%

AMRC workers earn 46% more (on average) than the average full-time worker in South Yorkshire



80%

South Yorkshire residents account for 80% of all apprenticeships delivered



£260m

The AMRC has helped to attract more than £260m of investment to the Advanced Manufacturing Park, creating over 600 jobs

Figure 7.1: Summary of AMRC economic benefits | Source: Lichfields







The
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