

Final Draft Version 10

A report on the opportunities for YU partners to contribute to the growth of innovative manufacturing in the region – presented as part of the Yorkshire Universities Technical Assistance Project

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1. Project Scope

The main aim of this report is to identify the opportunities for YU partners to contribute to the growth of the innovative (Advanced) Manufacturing Sector in the region. The report focuses on the region as defined as being the LCR, the Humber and YNY&ER area and the YU partners.

It will achieve this through reviews of the LEP strategic plans, strengths of the YU partners, advanced manufacturing in the region (specifically component manufacturing) and sources of national and European funding.

2. Introduction

The author of this report, Simon Malins has over 30 years industrial experience in the field of manufacturing automotive components before joining the University of Huddersfield in August 2013 as an Industrial Programme Manager. He is a member of the Yorkshire & Humber EEF Regional Advisory Board and has worked closely with UKTI, BIS, MAS, EEF, local manufacturing associations and local authorities in the region. With the assistance from colleagues at the University of Huddersfield this report will provide a balanced view on advanced manufacturing in the region, identify opportunities for the YU partners to assist advanced manufacturing and make some recommendations on how to facilitate these opportunities.

Innovative, High Value and Advanced are commonly used terms to describe sectors in manufacturing. Definitions of all three terms are not precise and there is a significant overlap between them however in general a company described as any one of these can be identified through one or more of the following traits:

- Produce a technically advanced product or assembly of parts
- Use technically advanced manufacturing processes
- High level of investment in R&D either internally or through collaboration
- Have an established process for encouraging innovation in the business

For the purposes of this report we will review the broader advanced manufacturing sector which encompasses both innovative and high value sectors. In particular the report will look at the manufacture of components as opposed to process industries such as chemicals and petro-chemicals. In this report the term Advanced Manufacturing will be used as the collective description for this boarder sector covering innovative, high value and advanced manufacturing.

3. Methodology

Reports and documents referenced in this report are:

LCR, Humber and YNY&ER LEP Strategic Economic Plans
YUTA report on HE/SME engagement
YU LCR Higher Education Institutions Key sector strengths report
Kirklees Employers Survey 2013
Advanced Manufacturing in the LCR Dec 2012 (Mazars LLP)



DBIS report on their findings from the UK innovation survey 2013

Witty Review of Universities and Growth

Information on the advanced manufacturing sector will also be sought from contacts within the LEPs, EEF & BIS Yorkshire, Humber & North East and local authorities.

Desktop review of the SEP's with follow-up discussion if required

University strengths will primarily come from the LCR Higher Education Institutions Key sector strengths report which identified institutions as specialising in the Advanced Manufacturing Sector. In addition the Universities of Hull and Leeds were contacted by phone.

The review of sources of national and European funding is based partly on similar other YUTA reviews and the authors knowledge of other funding opportunities.

4. Executive summary

The main conclusions from the research that was carried out in preparing this report are:

- all three LEPs identify innovation as a key to driving future growth and employment in the Yorkshire and Humber Region
- innovation in the Yorkshire & Humber Region, based on published data (e.g. patent applications) is thought to be below the national average
- this report questions if this is really the case by putting forward an argument that innovation is thriving in the region with many examples of innovative companies in the advanced manufacturing sector
- the report focuses on the advanced manufacturing of components (rather than processes industries) and concludes that the main clusters in this sector are in the LCR and the M62 corridor
- the LCR has the highest concentration of companies working in the manufacturing sector of all 39 LEP regions in the country and the 4th highest in terms of employment in the advanced manufacturing sector
- due to the industrial heritage of the LCR region academic institutions are strong in engineering, science, textile and material research particularly within the Universities of Bradford, Huddersfield and Leeds
- potential funding opportunities in the advanced manufacturing sector are identified which include ESIF, TSB, Horizon 2020, AMSCI & RGF
- the report highlights the reluctance of SMEs to engage with HEIs so a significant change is required on how the parties engage in collaborative partnership building
- some key recommendations from the Witty report are reviewed in context with the need to improve the SME/HEI relationship
- the report concludes with a proposal to create a project to develop innovation in the automotive supply base in the region through the YUs supplying the expertise to both embed an innovation culture within the automotive supply chain and to provide support in terms of research expertise for specific projects

5. LEP SEP reviews

5.1 Leeds City Region (LCR) LEP (£340m of EU Structural Funds)

LCR is the largest core UK city region (outside London) in terms of both output and population with 106,000 businesses in the area. It has 139,000 manufacturing jobs (more than anywhere else in the country) and an economic output of £55 billion (5% total England). It has 8 HE's and 14 FE Colleges where 36% of research is world-class and 10% world-leading.

They have 6 Key growth sectors including innovative manufacturing which employs 49,500 people in the region. There are strengths in textiles and components (e.g. gears, valves & turbochargers). One of the strategic pillars of the SEP is support for growing businesses through the Business Growth Programme and Growing Places Fund. It is clear that the LEP recognises the need to encourage more innovation in SME's as current levels based on R&D spend and patent registrations are below the UK average.

Key initiatives include:

- LCR Business Growth Hub
- Accelerate innovation by investing in capital infrastructure to develop 'flagship' innovation assets
- Project Growth Hub to provide information, advice, coaching and mentoring services to SME's accelerating their growth

The LEP has plans to engage with 20,000 new and existing SME's over the period between now and 2020 with an ambition to create 62,000 new jobs through the Growth Hub project. The long term vision is to have strong private sector growth based on innovation and exports. The challenge is how to unlock innovation in an SME dominated economy that perceives there are significant barriers to innovation (see Appendix B YUTA report table 6 Barriers to innovation).

5.2 York, North Yorkshire and East Riding (YNY&ER) LEP (£92m of EU Structural Funds)

YNY&ER LEP is the largest LEP area by geography with the business sector predominately being made up of small and micro companies. The LEP will deliver growth by supporting SME's to innovate, improve and grow. The priority business sectors have been identified as food manufacturing, agritech and bio-renewables. Indeed 35% of manufacturing jobs in the area are in the food sector. Whilst the area has some world class innovative companies overall innovation levels are below average so there is a need to support businesses to invest in R&D.

The investment priorities for the LEP as described in their SEP are:

1. Invest in profitable small and micro businesses. Increase innovation, support for new business starts, improve competitiveness and enhance skills. Create a single

- access point to improve links between business and universities. Financial support for R&D and new product development. Ensure coordinated business support.
2. World class innovation in agritech and bio renewables. Investment in the Biovale hub at the University of York.
 3. Create a productive workforce, inspired people and empowered communities. Supporting skills development
 4. Successful and distinctive places unlock major growth opportunities, environmental quality and community needs
 5. A well connected economy Transport infrastructure within the region and access to the UK and international markets.

Based on the recommendations of the Witty review and the principles of smart specialisation sector/cluster strengths are a foundation of the growth strategy. 4 core activities:

- National Agrifood innovation campus at York
- BioHub at the University of York
- Connect agriculture sector to agritech and biorenewables expertise and opportunities
- Support investment in energy and resource efficiency

Advanced manufacturing does not appear to be a high priority within this LEP area which reflects the typical rural nature of the region. With the reliance on agriculture it is clear that the priority areas are in food manufacturing and agritech sectors.

5.3 Humber LEP (£87.67m EU Structural Funds)

The Humber LEP is a diverse geographic area with urban conurbations, market towns, rural hinterlands and coastal settlements which means there will be an array of opportunities for growth across several sectors. 90% of the Humber by area is classed as rural. The Humber economy is heavily dependent on SME's with 80% of businesses having less than 10 employees. There are some large enterprises which include Smith & Nephew, BP Chemicals, Reckitt Benckiser & Tata Steel. Production accounts for 8% of GVA for the region.

The LEP has 5 strategic programmes to build on the regions strengths and to address the known challenges. These are:

- Growth and innovation programme to support SME's
- Skills development programme
- Sustainable communities and social innovation programme
- Change and environmental protection programme (flood risk management)
- Infrastructure programme

A report from the University of Hull titled 'The capability of the Humber Region' identifies the major economic sectors in the region that should be targeted for growth through the SEP plan period to 2020. These are:

- Renewable energy: offshore wind, biomass and biofuels
- Ports and logistics
- Chemicals (second largest sector in the UK)
- Food, food manufacturing and agribusiness
- Manufacturing (25,000 employed in the advanced manufacturing sector)
- Digital and creative services

The Witty review of Universities and growth identifies the Humber as a key supply chain area for offshore renewable engineering. The SEP identifies that the port and port related developments constitute the most significant development opportunity in the Humber especially related to offshore wind.

The growth and innovation programme seeks to increase innovation amongst local businesses and the University of Hull is working closely with the LEP in this respect. Examples of this include plans for a computational sciences institute at the University and the establishment of a hub for gaming and digital creativity in the Humber. Engagement with catapults in areas such as e-navigation, maritime commerce, security and integrated sea-land logistics and collaboration with Strathclyde in offshore renewables will be part of the innovation programme.

Through the SEP it is clear that the University of Hull is working closely with the Humber LEP to deliver on the innovation and skills strategies. Plans for a £100m investment at the University are outlined with major projects including, a Logistics Institute, a Health hub campus, the National centre for offshore wind, the Humber Energy Campus (virtual campus across HE/FE) and the University of Hull Humber development Institute.

Development plans for each of the key growth sectors are currently being drawn up. A substantial part of the £27m earmarked for SME development will support innovation activities in SMEs through various schemes (e.g. innovation vouchers).

6. Advanced Manufacturing in the Region

Manufacturing in the Yorkshire and Humber region is characterised by the high number of SMEs working in the sector. In the YU report on HE/SME engagement table 11 (see appendix C for table 11) shows that of the 22,495 SMEs in the manufacturing sector 14,280 (63%) have no employees. Of the remaining 8,215 companies, 7,525 are classed as small (less than 50 employees) and 690 as medium size (50 to 249 employees).

Due to the difficulty in precisely defining advanced manufacturing accurate numbers employed in this sector are difficult to determine. The LCR and Humber have the highest concentrations of advanced manufacturing in the region employing around 50,000 and 25,000 people respectively. In the YNY&ER region there is an estimated 7,000 employed in the advanced manufacturing sector. This figure has been estimated through an analysis of company registered SIC codes (figures supplied by the YNY&ER LEP). It is therefore clear that the highest concentrations of advanced manufacturing are in the LCR and Humber.

In the Humber area advanced manufacturing is in the main linked to heavy engineering (e.g. Steel Making) and the Chemical and Petro-Chemical industries. However there is a diverse advanced component manufacturing sector having a few large firms such as Swift Caravans & Ideal Heating but mainly made up of many small engineering companies. With the establishment of the new Siemens Offshore Wind facility in the region an opportunity exists to develop a local supply chain to manufacture components and assemblies for wind turbines.

The LCR is home to over 7,500 companies working in the manufacturing sector employing 135,000 people which gives it the highest level of such employment in all of the 39 LEP areas. With 50,000 employed in advanced manufacturing this gives it the fourth largest level of total employment in advanced manufacturing sectors of all the LEP areas.

The M62 corridor through West Yorkshire has an established reputation for engineering and component manufacture going back to the birth of the textile industry. There is a wide variety of high value added activities and some real niche strengths in products for the automotive, energy and low carbon supply chains such as gears, valves, pumps and turbochargers. Whilst there are only a few well-known large manufacturing organisations in the area, one of its core strengths is in the number of SME's that support important supply chains in the advanced manufacturing sector.

The region suffers in terms of publicity and awareness in the advanced manufacturing sector due to the lack of big name corporates attracting significant clusters of local companies to support supply chains in sectors such as aerospace and automotive. However in the area to the south and west of Leeds there are over 100 suppliers in the automotive sector the majority of which are SMEs. In fact one of the most significant strengths of the region in advanced manufacturing is the great diversity of companies in the sector supported by a cluster of world class innovative engineers delivering internationally recognised bespoke engineering solutions.

7. Innovation within Advanced Manufacturing in the Region

Quantitative data such as R&D tax credits, patent box returns, R&D spend and patents filed by Yorkshire based companies has been used in several reports to establish the level of innovation within the manufacturing sector. The analysis of this data suggests that the region is somewhat lacking in the area of innovation in advanced manufacturing which is a common theme running through the 3 SEP documents reviewed and an area of improvement that each of the LEP's have identified as a key strategy.

We should however have some caution when analysing the results of certain data as it could result in a misleading conclusion about the intensity of innovation in the region. For example:

- Many large companies file patents from their head office either in the UK or abroad even though the idea may have been generated locally (2013 IPO data top 50 companies who make multi patent applications account for 62% of all patents granted)
- Innovative companies may prefer to keep their ideas a trade secret rather than placing them in the public domain through filing a patent
- Innovation business to business through supply chain development may not lead to patent filing for commercial sensitivity reasons
- Many SME's don't make use of R&D Tax credits or patent box (Business survey in Kirklees only 10% of manufacturing companies claim these)

The latest data from the IPO for 2013 (See Appendix D for UK regional data) shows Yorkshire in 7th place out of 12 UK regions for the number of patents granted. Whilst Yorkshire at 171 is still below the North West at 204, it sits between the East Midlands (113) and West Midlands (192) and far out performs the whole of Scotland at 142. Data on trademarks and design are also available from the IPO but these are not necessarily a significant indicator of innovation in the manufacturing sector.

A report by Mazars LLP, commissioned by the LCR LEP on the advanced manufacturing sector in the LCR made several recommendations specifically aimed at improving the level of innovation in the region.

- Capitalise on existing local strengths in the sector
- Differentiate activities for existing businesses and for new/incoming businesses
- Encourage greater levels of innovation, for example through creation of more innovation space in the region
- Support to facilitate provision of R&D and new products

The report highlights the fact that advanced behaviours are prevalent in many firms not previously thought to be in the advanced sector. It is these companies, rather than the ones more traditionally known for innovation where the most forward thinking behaviour exists and demonstrates the strongest potential for growth.

The report also includes a survey of people from the policy community and the advanced manufacturing sector. The main findings of this survey were:

- Whilst hard data suggests 37% of employment is in the advanced sector the survey shows that almost 60% of firms undertake R&D and product development and exhibit the behaviours associated with this sector
- More advanced firms tend to be larger, have a highly skilled workforce and likely to export.
- They collaborate with local Universities and other academic institutions
- Main barriers to growth related to the general business climate (recession) and access to finance
- Majority of firms have little or no engagement with public or other agencies unless support is needed and they are also unclear about the support that may be on offer
- Only 13% of firms had contact with agencies like MAS (Manufacturing Advisory Service), local authorities, HE/FE institutions, UKTI etc.

These findings would suggest that the advanced manufacturing sector in the region is actually larger than previously estimated. It is however important to understand that whilst 60% of manufacturing companies undertake R&D only 13% engage with external agencies or academic institutions. This is an important finding and one that should be considered carefully in future strategic thinking on how to improve the collaboration between advanced manufacturing and academia. Whilst the YUTA report on HE/SME Engagement identifies some of the key issues with regard to collaborative partnerships between academic institutions and industry (especially SMEs), further research is recommended to ensure that any future strategy will address the current low level of engagement.

As a measure of the level of collaboration between industry and academia in the region an analysis of Knowledge Transfer Partnerships (KTP's) has been made. The key objective of this long established funding stream is the transfer of knowledge between an academic institution and an industry partner. The data has been taken from the UK KTP website so should give a good indication of how the region performs against the rest of the UK.

| Region | % KTP Projects 2013 |
|--------------------|---------------------|
| South East | 14% |
| Scotland | 13% |
| North West | 13% |
| Yorkshire & Humber | 10% |
| Northern Ireland | 8% |
| West Midlands | 8% |
| London | 7% |
| South West | 7% |
| East Midlands | 6% |
| North East | 5% |
| Wales | 5% |
| East | 4% |

Yorkshire & the Humber had an overall 10% share of current KTP projects with only the North West (13%) and the South East (14%) areas having a higher share in the English regions. Split by sector 12% of the current KTP's in Yorkshire & the Humber are in the HVM sector compared to the national average of 11%. Still the actual numbers are relatively low with only 8 current KTP's in the HVM sector in Yorkshire & the Humber regions.

An analysis of completed KTP's in the HVM sector shows that Yorkshire & Humber have an 11% share of the UK total with 29 projects. Of these 29 projects 28 were collaborations with YU partners which would indicate already a strong alignment between YU partners and the advanced manufacturing sector in the region where collaborative partnerships have already been established. Taking England as a whole the YU partners have a share of 16% of the total number of completed KTPs in the HVM sector.

In the region's advanced manufacturing sector there are many hidden gems, companies either at the cutting edge of global technologies or simply innovative in their own field of expertise. It is difficult to quantify this through statistical means so we have collated a list of companies (See Appendix A) that can be considered to be innovative in the advanced manufacturing sector. Many of the companies in this list have either won awards for innovation, are investing in R&D (product and/or process) or are leaders in their field of expertise.

The intention of including this list is to demonstrate the incredible breadth of innovation in advanced manufacturing across the region. It is by no means an exhaustive list but it will hopefully go some way to supporting an argument that innovation in the advanced manufacturing sector in Yorkshire & Humberside is actually alive and kicking.

As further indicator of R&D activity, the RGF has approved 14 projects in the Yorkshire & Humber Region having an element of R&D activity with a total investment of £34m. These RGF projects are directly linked to positive GVA and job creation in the region.

8. Strengths of YU partners to support Advanced Manufacturing in the region

University Partners within scope:

1. Bradford
2. Huddersfield
3. Hull
4. Leeds
5. Leeds College of Art
6. Leeds College of Music
7. Leeds Trinity University
8. Leeds Metropolitan University
9. York
10. York St John

The key strengths as relevant to the Advanced Manufacturing Sector from the YU Report - Leeds City Region's Higher Education Institutions Key Sector Strengths are set out below. This was supplemented by telephone interviews with Hull and Leeds Universities and web research.

University of Bradford

- Advanced materials engineering
- Automotive research – Automotive Research Centre
- Polymer micro and nanotechnology
- Wireless communications
- Visual computing

University of Huddersfield

- Efficiency and performance engineering
- Advanced metrology and innovative manufacturing - EPSRC Centre for Innovative Manufacturing in Advanced Metrology
- Powertrain engineering – Turbocharger Research Institute
- Railway research – Institute of Rail Research
- Materials and coatings research

University of Hull

- Medical Engineering
- Logistics Institute
- Sustainable & Green Energy Systems

University of Leeds



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- Institute of Design, Robotics and Optimisation
- Medical Technologies
- Functional Surfaces, Coatings & Tribology
- Electronics, photonics and electrical systems
- Advanced Textiles
- Nanotechnologies

Leeds College of Art

Leeds College of Music

Leeds Metropolitan University

- The New Technology Institute - Digital Research Centre
- Leeds Sustainability Institute

Leeds Trinity University

University of York

- Materials Research – novel optical, electronic, magnetic properties
- Electronics – signal processing, intelligent systems, electromagnetic compatibility
- Nanotechnologies

York St John University

- Design
- Assistive technologies

Summary:

In terms of “Advanced Component Manufacturing”, there is significant expertise within key institutions, covering many aspects which support and facilitate innovative component manufacturing. This area has a notably higher profile and depth of expertise at the Universities of Bradford, Huddersfield and Leeds.

University of Bradford:

The Automotive Research Centre established in 2010 builds on the School of Engineering’s research expertise giving a broad range of Mechanical and Automotive related topics especially focussed on CO₂ reduction in the road transport sector.

The Advanced Materials Engineering Group plays a central role in high-technology developing new materials such as electronic polymers, biomaterials, ceramics, nano-composites and ‘smart’ materials.

The re:centre is a new space designed especially to enable business to work more effectively with the University. Its aim is to inspire and support design and re-design of products, services and infrastructure to deliver new business solutions.

University of Huddersfield:

The ESPRC Centre for Innovative Manufacturing in Advanced Metrology is at the forefront of developing the concept of 'factory on the machine'. This links measurement and production in a way that improves quality, increases precision whilst minimising costs.

The Advanced Machining Technology Group (AMTG) has an international reputation in research into the abrasive machining area. It houses state-of-the art precision machining facilities and the group's main focus is to develop ultra-precision machining technology for ever increasing demands of the medical, aerospace, automotive and energy industrial sectors.

The University has recently launched the UK's only research group specialising in Turbocharging backed by support through the Region Growth Fund. The Turbocharger Research Institute (TRI) will support both teaching, through a new MSc course in Turbocharger Engineering and research into turbocharging. Being in close proximity to 2 major global turbocharger manufacturers (BorgWarner Turbo Systems & Cummins Turbo Technologies) means the University is ideally placed to collaborate with these major players in the turbocharger market.

The recently opened 3M BIC (Buckley Innovation Centre) is the gateway into the University for industry partners especially SMEs. It facilitates partnerships between business and the University and has been recognised (witty 2013 & Wilson 2012) as an exemplar of business to University Engagement. The 3600 sqm facility houses both large and SME companies and provides specialist equipment and resources that are not normally available to SMEs.

University of Leeds:

The University has a strong offer to industry partners in process engineering through the High Value Chemical Manufacture Hub. The University is closely engaged with a wide range of industrial partners such as Procter & Gamble, GSK, Syngenta and AstraZeneca.

The Institute of Design, robotics and Optimisation has expertise in design systems, solid mechanics, dynamics and control, optimisation, aerospace and structural engineering. The institute's 3 main areas of research are: 1) bio-mechanics & robotics; 2) design sciences; 3) energy efficient automotive and aerospace structures.

9. Review sources of national and European funding

9.1 ESIF/ESF

The YUTA report on HE/SME Engagement Section 2 details the background to the 2014-2020 ESIF programme and is very relevant to this report considering the high number of SMEs in the advanced manufacturing sector in the region. Appendices 2 & 3 of this report detail the forecast budget spend on SME innovation & research and SME competitiveness. These are two areas of interest to potentially fund future collaborations with universities. Match funding from universities can be either in cash or using in-kind support such as staff time (through time-sheet evidence).

HEI's must ensure that the match funding they are providing is eligible and generally must not come out of other EU funding streams. The proportion of the match varies and will depend for instance on the geographical location of the company being assisted in addition to other criteria. Historic intervention rates for previous HEI projects with ERDF funding in the region are in the range from 45% to 64%.

9.2 Technology Strategy Board

These are mainly single project engagements and can be applied for either as a single company or consortium of companies. Examples are TSB Smart Awards, TSB Innovation Vouchers, TSB themed competitions. All projects must be company led.

9.3 Horizon 2020 (replacement of FP7)

Within the Horizon 2020 programme there are relevant themes for SMEs, research and innovation. These tend to be larger projects and those which bring together consortia from across the EU. Local firms in the advanced manufacturing sector and universities could look to use supply chain connections to gain entry into these larger consortium projects. Projects can be either company or university led.

9.4 Advanced Propulsion Centre (APC)

The APC has been set up recently in conjunction with the UK Automotive Council to oversee the spend of £1bn (£500m government, £500m match from the private sector) in the next 10 years to support the development of low carbon automotive power plants of the future. Operating in the 5-8 TRL (Technology Readiness Level) region the APC has been set up to bridge the so called 'valley of death' where so many good ideas fail to get into production due to lack of support. This is a good opportunity for universities, large companies and SMEs to obtain funding either through consortium bids or single projects but minimum project size is currently £5m. Calls for projects will be twice per year to enable consortiums to be built and funding applied for knowing there will be a regular funding stream for the next 10 years. Projects must be industry led.



9.5 Advanced manufacturing Supply Chain Initiative (AMSCI)

Several rounds have now taken place through the AMSCI funding stream. This is all about developing the UK supply chain especially in those sectors where today a high proportion of components are made outside the UK (e.g. automotive power plants, wind turbines & nuclear). LCR applied for funding through AMSCI but were unsuccessful. A steering committee is being set up to look at future opportunities to fund supply chain projects. This is another funding stream that YU partners could potentially benefit from.

9.6 Regional Growth Fund (RGF)

Now into round 6 and both private enterprises and universities can bid for funding. For example the University of Huddersfield has successfully bid for RGF funding to expand its Institute for Rail Research and is also a collaborator in an industry led successful bid from BorgWarner TurboSystems in Bradford. Round 6 closes in September 2014 and it is not known if there will be another before the next general election in May 2015.

9.7 LCR and Humber Growth Funds (using RGF funding)

Both the LCR and the Humber were successful in obtaining RGF funding in earlier rounds as programme bids. This allows the local LEPs to allocate funding to smaller scale projects, mainly but not limited to SMEs with similar objectives to the main RGF projects, i.e. the creation of sustainable employment. Some examples of companies who have made successful bids can be found in Appendix A

9.8 Knowledge Transfer Partnerships (KTP)

A long established funding programme between industry and academia. This is an excellent way for a company to make its first engagement with a university. Projects must be built around a transfer of knowledge between the university and the company. Funding comes predominantly from the TSB and the company. The contribution for an SME is in the region of £21,000 to £25,000 per year. For that they get a post graduate associate placed within their organisation, half a day a week of a senior academic and opportunities to use equipment and facilities within the university.

10. HEI engagement with Advanced Manufacturing in the Yorkshire and Humber region

To begin this section here are some of the key recommendations from the Witty Review of Universities and Growth:

- Universities should make facilitating economic growth a core strategic goal
- Universities to assume an explicit responsibility for facilitating economic growth
- Universities to partner with innovative local SMEs
- Government through HEIF to incentivise universities to engage long term with innovative SMEs
- LEPs should direct a large share of innovation funding to excellent universities including those that support local innovative SMEs

Before we can answer the question as to how the YU partners can contribute to the growth of the advanced manufacturing sector in the region we must first understand the reasons why companies, especially SMEs are reluctant to partner with academic institutions for R&D. The YU report HE/SME engagement captures this for the SME's and the DBIS report on their findings from the UK innovation survey 2013 gives the broader UK view. 61% of companies collaborate with clients or customers, 59% collaborate with suppliers but only 22% collaborate with universities or other HEIs. Of companies that rate themselves as highly innovative, over 50% find sources of information from within their own internal enterprise groups, however only 3% find information from Universities or other HEIs. It is also interesting to note that the major factors driving innovation within businesses were quality enhancements being the most motivating factor followed by replacement of out-dated products or processes.

It is clear that if HEIs are to increase their collaboration with businesses then a significant change is required on how the parties engage in partnership building. New projects need to be industry led with a clear route to market if funding is going to be sought through LEPs as a key priority for all regions is to create GVA and sustainable employment. From the author's previous experience, successful collaborations between HEIs and industry are frequently built around individual personal contacts and trust. Given that individuals on both sides tend to be mobile these days, either within or outside of their organisations, collaborations built on this basis are likely to be weaker than those built on a commercial basis e.g. business-to-business. Indeed this could be one of the reasons behind the finding that companies are more likely to collaborate with their customers and suppliers than academic institutions.

Due to the diversity of the advanced manufacturing sector in the region it would be reasonable to assume that it is not possible for HEIs to have expertise in all the different technologies covered by the sector. However, within the region there are some technology themes that could be considered to be a high tech cluster. For example in the West Yorkshire area we have manufacturers of turbochargers, pumps, gears and valves together with their related supply chain partners within a technology theme encompassing the movement of fluids. In the Humber, with the creation of the new Siemens wind turbine plant, there is an opportunity to build a local supply chain creating a wind energy cluster.

Precision machining whilst being a very generic term covering many aspects of engineering could in itself define a group of advanced manufacturing companies in the region that would not necessarily fit into any of the other groupings.

With the lack of many large corporations in the area, YU partners will need to ensure their SME engagement strategy works for both themselves and is an attractive proposition for the SME. Indeed HEIs will need to decide if their overall strategy on working with industry includes growing partnerships with the advanced manufacturing sector as this will inevitably involve supporting a higher number of smaller projects with SMEs. YU partners should align themselves with a sector or sectors where they have expertise or where they see an opportunity within the region, e.g. University of Huddersfield setting up a Turbocharger Research Institute, Hull establishing a National Centre for Offshore Wind, Leeds a High Value Chemical Manufacturing Hub.

If the YU web site is intended to be a portal through which SMEs find their way into academia there needs to be a clear offer on the YU Web site detailing each YU partners strengths and what they can deliver in terms of expertise in the advanced manufacturing sector. In addition there needs to be an awareness campaign in the advanced manufacturing sector of opportunities to partner with local HEIs e.g. areas of expertise, introductory funding offers, funding explained in easy to understand terms, successful case studies, testimonials etc.

What does advanced manufacturing need from HEIs to grow their businesses? Do we really know or are the HEIs more focussed on their own areas of research? We need to align both the requirements of the advanced manufacturing sector with the research and knowledge base of academia in the region if YU partners are going to further contribute towards growth in the region's advanced manufacturing sector. This could be the topic of a follow-on project to research in detail the needs of the advanced manufacturing sector in the region, determine if innovation is built into business strategies and how they view collaboration with local HEIs.

This report cannot be complete without a mention of the proximity of the Sheffield LEP Region, the Universities of Sheffield and Sheffield Hallam and the Advanced Manufacturing Research Centre (AMRC) one of the government flagship catapult centres. Built up around the Nuclear and Aerospace sectors by far this is the largest single investment in the advanced manufacturing sector within the Yorkshire region. Large corporations such as Boeing and Rolls Royce have invested heavily along with government funding in the new advanced manufacturing park next to the AMRC. If the rest of Yorkshire and the Humber is to benefit from this huge investment in advanced manufacturing on our door step we need an inclusive integrated strategy with the aim of encouraging more participation by SMEs in collaboration partnerships with HEIs.

11. An opportunity for YU Partners to contribute to the growth of advanced manufacturing in the region – the development of innovation in the automotive supply chain in the Leeds City Region

From the research carried out during this report one recurring theme that is seen to be a barrier to growth in the region is the lack of innovation (perceived or actual). In the authors opinion it is unlikely that this is due to the region having a lack of innovators with ideas (in academia or industry) especially in the advanced manufacturing sector. We have in the region highly experienced engineers in the advanced manufacturing sector and world class academics. We must surely have the right ingredients for innovation, the question now is how to unlock the potential of great ideas to create wealth for the region. We therefore need to:

- create an environment within organisations especially SMEs for innovation to thrive
- establish processes to create ideas leading to higher levels of innovation
- embed innovation in the business strategy
- create a clear path from idea through to production

Within the Yorkshire and Humber region and in particular the LCR there is a significant cluster of companies that supply the automotive sector as can be seen from the map in Appendix E. There are circa 150 companies employing around 5,000 people who are operating in this sector.

The Automotive Sector is one of the key industrial strategy areas within advanced manufacturing. It is therefore proposed that the YU support an innovation programme within the regions automotive supply base funded primarily through ESIF, with additional potential funding through AMSCI 2014, private investment and academic institutions. A programme of this nature would support both regional and national strategies to unlock potential and accelerate growth in the advanced manufacturing sector in the LCR creating wealth and new employment.

YU partners would contribute to raising innovation levels in the automotive supply chain through:

- assisting companies to embed an innovation process into their business operation covering topics such as: idea generation, IP, patents, rapid prototyping, funding streams, R&D investment planning, tax credits, patent box etc. This could be done either on a one-to-one basis or through workshops
- setting up a programme to facilitate idea generating sessions (either at the company or external premises e.g. use the 3M BIC)
- supporting a process to take innovative ideas through an initial research phase with a nominated HEI & academic
- help to find funding to take projects through to market
- supporting research based collaborations with the automotive supply base



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Proposed next steps are:

- meet with the LEP to review the proposed approach
- YU meeting to review expertise relating to the automotive sector
- conduct an in depth analysis of the automotive supply base in the region
- market survey companies in the automotive sector to understand their development needs
- gap analysis to match YU expertise with the needs of the automotive sector in the region
- identify 'primes' in the automotive sector to lead a potential AMSCI bid
- make a proposal to the LEP for funding the project

Appendix A: Innovative & advanced manufacturing companies in the Yorkshire & Humber region.

Here are some examples of innovative advanced manufacturing companies from across the region.

Cummins Turbo Technologies: manufacture turbochargers, manufacturing plant & global R&D organisation in Huddersfield. Investing in new heat recovery technologies to improve the overall efficiency of commercial diesel engines.

BorgWarner TurboSystems: manufacture turbochargers, manufacturing plant & R&D in Bradford. Expanding R&D department and collaboration with the University of Huddersfield through an RGF grant.

Flexitalic: major global supplier of gaskets for the automotive, oil, gas and nuclear sectors world headquarters in Cleckheaton.

Parker Hannifin: Filtration Group manufacture highly engineered components such as engine crankcase breather systems at their plant in Dewsbury.

CJ Antich: in Huddersfield are world leaders in advanced 3D weaving technologies with applications across major industrial sectors including aerospace and automotive.

Camira Fabrics: 600 employees and £60m turnover, in Mirfield West Yorkshire, hold the Queen's Award for Sustainable Development. Award winning Sting fabric, they are experts in the field of natural 'blast fibre' fabrics where the textile fibre occurs naturally inside the stems of certain plants e.g. the common stinging nettle, hemp, flax and jute.

David Brown Gears: in Huddersfield world leaders in gear and gearbox design for transportation, defence, wind turbine and industrial sectors.

Paxman Coolers: in Huddersfield the global leader and innovator in Scalp Coolers that prevent hair loss during chemotherapy.

Reliance Precision: in Huddersfield Bespoke gear & gear drive systems for industry sectors such as medical, scientific instruments, aerospace, photonics, defence etc.

Harvard Engineering: in Normanton won the Queen's Award for innovation manufacture lighting control technologies.

Swift Caravans: in Cottingham East Riding, innovative Multi-award winning manufacturer of Caravans, Motor Homes and Holiday Homes. Use of advanced modelling techniques in structural stress analysis for light weighting and aerodynamic performance.

Harrison Spinks: in Leeds pocket spring bed manufacturer and experts in microspring technology. Queen's Award for Innovation developing this technology across to the automotive sector. Also successful RGF bid for extending R&D facilities.

Ideal Heating: in Hull manufacturer of boilers Queen's Award for Innovation 2013.

NTR Precision Tooling Engineers: Situated in Wetheby NTR are Europe's leading specialist in the repair of pocketed cutting tools. Won the EEF Future Manufacturing Award 2013 in the Operating Practices and Processes category through the development of a reverse engineering programme with the University of Huddersfield.

Surgical Innovations Group: Based in Leeds and specialises in the design and manufacture of solutions for use in minimally invasive surgery (MIS). Have a partnership with Leeds Metropolitan University. Won many awards including Queen's Award for Enterprise, SME manufacturer of the year Yorkshire Business Awards, Innovator of the year Medlink and Thebusinessdesk.

Millers Oils: based in Brighouse West Yorkshire manufacture advanced engine oils, lubricants and fuel additives. Won the Motor industry Award for Technology and Innovation for their low friction Nanodrive Technology.

Radio Design: based in Shipley West Yorkshire are market leaders in the provision of wireless infrastructure sharing solutions and RF filter systems. Have won the Queen's award for Enterprise, Young Innovative Business of the Year (Innovator 10 Awards) and finalist in the Royal Academy of Engineering (MacRobert) Awards.

Advanced manufacturing companies with successful Humber Growth Fund RGF Bids:

Donaldson Filter Components Ltd: Global leader in Filtration Technology. Increased production capacity

Rofin Sinar: with headquarters in Hull they design, develop and manufacture sealed carbon dioxide lasers. Recent RGF award to support innovative laser development and build a new manufacturing plant.

Kingston Eng Co Ltd: based in Hull, a leading specialist in the design and manufacture of bespoke power screws. RGF award to invest in a new CNC machine.



Appendix B: Barriers to innovation from the YUTA HE/SME Report

| Potential Barrier to Innovation | Y&H companies | UK Averages |
|---|--------------------------|--------------------|
| Excessive perceived economic risks | 17.3% | 20.8 |
| Direct innovation cost too high | 22.5% | 20.7 |
| Cost of finance | 21.4% | 24.7 |
| Availability of finance | 21.8% | 24.8 |
| Lack of qualified personnel | 6.9% | 7.5 |
| Lack of information on technology | 3.4% | 2.5 |
| Lack of information on markets | 3.1% | 2.8 |
| Market dominated by established businesses | 6.6% | 10.4 |
| Uncertain demand for innovative goods or services | 9.4% | 9.0 |

Appendix C: Number of SMEs in Yorkshire & Humber by Sector YUTA Report HE/SME Engagement

| SME by Sector | No Employees (unregistered)* | No Employees (registered)* | 1 | 2-4 | 5-9 | 10-19 | 20-49 | 50-99 | 100-199 | 200-249 | TOTAL |
|---|---------------------------------|-------------------------------|---------------|---------------|---------------|--------------|--------------|--------------|------------|------------|----------------|
| A Agriculture, Forestry and Fishing | 800 | 6,755 | 1,680 | 1,900 | 545 | 215 | 65 | 20 | 5 | 0 | 11,985 |
| B, D and E Mining and Quarrying; Electricity, Gas, Steam and Air Conditioning Supply; Water Supply; Sewerage, Waste Management and Remediation Activities | 770 | 290 | 20 | 190 | 120 | 85 | 45 | 20 | 5 | 0 | 1,545 |
| C Manufacturing | 11,085 | 3,195 | 585 | 2,915 | 1,740 | 1,320 | 965 | 430 | 210 | 50 | 22,495 |
| F Construction | 52,115 | 8,005 | 1,915 | 6,040 | 1,830 | 920 | 400 | 105 | 25 | 10 | 71,365 |
| G Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles | 12,290 | 10,120 | 2,900 | 9,015 | 4,265 | 1,940 | 895 | 285 | 110 | 20 | 41,840 |
| H Transportation and Storage | 15,195 | 3,140 | 485 | 1,190 | 565 | 370 | 260 | 70 | 35 | 10 | 21,320 |
| I Accommodation and Food Service Activities | 5,170 | 995 | 1,660 | 4,085 | 2,090 | 1,085 | 490 | 120 | 35 | 5 | 15,735 |
| J Information and Communication | 11,180 | 4,470 | 105 | 1,990 | 455 | 225 | 140 | 40 | 20 | 5 | 18,630 |
| K Financial and Insurance Activities | 4,780 | 830 | 100 | 700 | 260 | 120 | 60 | 30 | 10 | 5 | 6,895 |
| L Real Estate Activities | 50 | 3,095 | 175 | 1,360 | 520 | 205 | 55 | 15 | 5 | 0 | 5,480 |
| M Professional, Scientific and Technical Activities | 16,260 | 10,970 | 1,045 | 5,550 | 1,575 | 830 | 405 | 140 | 60 | 5 | 36,840 |
| N Administrative and Support Service Activities | 16,705 | 3,745 | 1,050 | 2,850 | 1,030 | 550 | 330 | 165 | 85 | 15 | 26,525 |
| P Education | 15,050 | 715 | 85 | 560 | 255 | 175 | 95 | 15 | 10 | 5 | 16,965 |
| Q Human Health and Social Work Activities | 18,180 | 955 | 500 | 1,060 | 805 | 875 | 795 | 205 | 50 | 15 | 23,440 |
| R Arts, Entertainment and Recreation | 7,615 | 1,350 | 175 | 725 | 275 | 140 | 100 | 25 | 15 | 10 | 10,430 |
| S Other Service Activities | 15,645 | 1,275 | 1,045 | 2,615 | 820 | 245 | 80 | 10 | 5 | 0 | 21,740 |
| TOTAL | 202,890 | 59,905 | 13,525 | 42,745 | 17,150 | 9,300 | 5,180 | 1,695 | 685 | 155 | 353,230 |

Appendix D Patent applications filed and Granted by Region 2012-2013

| Region | Applications Filed | | Patents Granted | |
|----------------------------------|--------------------|--------|-----------------|-------|
| | 2012 | 2013 | 2012 | 2013 |
| East Midlands | 860 | 742 | 130 | 113 |
| East of England | 1,821 | 1,802 | 360 | 337 |
| London | 2,522 | 2,588 | 375 | 346 |
| North West | 1,426 | 1,259 | 239 | 204 |
| Northern Ireland | 252 | 236 | 23 | 18 |
| North East | 358 | 314 | 58 | 52 |
| Scotland | 931 | 900 | 190 | 142 |
| South East | 2,865 | 2,822 | 614 | 437 |
| South West | 1,398 | 1,368 | 413 | 340 |
| Wales | 519 | 539 | 107 | 79 |
| West Midlands | 1,130 | 1,180 | 219 | 192 |
| Yorkshire | 1,025 | 984 | 182 | 171 |
| Unmatched | 263 | 237 | 64 | 33 |
| Postcodes** | | | | |
| Total | 15,370 | 14,971 | 2,974 | 2,464 |
| Percentage increase year on year | | -3% | | -17% |

Source: IPO Data

Appendix E Geographical spread of companies active in the automotive sector (Yorkshire & Humber)

