



# UNDERSTANDING THE REGION'S INNOVATION CAPACITY, CAPABILITY AND POTENTIAL

A Report to the West Yorkshire Combined Authority

June 2019

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# EXECUTIVE SUMMARY

RSM UK Consulting LLP (RSM) have been commissioned by West Yorkshire Combined Authority (the CA) to undertake research into the region's innovation capacity, capability and potential. For the purposes of this commission, 'the region' refers to the new West and North Yorkshire LEP geography which includes Bradford, Calderdale, Leeds, Wakefield, Kirklees, York, Selby, Harrogate, Craven, Hambleton, Scarborough, Richmondshire and Ryedale. The study has been undertaken between February and April 2019.

## Background to the Study

The study has been commissioned to inform the development of the region's Local Industrial Strategy. It will further West and North Yorkshire partners' understanding of innovation activity in the region and provide recommendations to support the development of a highly innovative economy. Despite a wealth of innovation assets, including nine Higher Education Institutions (HEIs), West and North Yorkshire partners have identified that regional innovation rates are low:

- Business research and development (R&D) is very low despite slightly higher than average HEI spending on R&D;
- Low take up of innovate UK opportunities (and other innovation support) by businesses; and,
- Low interaction between HE institutions and businesses.

The purpose of this commission is to provide a detailed assessment of how innovation takes place within the region, how innovation diffusion takes place, and the interventions that are required to increase business investment in innovative activities.

## Innovation within Businesses

There is evidence that firms that grow quickly through innovation tend to have positive regional spill-over effects (with the exception of firms in the professional services sector). In contrast, firms that grow quickly due to high employment growth can lower productivity, as labour competition drives up wage costs for other firms<sup>1</sup>. With the commercialisation of knowledge/invention within businesses being one of the primary drivers of jobs and productivity growth, it is important to understand the how businesses innovate and the implications for policy making.

Innovation within businesses has been categorised as:

- Incremental: typically internal, low cost, low risk, high frequency and low impact;
- Differential: typically customer-focused, medium cost, medium risk, fluid and regular with significant impact; and,
- Radical: typically strategic, high cost, high risk, low frequency and high impact.

## Business Capacity to Innovate

While public interventions tend to focus on understanding market failures and the constraints which are hindering innovation, some literature supports a focus on enablers rather than barriers.

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<sup>1</sup> Du and Vanino (2016), Gazelle firms Hoover up rural jobs but 'superstars' boost productivity for all.

Barriers should be seen as part of the innovation process i.e. if one route fails or a barrier is encountered, an alternative route should be sought.

There are a broad range of firm-level enablers such as collaboration, management and culture/climate. The strength of these enablers determines a firm's innovation capacity i.e. its ability to develop and coordinate the innovation process and to use innovation input to produce innovation output<sup>2</sup>. Where firms have strong innovation capacity, they are able to continuously improve and remain ahead of their competitors. It is important to differentiate between the capacity to innovate and the resources required to innovate, with capacity enabling firms to deploy resources efficiently and effectively to achieve innovation outcomes. Recognising and assessing the innovation capacity within businesses could therefore help to unlock innovation potential.

## Innovation Ecosystems

Given the range of variables which can impact on a business' propensity to innovate, creating 'better' and more innovative businesses cannot just focus on individual business interventions. Human resource and money are key inputs into the innovation system, with innovation enabled through knowledge assets, business activities and supportive structures which facilitate interaction across different actors.

Key to delivering a more innovative economy is ensuring that the building blocks for innovation (money, talent, infrastructure) are in place, but also that each element is connected and operating efficiently and effectively. It will be the places which can move from ideas to successful commercialisation the most quickly and efficiently which will see the greatest productivity benefits.

The ability to quickly lever different resources to respond to new opportunities, particularly within a fast-moving sector, has been critical to growth in other countries<sup>3</sup>. Within Germany, recent research has indicated that the scale of investment in R&D and the volume of ideas that are generated (particularly within the automotive sector) are supporting growth, but it is also the capability of the business base to quickly commercialise ideas and a sophisticated customer base which constantly challenges businesses to innovate which is creating efficiency within the system<sup>4</sup>.

## Addressing Inefficiencies

There are some common inefficiencies within innovation ecosystems which hinder innovation. A fragmented landscape which includes many players connected in indirect and uncoordinated ways limits capacity to innovate, and although there are numerous knowledge assets and structures to support businesses looking to innovate (e.g. incubators, accelerators, translational research facilities etc), each often provides a specific kind of support which may be time-limited, sector-specific or have other restrictions. The result is short-term and uneven provision which doesn't provide a consistent support structure capable of quickly meeting the diverse range of

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<sup>2</sup> <https://www.cairn.info/revue-journal-of-innovation-economics-2018-1-page-139.htm#>

<sup>3</sup> US Chamber Foundation, Enterprising States report, 2011

<sup>4</sup> <https://www.weforum.org/agenda/2018/10/germany-is-the-worlds-most-innovative-economy/>

business innovation support needs. A review of Singapore's innovation ecosystem<sup>5</sup> noted that a 'smart' innovation ecosystem would:

- provide innovators, integrators, and investors with direct access to what they need to do business, rather than having to jump through hoops;
- provide ongoing professional support to start-ups to grow;
- provide investors with greater exposure to deal flows; and,
- provide businesses with an accessible network of high potential partners, regardless of where they are.

Cutting across all this, should be deeper connections *“to allow a new level of learning, brainstorming, ideation and innovation processing. Through deep information sharing and mutual learning opportunities integrated into daily business spaces, Singapore can make it easier to encounter other players within the innovation value chain.”*

## Learning from the Literature

Businesses are constantly affected by a variety of different internal and external challenges, pressures and opportunities. They will respond to these in different ways. Some businesses will do nothing and risk losing market share/profitability; some will make incremental changes and others will make more radical changes to their business strategy. The effectiveness and efficiency of business responses will determine their future competitiveness, ability to create jobs and productivity.

Businesses ability to respond to new challenges or opportunities will be affected by their absorptive and internal capacity to acquire, absorb and use knowledge/information to produce innovation outcomes. The speed with which they are able to respond will also be affected by the effectiveness of the wider innovation ecosystem to support this process, and the strength/extent of their own innovation ecosystem. Supporting innovation requires more businesses to respond to challenges and opportunities. It requires businesses to be well placed to do this (i.e. in terms of their internal capacity), and it requires a supportive, efficient and dynamic ecosystem which facilitates the flow of ideas and speeds up the commercialisation process.

The most successful economies also appear to be those which are not passive but constantly push businesses to rethink their operations and innovate by presenting them with a flow of ideas/opportunities, providing the dynamic structures/incentives capable of quickly bringing together key and uncommon partners, and demanding change through the customer/supply base.

## The Region's Innovation Ecosystem

Analysis of headline statistics suggests that in relation to the key pillars which underpin an effective innovation ecosystem, the West and North Yorkshire region is, in most respects, comparable to other similar regions. Access to investment and download speeds are however below average.

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<sup>5</sup> <https://e27.co/singapore-innovation-ecosystem-is-in-need-of-a-new-model-20170719/>

## Summary Findings

Indicator	Result
Receipt of equity investment	Red
Receipt of Innovate UK grants	Green
Receipt of R&D tax credits	Red
Employment in science and technology occupations	Red
% population with no qualifications	Yellow
% population qualified to NVQ4+	Yellow
Level of innovation active firms	Green
Employment rate	Yellow
Life satisfaction	Yellow
Download speeds	Red
Gross annual earnings	Yellow
Total number of consultancy services delivered by HEIs	Green
Average number of consultancy services delivered by each HEI	Red
HEI spend on R&D per FTE	Yellow
Number of academic outputs (patents/disclosures etc)	Red
Productivity	Yellow

Stakeholders highlighted the following inefficiencies in the ecosystem:

- the composition of the business base i.e. predominance of SMEs and few large, tier one businesses;
- a mis-match between the region's main areas of research expertise and the local business base;
- low levels of exporting;
- low levels of collaboration with academia and inefficiencies in the collaboration process;
- insufficient support for business to business collaboration;
- a need to better integrate innovation into business support services;
- lack of a major physical hub for innovation activity;
- lack of a clear innovation offer to businesses which presents innovation in a way which is understandable and accessible;
- lack of talent to drive innovation; and,
- inadequate transport and digital infrastructure.

## Are Businesses in the Region Innovating?

A survey of businesses in the region indicates that most businesses are innovating. Nearly 70% of businesses surveyed carried out at least one Research and Development / Business Innovation activity in the last three years. This is almost 20 percentage points higher than the proportion of businesses nationally that indicated they were innovation active (50%) in the UK Innovation Survey 2014-2016 (2018).

Introducing new technologies is the most common innovation activity with 56% (236) of the 419 businesses that innovate undertaking this in the past 3 years. Just over 50% of businesses that innovate introduced new or significantly improved processes for producing or supplying goods or services and/or participated in knowledge transfer. The least popular business innovation activity was “introducing new or significantly improved goods” which was undertaken by just 31.5% (132) of businesses and investing in R&D which was undertaken by 38.9% (163) of businesses.

Whilst not conclusive, the findings could point towards a higher proportion of innovation activity within the region potentially being within lower value-added activities which focus more on process improvements/efficiencies. This may explain why high numbers of innovation active businesses has not translated into high GVA per capita. There is also a low proportion of businesses investing in new goods and R&D which are typically more differential and radical in nature. This view was broadly supported by stakeholders who suggested that the scale and nature of innovation activity within the region varies by business, but the focus of innovation investment is thought to be largely incremental, and the underrepresentation of large strategic businesses was thought to hinder more strategic and potentially higher impact innovation.

Stakeholders also perceive innovation to be undertaken predominantly ‘in-house’, with businesses only engaging with external partners when they run into difficulties. This can impact the quality of innovation activity, if businesses are not benefitting from external knowledge and solutions which may improve innovation outcomes. Lessons from innovation support programmes in the region have also suggested that many businesses lack the internal and absorptive capacity for innovation and require consultancy/mentoring support to understand what innovation is, how it can help their business, and how to do it.

It was also suggested by most stakeholders that many businesses will only invest in innovation when it is critical to the business. The suggestion here therefore is that businesses are primarily reactive to challenges rather than proactively seeking to maximise the potential that new opportunities could offer. This is potentially significant for the region as it does not suggest businesses are necessarily using innovation to get ahead, i.e. to be the first to maximise new market opportunities or disrupt their industries, but instead, are using innovation when faced with a challenge or competitive pressure to which they must respond to safeguard their position. This suggests that innovation capacity within the region’s business base may be weak and lacking a growth mindset and innovation culture. It could however also partly reflect the nature of the business base which may not necessarily be growth-oriented.

## Conclusions

**The majority of businesses in the region are innovating:** This study was commissioned based on the assumption that despite strong innovation assets (e.g. HEIs) within the region, this expertise is not been used to full effect, and regional innovation rates are low. Low investment in

R&D, low take-up of InnovateUK funding and low interaction between HEIs and businesses have been cited as weaknesses within the region's innovation ecosystem.

Analysis of the region's innovation ecosystem partly supports this view. Although the region's performance and the key factors which underpin a competitive innovation ecosystem are broadly comparable with other LEPs in the North and East Midlands, regions such as Oxfordshire demonstrate much stronger knowledge, talent and place assets and these are being levered to generate higher levels of productivity than in West and North Yorkshire.

**The number of innovation active businesses is above the national average:** Oxfordshire has fewer businesses that are innovation active. The same is also true for other 'innovative regions' such as Cambridgeshire and Peterborough, as well as northern examples such as Cheshire and Warrington where the number of innovation active businesses is below the national average.

**But it is important to consider not only who is innovating, but how and why:** Despite most businesses surveyed indicating that they are innovating, and official statistics indicating the region has an above average number of innovation active businesses, it is evident that this is not supporting a productivity uplift or creating the critical mass and spill-over effects which improve talent and place metrics. The main issue for consideration therefore, is not the scale of innovation activity within the region, but the nature of innovation activity and how innovation is being used by businesses.

**Innovation activity is driven by a broad range of factors determined at the individual business level:** Overall, innovation activity within the region is variable. It is driven and influenced by a broad range of factors which vary at the individual business level. While some businesses may be driven by new market opportunities and a desire to grow the business, others are driven by their personal experiences and a desire to 'do things differently' and solve 'real-world' problems. Discussions with businesses demonstrate that leadership/management capacity and motivation are important in creating innovative businesses, but external support structures can help to create the conditions which allow businesses to innovate efficiently and effectively to deliver business results.

It is widely accepted that innovation (i.e. using ideas to add value through the introduction of new/improved products, services or processes) is a mechanism through which the region can raise business productivity. Job creation is not however the primary objective of innovation at the business level. Although growth may lead to new job creation, innovation is primarily about building more competitive and profitable businesses.

**It is difficult to generalise about innovation activity by sector:** While broad conclusions could be drawn about innovation levels across different sectors, this risks oversimplifying a subject which is very diverse and dynamic. Mindset, culture, skills and other factors which impact a business's innovation capacity all have a bearing on when, how and why businesses innovate. Most stakeholders agree that some sectors are more likely to innovate collaboratively with research partners because the nature of their products and services requires this (e.g. med tech and bio economy sectors). However overall, most stakeholders felt that generalising about sectors risked masking variations within them, particularly as a lot of innovation activity is perceived to be unrecorded and not visible to external partners.

The sector focus for innovation activity may therefore need to consider where there is growth potential as innovation will play a key role in exploiting new opportunities in growing markets. The sectors identified as having the most growth potential within the region include:

- Agri-food sector in North Yorkshire;
- Rail and infrastructure in North Yorkshire;
- Med-tech in Leeds;
- Bio-science in North Yorkshire;
- Science and engineering in West and North Yorkshire;
- Cultural, creative and digital in West Yorkshire;
- Finance in Leeds; and
- Textiles in Calderdale and Kirklees.

**Most innovation activity is perceived to be incremental, reactive and not focused on enabling technologies which will deliver radical change:** Most innovation within the region is perceived to be incremental or differential i.e. predominantly low to medium cost and low to medium impact. Determining this with any degree of certainty however is challenging as quantitative statistics tend to focus on capturing the type of innovation undertaken and qualitative consultations with businesses tend to focus on those that are known innovators. Innovation is also understood to be reactive in a lot of instances e.g. undertaken when it is business critical or due to competitive pressures. The findings suggest that although businesses are innovating, it is not radical or strategic innovation which will deliver a step change in individual business performance and wider impacts on competitors or suppliers. Survey findings support this in part, indicating that businesses are more likely to be engaged in adopting or improving technology, processes and services rather than new goods, products or knowledge transfer.

**This is partly due to the nature of the business base and innovation capacity within the region:** The reasons for this may be partly attributable to the nature of the business base i.e. a high proportion of SMEs and few OEMs/tier one businesses, but also from low levels of innovation capacity within businesses and a lack of understanding as to what innovation is and how it can be used. Although business consultations and case studies indicate there are highly innovative businesses in the region, these are not perceived by stakeholder to be representative of the wider business base. Highly innovative companies such as Dyson and Microsoft use innovation strategically to disrupt sectors and proactively create new market opportunities which leaves their competitors having to adapt just to keep up. Building a business base with the internal capacity and mindset to use innovation more strategically is therefore required, and it is evident from discussions with innovative businesses in the region that leadership and management capability to drive and use innovation is an important precursor to creating a strong innovation culture in the region.

**But also due to inefficiencies within the wider innovation ecosystem:** Stakeholders identified a wide range of opportunities to improve the effectiveness of the innovation ecosystem. The challenges of business/HEI collaboration were highlighted, as well as opportunities to improve skills, business support, finance and the physical infrastructure to support innovation. Across all consultations, better communication and more opportunities for 'conversations' emerged as a common theme. This mirrors findings in the literature review which placed open and cross sector

communication as the core of innovation ecosystems which are efficient and proactive - constantly presenting businesses with a flow of ideas/opportunities, providing space for interaction, and providing the dynamic structures/incentives capable of quickly bringing together key and uncommon partners. Businesses also highlighted the importance of their external networks and partnerships in supporting innovation and the role of external mentors who can provide a different perspective and challenge businesses to help the identification of new opportunities.

**Improving communication and the effectiveness of the innovation ecosystem could encourage more open and outward looking innovation:** There is evidence that when innovating, businesses are not necessarily making full use of the support available to elevate the quality and impact of innovation activity. Although most businesses engage with external partners when innovating, approximately 43% do not. Where businesses are looking in-house to innovate, this can result in inefficient solutions being implemented and miss the potential benefits new external insight can bring. As noted above, businesses with a strong innovation culture are typically keen to bring external perspectives into the business to stimulate knowledge creation and diffusion.

**Innovation is more than investment in R&D and collaborative research:** Overall, businesses do not appear to associate innovation with investment in R&D with only a minority having a dedicated R&D budget. Analysis of expenditure on R&D is therefore likely to exclude a large proportion of innovation activity within the region. Most partnership working is business to business rather than involving the knowledge base, although, as noted above, there is evidence of variations by sector where testing and validation support from a HEI is required. Many businesses favour the immediate and flexible support private sector partners can provide and good practice from other regions suggests that brokering business to business solutions can be an effective mechanism to unlock innovation and business growth. What remains unclear however is the depth of partnerships being developed within the region and whether these are strategic or transactional in nature.

**However, HEIs play a key role in the region's innovation ecosystem:** Despite only a minority of businesses collaborating with HEIs, this remains an important component of innovation activity within the region. Most stakeholders suggested there is scope to better utilise the region's HEI assets particularly their national and international connections and ability to attract funding and investment, including for physical infrastructure and equipment. Physical innovation hubs and translational research facilities which provide an opportunity for interaction were highlighted as being important not only to improve HEI and business interaction, but also due to their potential spill over effects and ability to attract inward investment. The recent McLaren investment in Sheffield's Innovation Corridor was highlighted as an example of this. However, the opportunity to bring partners together around 'big ideas' of importance to the region (e.g. the circular economy, digital adoption, design) was also identified as an opportunity.

## Implications

The findings suggest the main building blocks for a successful, open innovation ecosystem are present in the region. There are however opportunities to make these elements work more efficiently and effectively through supply side interventions, as well as by stimulating demand from businesses which will encourage greater efficiency.

The system needs to be geared to continuing to increase the number of businesses that are innovating but also pushing more businesses to innovate differently and more strategically to unlock growth. Business need to be equipped to build dynamic relationships which allow them to increase the speed and quality of innovation activity. Based on the findings and stakeholder

feedback, the following sets out potential areas for intervention. Whilst disaggregated into supply and demand considerations, it should be noted that there is considerable overlap between the two 'sides'.

### **Stimulating Demand: Building an Innovation Culture**

Key opportunities identified to build a stronger innovation culture and stimulate demand for innovation include:

**Market building activities:** There is a need to engage with businesses differently. For most businesses, innovation is a process they implement in order to achieve something else. It is not an objective in itself. Talking to businesses about innovation can therefore have little meaning and value. Although the Industrial Strategy's Grand Challenges are intended to provide a focus for sectors and partners to come together to solve national problems, they are not necessarily issues which all businesses within the region can identify with and make a contribution to. Engaging businesses in campaigns which resonate, but will also, by their nature, stimulate innovation could therefore be explored. Engaging businesses in innovation via exporting, resource efficiency, digital adoption or design are possible options for consideration. These activities will also draw on sector strengths and expertise within the region, supporting market building and growth within these sectors.

**Maximising opportunities within the public sector:** Although austerity and public spending cuts have reduced the public sectors ability to stimulate demand, with a shortage of tier one businesses in the region, maximising the potential of public sector institutions to stimulate innovation through their supply chains remains important. This can include relatively light touch measures such as through procurement practices which incentivise innovation, or more intensive measures which lever the expertise of the private sector to improve the efficiency of public sector investments and activities.

**Collaboration and networking to support knowledge diffusion and identify new markets:** The region needs a process to encourage an exchange of ideas and a forum for business to business, business to HEI/research and user/producer meetings to speed up knowledge diffusion and increase demand for innovation by identifying new markets and functions for products and services (e.g. across businesses, sectors and supply chains). This is seen across the board as something the region needs. Business, support agencies and academia all recognise the importance of working collaboratively to break down artificial barriers and learn from each other. Providing such opportunities demonstrates that not all work to promote innovation must require significant resources. These forums are also vital in developing a more proactive approach to innovation which seeks to encourage more radical innovation rather than incremental innovation which is driven by competitive pressures.

The knowledge base needs to engage more proactively to provide a range of different mechanisms for knowledge sharing and conversations in addition to via collaborative research. HEIs are well placed to draw on their national and international connections for the benefit of regional businesses, with coordination and leadership viewed as key to successful networking. Networking across the region needs to be actively managed to encourage interaction between uncommon partners, encourage a more dynamic exchange of ideas and build multi-partner and cross border/cross sector relationships.

## Supply Considerations

**Building leadership and management capabilities:** Innovation culture within businesses is driven by leaders and management teams. Within established businesses consideration could be given to strategic business mentoring/advisory support or, at a technical level, studentships which bring temporary external expertise into businesses to develop innovation strategies or R&D capabilities.

**Entrepreneurialism and maximising the potential of the region's graduate population:**

Taking a long-term view, creating more innovative business leaders should start within the education system and the development of entrepreneurial skills amongst young people. Measures to encourage start-up amongst graduates and early stage career researchers is also important. Forums for researchers to interact with business leaders and commercial mentors to identify business opportunities and access practical support have been recommended, as well as increasing funding for academics to commercialise and take their research to industry rather than relying on businesses to lead collaboration.

**Branding and a place-based approach to innovation:** Attracting new investment to the region has the potential to drive innovation within indigenous businesses and create new market opportunities. The science parks in Daresbury, South Manchester and Liverpool have a clear identity, focusing largely on the brand of the City. If the region is to compete with other potential hubs to attract a critical mass of innovation led companies, there needs to be a strong and well understood brand and offer which can be marketed nationally and internationally.

The notion of clear messages and 'big ideas' which partners can buy into is linked to a place-based approach to innovation. The region, stakeholders and particularly its universities are focusing on the role of place in delivering economic goals established in the Industrial strategy, as well as wider social and cultural benefits. At its heart is the growing realisation that place plays a major role in driving innovation-led regional growth. Place based development is seen as having potential to:

- Drive clusters of business with the potential to innovate;
- Accelerate innovation collaboration; and,
- Promote business and academic exchange of ideas to adopt new technologies.

The region is well placed to develop place based innovation as it brings together the research hubs and Knowledge Centres engaging local businesses at the forefront of economic growth and economic sectors with the greatest potential for innovation. The Leeds City Region has been successful in securing seedcorn funding to develop a full proposal for the UK Research and Innovation (UKRI) Strength in Places Fund (SIPF) and the Yorkshire Universities are driving forward thinking on place-based innovation.

**Investment in infrastructure and digital connectivity:** The region needs investment in its physical and digital infrastructure to make it attractive for investment and to support knowledge diffusion. Interventions which facilitate the more effective and efficient movement of people, goods and services will create new opportunities, open new markets and bring new ideas and talent to the region. Whilst for some this requires investment in transport infrastructure, the potential of digital connectivity to facilitate interaction and exchange should not be overlooked. Leaders should also consider whether there is appetite to invest in a central hub for hi-tech

industry and innovation, or whether existing assets and facilities could be enhanced/coordinated to support a hub and spoke approach to development.

**Targeted business support:** New approaches to business support should be considered. There needs to be an on-going programme of activity to raise the innovation capacity of businesses and this needs to be integrated into existing business support mechanisms. Flexibility to respond to individual business innovation needs is vital, as well as the provision of consultancy and mentoring support to enable businesses to develop the soft skills and intangible assets which underpin innovation activity. With the findings indicating a need to increase the scale of differential and radical innovation, partners may also need to consider whether there is a rationale for targeting supply side interventions on high value/high growth sectors which may have more opportunity and capacity for innovation-led growth. Work (which is on-going) to identify local supply chains to focus investment and identify high productivity sector will be important in informing this but should also look at opportunities for cross fertilisation of supply chains and sectors too.

**A clear HEI offer:** Consideration should be given to the development of a clear, branded and consistent offer to businesses to access industry-focused research support and near to market solutions. The Technology/Innovation Gateway model for instance provides clarity regarding industry access points to research expertise. They provide a forum for researchers to engage with industry and undertake market focused R&D and can be underpinned by a consistent minimum support offer to businesses. Identifying gateways on the region's research specialisms also provides clarity regarding capabilities and priorities for growth.

In addition to physical gateways, businesses need a portal to access technology, expertise, IP, licences and facilities, and the research community need a forum to market their services as well as market specific projects and opportunities. Creating a research/knowledge 'marketplace' could help to stimulate greater collaboration and a culture of open innovation.

**Funding:** Funding is important to stimulate investment in innovation, particularly early stage and high-risk ventures and opportunities. Funding must support all stages of the innovation journey and should offer fast-track assistance for businesses requiring quick turnaround; small scale, flexible funding (such as innovation vouchers) to enable quick responses to technical challenges; strategic investment in radical innovation opportunities perhaps focused at supply chains, larger companies or disruptive technologies; and funding to allow businesses and organisations to better plan and improve the quality of innovation activity (e.g. funding for activities such as testing project viability, strategic thinking around disruptive technologies, engagement with partners outside of their own organisations for inspiration and for guidance, prototype development etc.) Awareness raising of tax credits for research and development as well as grants is key.

# CONTENTS

EXECUTIVE SUMMARY .....	2
1. INTRODUCTION.....	14
2. POLICY AND LITERATURE REVIEW .....	17
3. THE INNOVATION ECOSYSTEM .....	31
4. INNOVATION IN THE REGION .....	47
5. REGIONAL STRENGTHS AND WEAKNESSES .....	51
6. CONCLUSIONS & ISSUES FOR CONSIDERATION .....	65
APPENDIX 1: STATISTICAL ANALYSIS.....	72
APPENDIX 2: CONSULTEES .....	91
APPENDIX 3: SURVEY DATA .....	92
APPENDIX 4: INNOVATION ASSETS .....	99

# 1. INTRODUCTION

RSM UK Consulting LLP (RSM) have been commissioned by West Yorkshire Combined Authority (the CA) to undertake research into the region's innovation capacity, capability and potential. For the purposes of this commission, 'the region' refers to the new West and North Yorkshire LEP geography which includes Bradford, Calderdale, Leeds, Wakefield, Kirklees, York, Selby, Harrogate, Craven, Hambleton, Scarborough, Richmondshire and Ryedale. The study has been undertaken between February and April 2019.

## 1.1 Background to the Study

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- Business research and development (R&D) is very low, despite slightly higher than average HEI spending on R&D;
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- Low interaction between HE institutions and businesses.

The purpose of this commission is to provide a detailed assessment of how innovation takes place within the region, how innovation diffusion takes place, and the interventions that are required to increase business investment in innovative activities.

## 1.2 Research Questions

The research questions have been developed following discussion with the study steering group comprising representatives from the CA and the York, North Yorkshire and East Riding (YNYER) LEP; a review of literature; and consultation with an academic expert.

It is important to recognise that innovation is a very broad and complex subject area. There are different types of innovation (e.g. incremental or radical), different stages to the innovation processes (which may not be linear), and a diverse range of issues which can impact and influence innovation culture and propensity to innovate. The complexity of the subject matter means common trends and themes can be difficult to determine, and what works for one actor, institution or locality may not be successful at another place and time. The market failures which hinder innovation can also be broad and cut across different policy domains. It may be the case for instance that skills interventions could be the key to unlocking innovation potential within a locality, or a range of interventions may be required to build a more effective innovation ecosystem.

It is also important to recognise that the rationale for encouraging innovation (within the context of this commission), is to support 'good' economic growth which delivers against strategic economic growth objectives. While a locality may therefore be highly innovative, generating new

ideas/knowledge, products and processes, if this expertise is not being shared and commercialised, economic growth opportunities are being missed.

Literature suggests that innovative economies require several different building blocks to be in place to create the conditions and structures which will encourage innovation. The research themes and questions have therefore been underpinned by the Allas framework (see section 2.5) which sets out the characteristics of a successful innovation ecosystem i.e. investment, talent, assets, infrastructure/incentives and broader environment characteristics required to support knowledge creation, diffusion, translation, application and value capture.

The key questions that this research will aim to address are:

- Who is currently innovating and conversely, who is not?
- Does innovation activity vary by sector?
- How much innovation is not captured in R&D investment?
- What drives innovation activity?
- Is anything unique to The Region in terms of innovation or innovation activity?
- Who do innovating businesses engage and collaborate with on innovation activity?
- What role can Universities play in innovation and innovation diffusion? What does best practice look like?
- How do we (the Region) perform in terms of innovation and diffusion of innovation – and what role do issues such as business culture and sectoral make up play in this?
- How do we create/foster a culture of open innovation?
- What role do enabling technologies play in innovation and innovation diffusion?
- What role does place have in innovation activity and diffusion?

### **1.3 Approach**

The research approach has involved the following stages and activities:

- Literature, policy and good practice review: which explores definitions of innovation, how businesses innovate and the enabling factors which support this; and, the characteristics of an effective innovation ecosystem;
- Data analysis of the region's innovation ecosystem benchmarked against other regions;
- Qualitative stakeholder interviews: 21 in total which explored all key research questions outlined above; and,

- Quantitative business telephone interviews: 603 five to ten-minute telephone interviews with businesses within the region;
- Qualitative business telephone interviews: 11 qualitative business interviews.

## 1.4 Structure of the Report

The report is structured as follows:

Chapter	Content
Chapter 2	Policy and literature review
Chapter 3	Analysis of the region's innovation ecosystem
Chapter 4	Analysis of innovation activity in the region
Chapter 5	The region's innovation strengths and weaknesses
Chapter 6	Conclusions

## 2. POLICY AND LITERATURE REVIEW

### 2.1 Introduction

This chapter provides an analysis of literature, policy and good practice relating to the development of innovative economies. It explores:

- Definitions of innovation;
- How businesses innovate and the enabling factors which support this; and,
- The characteristics of an effective innovation ecosystem.

### 2.2 Defining Innovation

The What Works Centre for Local Economic Growth defines innovation as “*the invention, diffusion and exploitation of new ideas*”, which can lead to lower costs, smarter ways of working, higher productivity, and increased profits<sup>6</sup>. While there are other activities which can help to improve ways of working or lower costs (e.g. business support to create a marketing or business plan), innovation focuses on the invention and exploitation of new products and processes.

Each of these three steps (invention, diffusion and exploitation) are essential for innovation-led growth. If a HEI develops a new technology but does not share that knowledge, or if knowledge is shared but a firm cannot commercialise it, then the wider economic and productivity benefits of innovation will not be realised. The importance of invention, diffusion and exploitation coming together to support innovation has increased policy focus on the development of innovation ecosystems - the term used to describe the large number and diverse nature of participants and resources that are necessary for innovation<sup>7</sup>.

A strong and successfully functioning innovation ecosystem is important in supporting innovation-led growth. However, the geographical scale at which an ecosystem operates is not necessarily coterminous to political and geographical boundaries. Innovation ecosystems bring together a range of actors, including large firms, small and medium enterprises (SMEs), publicly funded universities, and other government research agencies as well as investors and other technical service providers. These actors will operate locally, nationally and internationally, with businesses exploiting research and inventions from across the globe and HEIs collaborating with businesses located overseas. This has been recognised by Government via Sector Deals, which support the bringing together of national assets to drive sector growth, as well as within the Northern Powerhouse, which is looking to exploit opportunities which cut across northern regions.

Whilst there are undoubtedly local economic benefits derived from the presence of world-class academic and research institutions within a locality, it is primarily the commercialisation and exploitation of knowledge, ideas and R&D within a locality’s business base which will deliver the jobs and productivity targets set out in local economic growth strategies. This could include innovation-led growth within the indigenous business base as well as the creation/attraction of new starts, spin-outs and inward investment.

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<sup>6</sup> <https://whatworksgrowth.org/policy-reviews/innovation/>

<sup>7</sup> <http://www.know-hub.eu/knowledge-base/videos/innovation-ecosystems-as-drivers-of-regional-innovation-validating-the-ecosystem.html>

## 2.3 Innovation within Businesses

There is evidence that firms that grow quickly through innovation tend to have positive regional spill-over effects (with the exception of firms in the professional services sector). In contrast, firms that grow quickly due to high employment growth can lower productivity, as labour competition drives up wage costs for other firms<sup>8</sup>. With the commercialisation of knowledge/invention within businesses being one of the primary drivers of jobs and productivity growth, it is important to understand the how businesses innovate and the implications for policy making.

### 2.3.1 How Businesses Innovate

Innovation within businesses has been categorised as:

- Incremental: typically internal, low cost, low risk, high frequency and low impact;
- Differential: typically customer-focused, medium cost, medium risk, fluid and regular with significant impact; and,
- Radical: typically strategic, high cost, high risk, low frequency and high impact.

Many businesses make on-going improvements and adjustments to their processes and products. These incremental changes are important in maintaining business competitiveness and safeguarding employment. Typically, these changes are undertaken in-house, without external support and happen 'below the radar' of most public sector partners. They can often be implemented quickly and easily and do not require significant risk or resource/time input. Indeed, many businesses do not recognise these incremental changes as innovation.

For many actors in the innovation ecosystem, these incremental changes are not true 'innovation' as they tend to focus on refinement and modification of existing processes and products rather than the introduction of new processes/products which will deliver a step change in business performance or direction. For many therefore, these incremental changes are best managed internally by businesses or via external business support where this will add value.

However, the European Community Innovation Survey notes that 'design' innovation may not radically change products/ or processes but can help businesses to better meet customer needs and are therefore an important part of the innovation process.

*"The role of design innovation for SMEs must be stressed. Design is only a small part of the complete R&D cycle and does not necessarily require access to scientific knowledge or advanced engineering technology. However, design is an enormously rich inventive and creative activity, which opens large opportunities to improve products. Traditional accounts of R&D largely underestimate the subtleties of innovative design which require a deep understanding of product function in relation to customer requirements; a strong command of all technical interdependencies within product components; and a clear appreciation of constraints posed by the manufacturing system. It is a highly synthetic professional capability and one important to many SMEs."*<sup>9</sup>

Differential innovation tends to involve the introduction of new products and/or processes, typically in response to changes or opportunities within the businesses current market e.g. responding to new customer service preferences or introducing new technologies to manage business processes. Differential innovation may require more planning, time and resource input from the

<sup>8</sup> Du and Vanino (2016), Gazelle firms Hoover up rural jobs but 'superstars' boost productivity for all.

<sup>9</sup> <http://www.oecd.org/industry/smes/2010176.pdf>

business than incremental innovation but will typically provide growth opportunities for the business and financial benefits.

Radical innovation however delivers more of a strategic change within the business and may involve the introduction of new products/services or expansion into a new market. This type of innovation typically delivers a more radical shift in the business and requires significant strategic planning, preparation and resource input. This type of innovation tends to be higher risk but offers higher rewards and scale-up opportunities.

### **Innovation Inputs**

Whatever the scale of innovation undertaken by businesses (incremental, differential or radical), it is important to consider the mechanisms by which businesses acquire or generate knowledge or ideas which ultimately lead to innovation outcomes.

Research suggests that SME's, particularly those operating in medium to low technology sectors, tend to innovate without using formal R&D. Instead innovation processes are very heterogeneous. The European Community Innovation Survey (CIS) distinguishes between R&D and non-R&D based innovation, with SME innovation identified as mostly non-R&D investment based, "*only as firm size increases does the importance of R&D investment in innovation increase too*". The main exception to this however is within sectors which require formal validation of products and processes and are highly research/technology based e.g. health and environmental technologies.

Although the returns to R&D can be significant, with firms in developed countries seeing returns of 20% to 30%, firms often under-invest in R&D as it is difficult for investors to capture and monetise all the benefits that could be derived. There is also the possibility that benefits can spill over to other firms e.g. through turnover of personnel to other firms or reverse engineering of products by competitors.

The different types of innovation which can occur within businesses and the fact that innovation is not always led by formal R&D activity (particularly amongst SMEs) has important implications for policy making. The focus on HEI's role in local economic development has been a key feature of innovation policy over recent years. Encouraging more and better business/HEI interaction supports knowledge diffusion and is therefore an important component in an effective innovation ecosystem. However, the literature suggests that a high proportion of innovation will not be led by formal R&D and this therefore makes support for other forms of knowledge creation (e.g. businesses internal innovation capacity) and knowledge diffusion (e.g. intra/inter business networking) important considerations.

### **2.3.2 Why Businesses Innovate**

The scale of innovation (i.e. incremental, differential or radical) undertaken by businesses is typically determined by what is driving them to innovate and what they hope/need to achieve through innovation. Business tend to innovate for the following reasons:

- Solving problems: Most ideas are derived from attempts to solve existing problems. For instance, if a business provides services, and customers do not have an avenue to provide feedback, a business may establish a virtual office where customers' needs can be attended to within a short time thereby increasing customer satisfaction which may drive additional sales.
- Adapting to change and competition: such as adapting to technological changes which help businesses remain relevant and profitable or responding to new market entrants.

- Maximising on globalisation: As global markets become more interlinked, businesses have access to more international opportunities but may need to adapt products and processes to meet the needs of different consumers and cultures. Whilst businesses have had access to support to tap into the growing Asian (and particularly Chinese and Indian) markets over recent years, Africa is expected to be the next growth area which may drive businesses to innovate.
- Evolving workplace dynamics: The demographics in the work place are constantly changing and some workplaces now have workforces which span up to five different generations and bring together employees with a broad range of different expectations and working cultures/practices. Workplaces need to adapt to this if they are to remain competitive.
- Customers' changing tastes and preferences: In an increasingly connected society, consumers have access to more choice and information than in the past and are adopting different consumer behaviours demonstrated by the well-publicised challenges facing the High Street. Businesses need to adapt to these evolving tastes and preferences.

In most instances therefore, it is a new pressure or opportunity which requires a business to rethink their strategy which leads to innovation. These pressures and opportunities will vary by sector and type of business and could stem from internal or external forces. This makes the targeting of innovation support difficult and suggests that flexibility to respond to individual business needs will be important.

### 2.3.3 External Drivers of Innovation

As noted in 2.3.2 above, businesses are constantly exposed to external changes and pressures which, in some instances, may encourage innovation. These influences may be national or international in scale, affecting many businesses within an economy (e.g. trade agreements which open new markets, or low carbon agreements); or they may be highly localised, only impacting businesses within a defined locality or sector (e.g. the availability of funding for innovation support).

External drivers are constantly changing as for instance, new regulations and policies come into effect, new technologies become available or new markets emerge as consumer demand changes. Regulation within the biotechnology sector for example is particularly heavy and increasing as ethical considerations (such as opposition to genetically modified foods) impose stringent regulations on the sector. Adapting to the constraints or opportunities changing operating environments create can drive innovation, and in some instances can drive innovation and opportunity in other sectors. For instance, the design sector is expected to benefit over the next five years from the government's commitment to increase investment in R&D, as businesses investing in new products could raise demand for design services. However, given that these changes will vary significantly between different sectors and individual businesses, identifying drivers at any given point in time can have limited value, particularly for policymakers. What is more important, is ensuring businesses are equipped, and encouraged, to pre-empt these opportunities/changes, and ensure that external conditions support businesses to react quickly and proactively. Businesses that innovate tend to be sensitive to their wider environment and therefore poor access to skills, finance or heavily regulated business environments can detract from businesses willingness to innovate<sup>10</sup>. The Allas framework (outlined at 2.5.1) sets out the

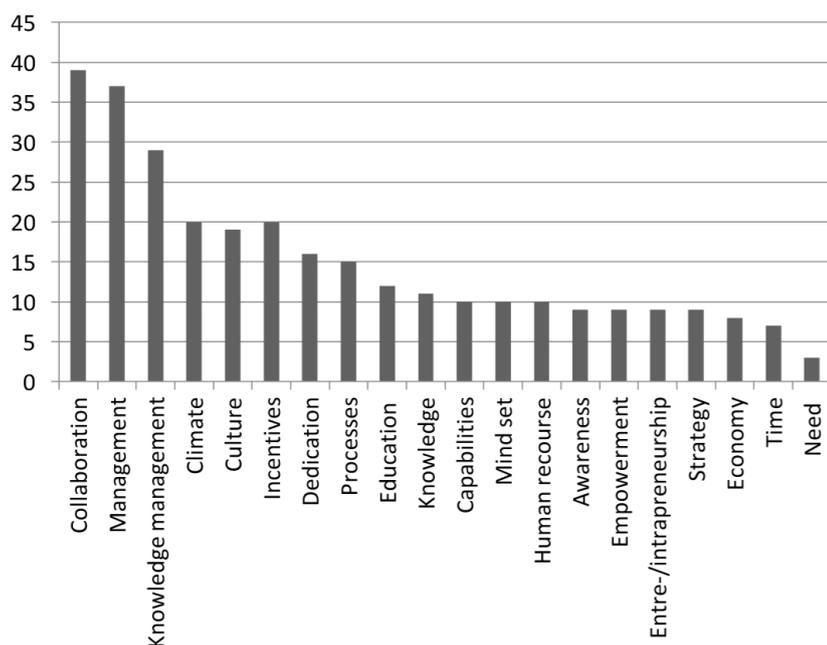
<sup>10</sup> <https://www.ebrd.com/downloads/research/transition/tr14c.pdf>

primary external enablers of innovation (money, talent, knowledge assets, business structure and incentives, broader environment), and are explored in more detail in chapter 3.

### 2.3.4 Internal Enablers of Business Innovation

While public interventions tend to focus on understanding market failures and the constraints which are hindering innovation, some literature supports a focus on enablers rather than barriers. Barriers should be seen as part of the innovation process i.e. if one route fails or a barrier is encountered, an alternative route should be sought. As noted above, the range of factors which can impact on a business’s ability and propensity to innovate are varied. Research by Johnsson published in 2017<sup>11</sup> reviewed innovation literature to identify the frequency with which innovation enablers were referenced. As identified in Figure 2.1, the following broad range of firm-level enablers were identified, with collaboration, management and culture/climate being most frequently cited.

Figure 2.1: Frequency firm-level enablers were mentioned in innovation literature



Source: Johnsson, 2017<sup>12</sup>

The strength of these enablers determines a firm’s innovation capacity i.e. its ability to develop and coordinate the innovation process and to use innovation input to produce innovation output<sup>13</sup>. Where firms have strong innovation capacity, they are able to continuously improve and remain ahead of their competitors. It is important to differentiate between the capacity to innovate and

<sup>11</sup> <https://www.diva-portal.org/smash/get/diva2:1170239/FULLTEXT01.pdf>

<sup>12</sup> 'Knowledge management' refers to the formalised approach to managing the creation, transfer, retention and utilisation of an enterprise's knowledge assets. 'Management' refers to the extent to which management capabilities support innovation.

<sup>13</sup> <https://www.cairn.info/revue-journal-of-innovation-economics-2018-1-page-139.htm#>

the resources required to innovate, with capacity enabling firms to deploy resources efficiently and effectively to achieve innovation outcomes.

Recognising and assessing the innovation capacity within businesses could therefore help to unlock innovation potential. Within the business support arena, there is increased recognition that culture and mindset play important roles in business growth and innovation. For example, RTC North's ScaleUp programme explicitly assesses business owner's mindset and ambition as this is recognised as a key factor in unlocking growth. The CA's Access Innovation programme also recognised the importance of raising businesses internal capacity through coaching support as a potential precursor to collaborative R&D.

Alongside innovation capacity which focuses on the internal capabilities to facilitate continuous improvement, literature also highlights 'absorptive capacity' as an important feature of businesses innovation potential i.e. the ability of firms to use new knowledge<sup>14</sup> by recognising its value, assimilating it and applying it to commercial ends<sup>15</sup>. Typically, this relates to new external knowledge however there is some crossover with analysis of internal innovation capability.

Four 'routines' have been identified as being relevant to absorptive capacity:

- *Acquisition capacity* - a firm's ability to locate, identify, value and acquire external knowledge that is critical to its operations;
- *Assimilation capacity* - a firm's ability to absorb external knowledge that it will later analyse, process, interpret, understand, internalise and classify;
- *Transformation capacity* - a firm's ability to develop and refine the internal routines that facilitate the combination of previous knowledge with the newly acquired or assimilated knowledge; and,
- *Application (or exploitation) capacity* – a firm's ability to incorporate acquired, assimilated and transformed knowledge into their existing and future operations and routines<sup>16</sup>.

While the first two bullet points relate to a firms' potential absorptive capacity, the final two bullet points relate to realised absorptive capacity which will be influenced by the firms' internal innovation capabilities outlined above i.e. their ability to use inputs to generate innovation outcomes.

Research by the Centre for Business Research (CBR)<sup>17</sup> argued that, "*regional differences in economic performance across UK can, at least in part, be explained by large differences in regional innovation performance ...it is argued that the observed 'regional innovation map' in the UK is largely a result of the differences in regional sectoral structures and in variations in firms' absorptive capacity.*"

CBR's research noted that higher absorptive capacity results in higher levels of intra and inter-firm knowledge spillovers and greater transmission of knowledge between firms and other institutions such as universities and public research institutes. Absorptive capacity is therefore

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<sup>14</sup> Roper and Xia (2014), *Unpacking open innovation*.

<sup>15</sup> [https://www.jstor.org/stable/2393553?seq=1#page\\_scan\\_tab\\_contents](https://www.jstor.org/stable/2393553?seq=1#page_scan_tab_contents)

<sup>16</sup> <https://blog.hypeinnovation.com/absorptive-capabilities-for-innovation-what-really-matters>

<sup>17</sup> <https://core.ac.uk/download/pdf/4158213.pdf>

important when considering the process of knowledge diffusion within an economy. Three different types of absorptive capacity are identified:

- Absorptive capacity for intra-industry knowledge (necessary to capture knowledge from sources within the firm's industry);
- Absorptive capacity for inter-industry knowledge (for knowledge originating in other industries); and,
- Absorptive capacity for scientific knowledge (for knowledge related to cooperation with universities and public research institutes).

A recent UK study by Harris and Yan (2018)<sup>18</sup> into absorptive capacity recommend that innovation policy should aim to (1) develop in firms the capabilities to search for, recognise, evaluate, assimilate and exploit knowledge; and (2) encourage connections and facilitate collaborations between firms. However, the authors also note that the specific approaches that governments should use to achieve these aims is a topic that requires further research. Drawing on the CBR research, and as noted above, it is evident that while business/HEI interaction has often been a focus for interventions supporting knowledge diffusion, consideration also needs to be given to intra and inter-industry knowledge diffusion and ensuring businesses have the internal innovation capacity to use this.

## 2.4 Open Innovation

Open innovation which encourages cooperation and collaboration between different partners to facilitate the smooth flow of ideas and knowledge is linked to absorptive capacity. Research has found that open innovation impacts innovation performance both directly and indirectly because it facilitates the building of absorptive capacity<sup>19</sup>. Encouraging open innovation and increased collaboration between firms, industries and research partners can therefore raise *potential* absorptive capacity, while raising firms' internal innovation capacity can support *realised* absorptive capacity. Barriers to open innovation can include:

- Cultural barriers, where firms or organisations lack prior experience of collaborative research;
- Internal barriers, namely organisational or administrative barriers within firms or institutions;
- Legal barriers, such as patents on products or processes;
- Financial barriers, such as lack of funding for collaborative research;
- Infrastructural barriers, such as a lack of suitable research institutions or facilities; and,
- Institutional barriers, such as a lack of collaboration networks.

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<sup>18</sup> Harris and Yan (2017) *The Measurement of Absorptive Capacity from an Economics Perspective: Definition, Measurement and Importance*.

<sup>19</sup> <https://core.ac.uk/download/pdf/74613260.pdf>

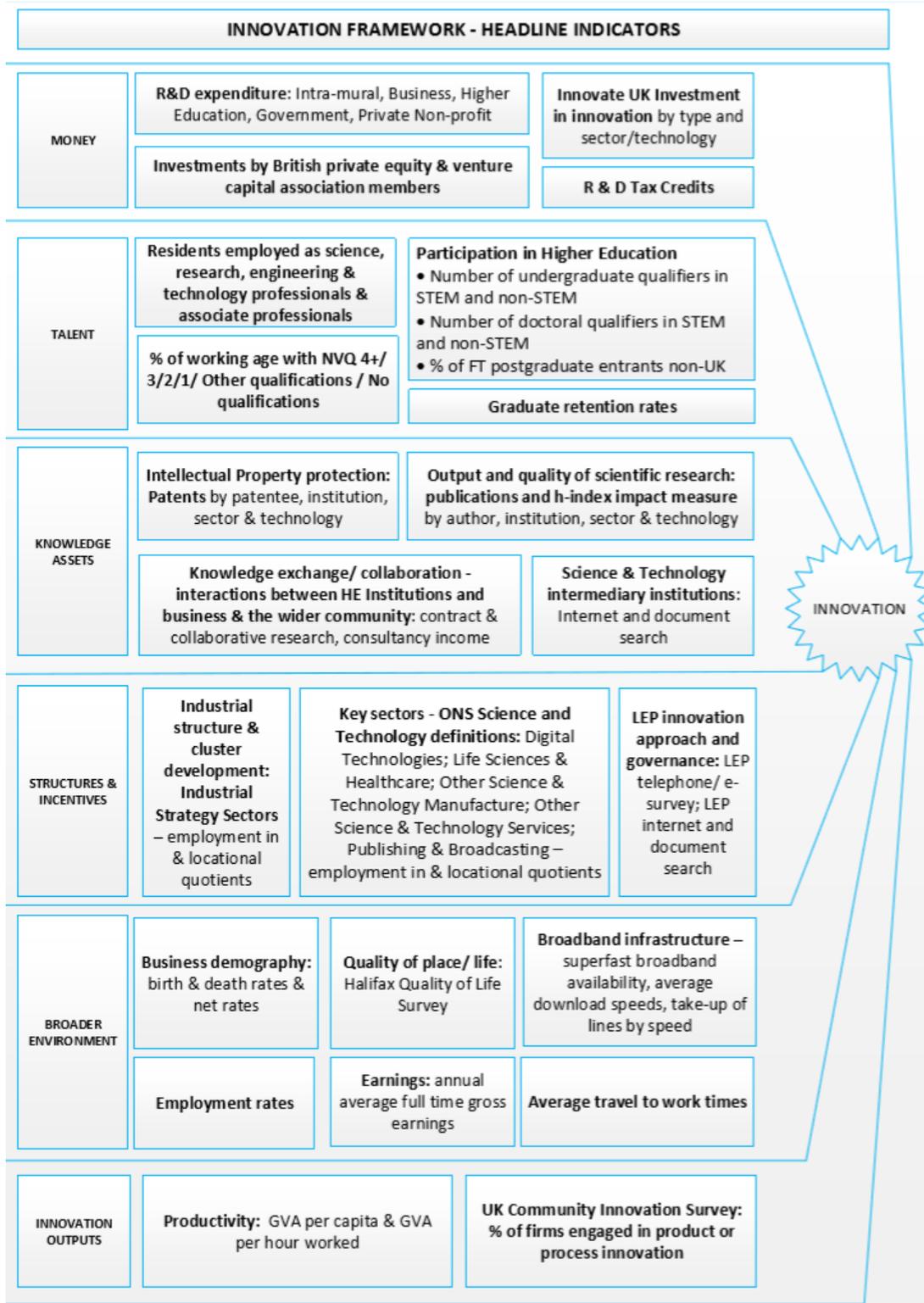
## 2.5 Innovation Ecosystems

### 2.5.1 The Features of Effective Innovation Ecosystems

Given the range of variables which can impact on a business' propensity to innovate, creating 'better' and more innovative businesses cannot just focus on individual business interventions. The Allas (2014) research provides a useful framework (refer to Figure 2.2) for understanding the features which can underpin innovative economies and support knowledge creation, diffusion and application. It identifies inputs and enablers which support interaction within the system and an intermediary output (knowledge assets) which provide an indicator of the quality and potential within the system.

- Money: An input used to invest in infrastructure, new knowledge, absorptive capacity and innovation.
- Talent: The human capital input required to demand, develop, share and exploit new and existing knowledge.
- Knowledge assets: Intermediary outputs of the system that provide an indicator of its quality and potential.

Figure 2.2: Allas Framework



- Structures and incentives: The institutions and interconnections that determine how effectively the actors in the system work together to generate outcomes.
- Broader environment: The economic and societal context with which the science and innovation system interacts

The European Commission's Regional Innovation Scoreboard adopts a similar approach identifying enablers (human resource; open research systems; finance and support) alongside business activities (investment, entrepreneurship, intellectual assets) as the variables supporting innovation and economic effects.

Both approaches support the view that the human resource and money are key inputs into the innovation system, with innovation enabled through knowledge assets, business activities and supportive structures which facilitate interaction across different actors. What is key to delivering a more innovative economy is ensuring that these building blocks are in place, but also that each element is connected and operating efficiently and effectively. It will be the places which can move from ideas to successful commercialisation the most quickly and efficiently which will see the greatest productivity benefits.

The ability to quickly lever these different resources to respond to new opportunities, particularly within a fast-moving sector, has been critical to growth in other countries<sup>20</sup>. Within Germany, recent research has indicated that the scale of investment in R&D and the volume of ideas that are generated (particularly within the automotive sector) are supporting growth, but it is also the capability of the business base to quickly commercialise ideas and a sophisticated customer base which constantly challenges businesses to innovate which is creating efficiency within the system<sup>21</sup>.

## 2.5.2 Policy to Support Innovation Ecosystems

With the UK and the North's productivity gap being well documented, there has been a significant focus within national policy on building an innovative and productive economy. There is a need to create better jobs within high value sectors, and with innovation-intensive businesses growing faster than other firms, exporting more and generating a higher GVA per worker, encouraging innovation and creating an effective innovation ecosystem has become a national policy objective. The UK Industrial Strategy (2017) is focused on raising productivity and innovation. The vision is for the UK to become the world's most innovative economy; providing good jobs, higher earnings, and becoming a place which nurtures growing businesses.

### Investing in R&D

One of the core pillars within the Government's proposed approach is the Industrial Strategy Challenge Fund, through which, the Government will increase funding in research and development by £4.7 billion over 4 years to strengthen UK science and business. As outlined above, analysis of the most successful economies has demonstrated a direct correlation between investment in R&D and innovation-led growth. The region already has a world-leading knowledge

<sup>20</sup> US Chamber Foundation, Enterprising States report, 2011

<sup>21</sup> <https://www.weforum.org/agenda/2018/10/germany-is-the-worlds-most-innovative-economy/>

base and several translational research assets, as well as several highly respected HEIs located in neighbouring regions. The region should therefore be well placed to capitalise on new investment in R&D, however it is the speed and efficiency with which this R&D is converted into new products and processes which will unlock business growth.

### **Responding to Grand Challenges**

The Industrial Strategy identifies four grand challenges (Artificial Intelligence (AI) and data, an ageing society, the future of mobility and clean growth) which are intended to provide a focus for future economic growth. These challenges therefore provide a focus for innovation activity which can bring different stakeholders, partners and sectors together around a common issue or theme. In addition to the grand challenges, other opportunities which can provide a focus for innovation activity across all sectors include digital adoption/Industry 4.0, the circular economy and design.

### **Creating the Structures and Networks to Underpin Innovation**

Aligned with the Allas framework, the Industrial Strategy emphasises the importance of collaboration, co-location and partnership working to build an effective innovation ecosystem and facilitate the translation of ideas and research into new products and processes. There is a strong focus on establishing 'innovation clusters', nucleated around world-leading universities and research centres, and an additional £2.3bn in public R&D investment has been committed to encourage cluster formation<sup>22</sup>.

This approach builds on the principles set out in the Dowling Review of Business University Research<sup>23</sup>, which identified that *“co-location of academics and industrialists can generate a vibrant environment that fosters knowledge creation and technology transfer, and collaborative work is often at its most effective when people are able to work side-by-side, with a free flow of ideas.”* The review stated that physical hubs tend to support collaboration best when they provide an attractive and concrete service in addition to shared space. The services on offer have to match a need in the business or academic community in order to persuade people to use them. This can be brokerage, funding, access to specialist equipment or services, or simply common ground for experimentation.

UK Research and Innovation (UKRI) which brings together seven councils, Research England and Innovate UK under a single umbrella has identified greater collaboration between business and the research base as being key to delivering innovation objectives.

*“Valuable research and innovation is undertaken in businesses, universities and other research and innovation organisations throughout the UK. We want to enable places right across the UK to use their research and innovation assets to drive economic growth.” UKRI*

UKRI is keen to work with partners to, *“make it easier for businesses and research organisations to collaborate to exchange knowledge, people and ideas to produce innovative products, services and markets”*, and champions business-led innovation through the provision of finance and *“helping businesses to find and connect with the most promising ideas emerging from the research base”*.

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<sup>22</sup> HM Government, Industrial Strategy: Building a Britain fit for the future. (2017)

<sup>23</sup> Source: The Dowling Review of Business-University Research Collaborations (2015)

National policy is therefore aligned with innovation literature to provide the investment, structures and networks which will underpin innovation within the business base. This is also reflected in local Strategic Economic Plans and whilst slightly dated, the LCR Innovation Strategy (2014) identified the importance of encouraging partners across the region to work together to ensure that they are competing for the capital, people and ideas needed to drive innovation and economic growth. As a region looking to deliver a step change in its economic performance it will be vital for the region to ensure that the building blocks which underpin innovation are in place, but also that these systems and structures operate efficiently and effectively. Addressing inefficiencies will be key to unlocking growth.

## 2.6 Addressing Inefficiencies

Analysis of the literature and 'what works', suggests that there are some common inefficiencies within innovation ecosystems which hinder innovation.

Analysis of innovation ecosystems often reveals a fragmented landscape which includes many players who, despite living within an increasingly connected society, tend to be connected in indirect and uncoordinated ways. Silo working is often evident which limits capacity to innovate, and although there are numerous knowledge assets and structures to support businesses looking to innovate (e.g. incubators, accelerators, translational research facilities etc), each often provides a specific kind of support which may be time-limited, sector-specific or have other restrictions. The result is a patchwork of short-term, selective and uneven provision which doesn't provide a consistent support structure capable of quickly meeting the diverse range of business innovation support needs. A review of Singapore's innovation ecosystem<sup>24</sup> noted that a 'smart' innovation ecosystem would:

- provide innovators, integrators, and investors with direct access to what they need to do business, rather than having to jump through hoops;
- provide ongoing professional support to start-ups to grow;
- provide investors with greater exposure to deal flows; and,
- provide businesses with an accessible network of high potential partners, regardless of where they are.

Cutting across all this, should be deeper connections *“to allow a new level of learning, brainstorming, ideation and innovation processing. Through deep information sharing and mutual learning opportunities integrated into daily business spaces, Singapore can make it easier to encounter other players within the innovation value chain.”*

Other literature has pointed to the need for more dynamic ecosystems which recognise and cater for the fast-moving and varied nature of business needs. Rather than an approach which, for instance, uses brokers to connect partners that coordinate separately with a business, a more dynamic approach orchestrates multiple partner connections and encourages all partners to work collectively. As new opportunities or new needs arise, a more dynamic approach quickly enables orchestrators to introduce new partners which speeds up the innovation process. This approach was noted as being particularly important to capitalise on opportunities in emerging and rapidly

<sup>24</sup> <https://e27.co/singapore-innovation-ecosystem-is-in-need-of-a-new-model-20170719/>

changing sectors. Whereas traditional and more linear systems can be suitable to address a specific problem which may need to bring together a small number of partners, a dynamic approach is helpful where the potential opportunity or challenge is less well defined (e.g. how to make use of new technology within a business) and orchestrators can bring together a more diverse range of partners which may cross sectors and industries and facilitates knowledge sharing between 'uncommon' partners.

*"In 2015, Cisco brought more than 80 people together in Berlin for a brainstorming session to think of ways in which manufacturers could manage global inventory in a more flexible manner and better forecast problems with component supplies before they arise. The collaborators sought ways to enable companies to track shipments more precisely with sensors and authenticate the sources of components with blockchain technology. The possible uses of blockchain technology in supply chain management are wide-ranging. In the near term, companies will be able to use secure, digitized supply chains to monitor and authenticate specific spare airplane parts, for instance, or the origins of the diamonds used in jewellery. Such breakthroughs would not have been possible without an ecosystem of uncommon partners.<sup>25</sup>"*

The above example highlights an important consideration when analysing innovation ecosystems. Whilst policy has often focused on innovation systems predominantly at the regional level, systems are also important at the business and institutional level. To successfully innovate, businesses and research institutions need to actively manage and develop their own innovation ecosystems, building the partnerships and connections which will support innovation and resilience.

Within HEIs, the barriers to the translation of science and technology are well documented and have been the focus for policy intervention for several years. Research by the Wellcome Trust<sup>26</sup> noted that the UK's academic culture does not incentivise the translation of research with a focus on paper citations as a measure of academic success, a lack of awareness amongst academics regarding the commercialisation process, insufficient funding for concept testing and a lack of long-term investment for commercialisation.

## 2.7 Implications

Businesses are constantly affected by a variety of different internal and external challenges, pressures and opportunities. They will respond to these in different ways. Some businesses will do nothing and risk losing market share/profitability; some will make incremental changes and others will make more radical changes to their business strategy. The effectiveness and efficiency of business responses will determine their future competitiveness, ability to create jobs and productivity.

Businesses ability to respond to new challenges or opportunities will be affected by their absorptive and internal capacity to acquire, absorb and use knowledge/information to produce innovation outcomes. The speed with which they are able to respond will also be affected by the effectiveness of the wider innovation ecosystem to support this process, and the strength/extent of their own innovation ecosystem.

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<sup>25</sup> <https://sloanreview.mit.edu/article/building-the-right-ecosystem-for-innovation/>

<sup>26</sup> [https://wellcome.ac.uk/sites/default/files/wtp057817\\_1.pdf](https://wellcome.ac.uk/sites/default/files/wtp057817_1.pdf)



Supporting innovation requires more businesses to respond to challenges and opportunities. It requires businesses to be well placed to do this (i.e. in terms of their internal capacity), and it requires a supportive, efficient and dynamic ecosystem which facilitates the flow of ideas and speeds up the commercialisation process.

The most successful economies also appear to be those which are not passive but constantly push businesses to rethink their operations and innovate by presenting them with a flow of ideas/opportunities, providing the dynamic structures/incentives capable of quickly bringing together key and uncommon partners, and demanding change through the customer/supply base.

## 3. THE INNOVATION ECOSYSTEM

### 3.1 Introduction

This chapter provides a statistical analysis of innovation performance and the strength of the region's innovation ecosystem. It draws on the Allas Framework (adopted by the Department for Business, Energy & Industrial Strategy (BEIS), formerly the Department for Business, Innovation & Skills, or BIS) which provides a tool for analysing local innovation strengths measured through selected indicators for each innovation element. The selected indicators are summarised as follows:

**Table 3.1: Innovation Indicators/ Themes**

Indicator / Theme	Description
Money	A key input into all parts of the system, used to invest in infrastructure, new knowledge, absorptive capacity and innovation.
Talent	The human capital required to demand, develop, share and exploit new and existing knowledge.
Knowledge Assets	Intermediary outputs of the system that provide an indicator of its quality and potential and that are relatively easy to measure.
Structures and Incentives	The institutions and interconnections that determine how effectively the actors in the system work together to generate outcomes.
Broader Environment	The economic and societal context with which the science and innovation system interacts.
Innovation Outputs	Measurable outputs that can be used as proxies for the ultimate outcomes sought, i.e. economic and societal benefits.

Source: Department for Business Innovation and Skills: Mapping local comparative advantages in innovation - Framework and Indicators, 2015.

Under each of these high-level themes, BIS has provided a comprehensive list of useful indicators which have been deemed most suitable in measuring the level of innovation within LEPs. Each of these will be explored in more detail below.

A key part of this review has been direct comparison of the LCR/YNYER innovation network with innovation ecosystems elsewhere. BIS has produced a report<sup>27</sup> on local innovation with an "LEP area typology" that groups similar LEPs into tiers, based on factors such as the distribution of population between rural areas and city regions. Using the LEP area typology, we have selected three comparator LEPs that are similar to the West and North Yorkshire region.

- Derby, Derbyshire, Nottingham and Nottinghamshire (D2N2) LEP (i.e. 2<sup>nd</sup> tier);
- Greater Manchester LEP (2<sup>nd</sup> tier);
- North East LEP (2<sup>nd</sup> Tier); and,
- Lancashire LEP (3<sup>rd</sup> tier)

<sup>27</sup> Department for Business Innovation & Skills: Mapping local comparative advantages in innovation - Framework and indicators. 2015. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/546999/bis-15-344-mapping-local-comparative-advantages-in-innovation-framework-and-indicators.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/546999/bis-15-344-mapping-local-comparative-advantages-in-innovation-framework-and-indicators.pdf)

Although Lancashire LEP is categorised as a tier 3 area, it has been included in the analysis given its strong research base and comparability with the York and North Yorkshire region. In order to provide further context for the analysis, data for Oxfordshire LEP has been included where relevant as an innovation exemplar.

Due to data limitations it has not always been possible to examine performance for the West and North Yorkshire region. Therefore a 'best fit' approach has been used where required. A RAG rating has been used to benchmark the region's performance against other regions and the national average where relevant to do so. The following presents a summary with additional data analysis and sources included in Appendix 1.

## 3.2 Money

Money is a key input into all parts of the innovation system, used to invest in infrastructure, new knowledge, absorptive capacity and innovation. Bringing more money into the region and encouraging more businesses to invest in R&D is vital in raising the region's capacity for innovation.

**Table 3.2: Money Indicators**

	Companies in receipt of private equity investment per 1,000 VAT registered businesses	No. of InnovateUK grants received since 2004	R&D tax credits per 1,000 VAT registered businesses
LCR & YNYER LEP	<b>0.18 (Y&amp;H data)</b>	1,400	<b>14.8 (Y&amp;H data)</b>
Greater Manchester LEP	0.27 (NW data)	1,186	17.7 (NW data)
North East LEP	0.22 (NE Region data)	1,073	20.2 (NE data)
D2N2 LEP	0.11 (EM data)	1,333	14.1 (EM data)
Lancashire LEP	0.27 (NW data)	501	17.7 (NW data)
Oxfordshire LEP	0.25 (SE data)	1,374	16.1 (SE data)
<b>Great Britain</b>	<b>0.24</b>	-	<b>15.1</b>

Source: HMRC, InnovateUK

The indicators analysed in table 3.2 above suggest that the proportion of businesses in Y&H accessing equity investment and R&D tax credits are below national averages. This is supported by RSM's survey of local businesses which indicates that only 27% of businesses have invested in R&D in the past three years.

Analysis of InnovateUK data however suggests that the LCR and YNYER LEPs are aligned with and exceed comparator LEPs in terms of the number of grants secured. Of the 34,822 grants issued by InnovateUK since 2004, 4% were secured by applicants in Leeds City Region and/or YNYER. This compares to 3.8% in D2N2 and 3.4% in Greater Manchester. It is interesting to note that compared to Greater Manchester, LCR and YNYER applicants are more likely to engage in

partnerships which cross LEP boundaries and include partners in the Humber and Sheffield City Region. Of the LCR/YNYER InnovateUK projects, the majority were in emerging and enabling technologies. As InnovateUK set the sector priorities for grants, it is important not to attach too much significance to this, however it does provide some insight into local sector strengths which are aligned to the Industrial Strategy and UK Grand Challenges (see Appendix 1).

### **Money Summary**

The Allas framework identifies money as a key input into all parts of the innovation system, used to invest in infrastructure, new knowledge, absorptive capacity and innovation. Bringing more money into the region and encouraging more businesses to invest in R&D is important therefore in raising the region's capacity for innovation and also to increase the proportion of innovation activity which is more radial and differential in nature. The indicators analysed above suggest that the proportion of businesses in Y&H accessing equity investment and R&D tax credits are below national averages which is supported by findings from RSM's survey of local businesses.

This may indicate there is a need to raise awareness of financial supports available to businesses and broker introductions to investors. The findings may however also reflect the nature of the business base in the region and high proportion of SMEs to which tax credits may have less relevance in unlocking innovation activity.

Analysis of InnovateUK data however does suggest that the LCR/YNYER LEPs are aligned with comparator LEPs in terms of the number of grants secured. The findings indicate that partners within the region are capable of successfully competing for funds in key growth sectors aligned with the Grand Challenges, and the number of businesses, HEIs and other public sector partners involved in applications (as well as evidence of cross border collaboration) suggests that there are examples of good networks and relationships within the region which can underpin knowledge diffusion.

It is important to note that money is an input into the innovation ecosystem which may, or may not, lead to knowledge adoption/commercialisation of research and, therefore, business/economic benefits. However, unlocking innovation potential requires the right type of investment which is accessible and fit for purpose. Stakeholder consultations (outlined in more detail in chapter 5) noted that there appears to be sufficient money available to support innovation, the challenge is making sure it meets business and research partners' needs. There are funds available within the region to support innovation (e.g. Access Innovation, Finance Yorkshire/NPIF) which are successfully unlocking innovation capacity. However, with some stakeholders suggesting a need for more risk capital there may be merit in undertaking further research to assess the scope and scale of funding available, any specific barriers/limitations to their use and any gaps in the funding landscape.

### **3.3 Talent**

Talent relates to "the human capital required to demand, develop, share and exploit new and existing knowledge". With a sizeable number of residents employed in professions that are notoriously innovative, this should act to raise business ambition to employ new processes; to share knowledge; and, to shift the dynamic of the region to engage in new technologies, production techniques and processes.

Having the right talent is integral to having a fully mobilised innovation ecosystem. A skilled labour pool is important to attract/retain businesses and raise absorptive capacity/innovation potential within businesses. Human capital is also the main mechanism through which knowledge is shared and diffused as labour moves between localities and businesses.

**Table 3.3: Talent Indicators**

	% Residents employed as science, engineering and technology professionals	% of population with no qualifications	% of population qualified to NVQ4+	% of all HE students enrolled on Engineering and Technology Courses 2017/18*
Greater Manchester LEP	4.9	6.5	40.8	6.7
D2N2 LEP	4.8	4.5	37.8	4.7
Lancashire LEP	4.8	5.6	39.1	1.3
WY/NY	<b>4.4</b>	<b>5.3</b>	<b>39.7</b>	6.2
YNYER LEP	<b>4.4</b>	<b>4.5</b>	<b>42.9</b>	3.8
LCR LEP	<b>4.5</b>	<b>5.4</b>	<b>38.9</b>	8.4
Oxfordshire LEP	9.9	2.5	54.1	1.4
NE LEP	4.3	5.0	36.1	6.8
<b>Great Britain</b>	<b>5.7</b>	<b>5.1</b>	<b>43.7</b>	-

(\* no RAG rating as reflects HEI provision in the region)

### Talent Summary

Employment in science, engineering and technical occupations (table 3.3 above) provides an indication of innovation capability within a region and the extent to which the region will attract more innovative industries, and it is evident that the West and North Yorkshire region has a lower proportion of residents employed in these sectors. However, the region (particularly LCR) does attract engineering and technology students, and therefore retaining these in the local workforce offers a considerable opportunity for the region.

Research has also indicated that the availability of skilled workers across all intermediate, technical and higher-level skills is important to raise innovation potential. While YNYER has a high proportion of its working age population qualified to NVQ3+, skills levels in LCR are below the national average and this could be a barrier to raising innovation capacity. This does however mask local geographical variations. There are also variations in the age profile of those with higher skills levels, with young people (20-29) accounting for a higher proportion of higher skilled residents in Leeds (see Appendix 1).

66% of businesses responding to RSM's survey indicated that they had skills needs. However, only 21% of businesses that were not engaged in innovation reported having skills needs. There appears therefore to be a trend with businesses that are innovating being more likely to be looking to increase, change or improve their skills base. Having access to a strong labour pool will therefore help to unlock innovation potential. The analysis shows for instance that Oxfordshire has a

significantly higher proportion of residents in science and technology occupations and a more highly educated workforce.

### 3.4 Structures and Incentives

This element of the Allas framework attempts to capture “the institutions and interconnections that determine how effectively the actors in the system work together to generate outcomes”. This is a difficult aspect of the ecosystem to analyse using statistical indicators, as the effectiveness of the system is often determined by intangible factors such as how quickly institutions respond, the scale of personal networks, and appetite for innovation. The following provides an overview of employment in science and technology sectors, and explores one of the region’s key sector strengths and assets which may provide a focus for innovation activity.

#### Science and Technology Sectors Employment

The ONS has provided a full list of five-digit UK Standard Industrial Classification of Economic Activities 2007 (SIC07) codes assigned to science and technology sectors. Innovation is likely to be prevalent and sought after in science and technology sectors. Technological advancements are moving at momentous speeds and firms are constantly designing or acquiring new processes which improve their competitive edge. As such, having a strong working base in these sectors is likely to progress new innovative designs and share knowledge; a high proportion is indicative of an innovative culture. Table 3.4 below summarises ONS statistics for Professional, Scientific and Technical Activities employment in 2017 at the LEP level.

**Table 3.4: Professional, Scientific and Technical Activities Sectors Employment Count**

LEP	ONS Professional, Scientific and Technical Activities Sectors Employee Count	As a % of Total Employee Jobs in the Region	As a % of the Economically Active Population in the LEP	Rank
Oxfordshire LEP	38,000	10.6	10.3	1
Greater Manchester LEP	118,000	9.1	8.5	2
YNYER LEP	30,750	8.1	7.4	3
LCR LEP	111,000	8.1	7.3	4
D2N2 LEP	55,000	5.8	5.0	5
Lancashire LEP	35,000	5.6	4.8	6
North East LEP	36,250	4.5	3.8	7
Great Britain	3,013,000	8.8	9.1	-

Source: ONS (NOMIS) Labour Market Profile Data 2017, Employment by Occupation (Annual Population Survey) 2017.

#### Innovation Assets

**HEIs:** The region has one of the highest concentration of higher education institutions in the UK outside London and one of the highest in Europe. Whilst not an audit of provision, research suggests that all nine HEIs have teams and/or programmes in place to support industry

engagement. For instance, at least two HEIs in the region have dedicated business / economic development teams whilst the remaining seven offer networking programmes or enterprise hubs to help support businesses and encourage collaboration. Key sector strengths identified by HEIs in the region include:

- Engineering / Advanced Manufacturing;
- Arts and the Creative Industries;
- Bioeconomy;
- Environmental sustainability / climate change / energy; and,
- Health.

While stakeholders consulted during the commission agreed that given the breadth of expertise within the region there were likely to be very few areas where the region's HEIs couldn't support business R&D needs, a desk-based review of HEIs websites illustrates the challenge businesses face in accessing support. Each HEI lists numerous specialisms and areas of expertise, however there is a lack of clarity at a strategic level regarding the region's combined specialisms and offer to businesses. Although sectoral Science and Innovation Audits on Bioeconomy and Medical Technologies provide a detailed analysis of these sectors, understanding the entirety of the region's offer at a strategic level is challenging.

**Research and Business Space:** The region supports numerous research facilities which provide access to equipment, translational research expertise, meeting and business space. Whilst not a full audit of provision, these assets include:

- EPSRC-funded Medical Technologies Innovation and Knowledge Centre (University of Leeds) brings businesses together with world-class experts from across 35 UK universities to accelerate the commercial development of new medical technology products and services.
- The National Institute for Health Research (NIHR) Leeds Musculoskeletal Biomedical Research Centre is a collaboration between Leeds Teaching Hospitals NHS Trust and the University of Leeds.
- 'Translate – Realising Medical Technology Innovation in the Leeds City Region' is a £3m HEFCE funded programme focusing on developing nationally leading capability in Medical Technology Innovation. Led by the University of Leeds, in partnership with the Universities of Bradford, Huddersfield, Leeds Beckett and York, it is creating a sustainable working partnership between academics, clinicians and industry in the Leeds City Region, focusing on unmet clinical needs to drive innovation.
- Biorenewables Development Centre is an open access R&D centre in York which was established by the University of York to work at the interface between academia and industry and support the development of the bioeconomy.
- Digital Creativity Labs (at the University of York) brings together over 100 partners and 30 researchers from multiple disciplines to deliver impact from research in the games and media industries.
- Nexus provides business workspace and access to equipment, research expertise and relationship manager support at the University of Leeds.

- 3MBIC Huddersfield facilitates business growth, encourages business to academia collaboration and actively promotes innovation. The centre caters for all business needs, from start-ups, SMEs to large corporates. Facilities include hot desks and individual office spaces to rent in a variety of sizes, flexible workshops and state-of-the-art laboratories, as well as meetings and conference spaces kitted out with the latest audio-visual technology.

**Networks and Partnerships:** There are a range of business networks and events across the region facilitated by intermediary and representative organisations such as Chamber of Commerce and FSB. At a strategic level, Yorkshire Universities works to maximise the contribution of higher education to the region, and beyond, through collaboration and partnerships where this generates greater impact and public benefit. Priorities are directed towards strengthening the contribution of universities in Yorkshire to place development and building institutional and organisational relationships across sectors and between actors.

Leeds and York universities are also members of the N8 partnership which promotes collaboration between universities, business & society across the North, and establishes innovative research capabilities and programmes of national and international prominence. Key research these include Urban and Community Transformation and Agrifood. The partnership also supports several ‘research communities’ in robotics and autonomous systems; industrial biotechnology for the bioeconomy; and, target validation.

**Priority Sectors:** Science and Innovation Audits in the region have identified sector strengths in medical technologies and the bioeconomy. The Northern Powerhouse Independent Economic Review has also highlighted four ‘Primes’ where the North has competitive advantage - Advanced Manufacturing, Energy, Health Innovation and Digital. These primes were further developed in a review of the North’s sectoral strengths undertaken by Steer Economic Development in 2018, which overlap with priority sectors identifies in LCR and YNYER Strategic Economic Plans.

**Table 3.5: Sectoral strengths in the North - a composite view from the research**

Sector	Sub-Sector
Low Carbon and Energy	<ul style="list-style-type: none"> <li>• Biofuels</li> <li>• Carbon capture</li> <li>• Eco-innovation</li> <li>• Geothermal</li> <li>• Heat networks</li> <li>• Hydrogen</li> <li>• Low Emission Vehicles/Fuels</li> <li>• Nuclear</li> <li>• Offshore wind</li> <li>• Tidal/Wave Energy</li> </ul>
Advanced Manufacturing and Engineering	<ul style="list-style-type: none"> <li>• Aerospace</li> <li>• Automotive and propulsion/turbos</li> <li>• Formulation and polymer chemistry</li> <li>• Materials Chemistry and Advanced Materials e.g. 2D-materials, graphene, Fast</li> <li>• Moving Consumer Goods, and textiles</li> </ul>

	<ul style="list-style-type: none"> <li>• Process industries and chemicals</li> </ul>
Health and Life Sciences	<ul style="list-style-type: none"> <li>• Ageing</li> <li>• Anti-Microbial Resistance</li> <li>• eHealth Data</li> <li>• Infectious Diseases</li> <li>• MedTech</li> <li>• Precision Medicine</li> </ul>
Digital	<ul style="list-style-type: none"> <li>• Applied Digital Technologies</li> <li>• High Performance and Cognitive Computing</li> <li>• Gaming</li> <li>• Animation</li> <li>• Creative content</li> <li>• Cyber security</li> </ul>
Bioeconomy	<ul style="list-style-type: none"> <li>• Industrial Biotechnology</li> </ul>
Food and Drink	<ul style="list-style-type: none"> <li>• Agri-Tech</li> <li>• Processing</li> </ul>

Source: Steer Economic Development, 2018

**Public Investment:** The region has access to ERDF, HEIF and Growth Deal funding which has been used to support a range of interventions including the University of York's Product and Process Innovation project and Access Innovation. The region also has two Enterprise Zones which provide an opportunity for clustering of business and knowledge assets. Leeds City Region M62 Corridor Enterprise Zone comprises nine sites spread across Bradford, Calderdale, Kirklees and Wakefield which target advanced manufacturing and logistics operations.

The York Central Enterprise Zone is a 72-hectare site immediately adjacent to York City centre and encompassing York railway Station and the National Railway Museum. The site offers an opportunity to develop an urban extension across commercial, cultural and residential uses. The Zone targets investment in professional and business services; digital and creative; high tech engineering and rail; and, education.

### Structures and Incentives Summary

With the exception of Oxfordshire, the Greater Manchester LEP has the highest employee count in Professional, Scientific and Technical Activities sectors (118,000) representing 9.1% of total employee jobs in the LEP and 8.5% of the total economically active population in the LEP. The YNYER and LCR regions follow closely behind Greater Manchester but are below national averages.

The above provides a snapshot of some of the structures which should support innovation activity in the region. Accurately mapping these assets is beyond the scope of this commission, but the analysis demonstrates that the region has an extensive array of HEIs, research assets, networks and place-based initiatives which underpin the innovation ecosystem. There is however a need to agree and synthesise this into a clear offer to industry. WYCA's current research into local supply chains should provide additional insight into the sector strengths/clusters within the region which

may facilitate this, and WYCA's research into productivity across the region could also add to this insight.

### 3.5 Broader Environment

The 'broader environment' element of the framework seeks to "capture the economic and social context with which the science and innovation system interacts". The indicators here are designed to capture the relative strengths of LEP local economies in terms of labour force participation, business and entrepreneurial activity, earnings, quality of life / place and local connectivity.

**Table 3.6: Broader Environment Indicators**

LEP	Employment rate of working age population	Life satisfaction	Average download speed	% of business base which are 'large' companies	% of business base which are 'micro' companies	Average Gross Annual Pay
WY/NY	73.9	7.53	40.5	0.41	88	£27,428
LCR LEP	73.3	7.50	44.8	0.45	82.5	£27,212
YNYER LEP	78.2	7.69	36.9	0.24	84.5	£27,926
North Eastern LEP	72.1	7.43	47.5	0.52	80.5	£26,641
D2N2 LEP	73.6	7.54	48.2	0.36	88	£28,207
Lancashire LEP	74.3	7.55	45.3	0.32	88	£26,542
Greater Manchester LEP	72.8	7.40	52.7	0.40	89	£26,819
Oxfordshire LEP	81.3	7.67	53.0	0.45	89	£34,413
<b>Great Britain</b>	<b>75.1</b>	<b>7.53*</b>	<b>-</b>	<b>0.39</b>	<b>89</b>	<b>£29,661</b>

(\* UK data)

#### Broader Environment Summary

Most businesses in the West and North Yorkshire region are micro businesses with few large businesses (250+ employees). This is particularly important as large OEMs and Tier one businesses can drive innovation within their local supply chains and provide a focus for innovation support activity. This pattern is however comparable with other regions and Great Britain, suggesting the region should not be disadvantaged in this regard. However, the data does not confirm the extent to which 'large' businesses comprise OEMs/tier one businesses and it is possible that the region could be disadvantaged if the majority of large businesses are within low value-added sectors. As noted above, ongoing research analysing the region's supply chains may however provide further insight.

The employment rate shares two messages regarding economic output and innovative behaviour within an economy. A high employment rate is indicative of a prosperous, well-functioning economy which can attract the right type of talent and limit the level of structural unemployment. The employment rate can also be seen as an outcome of innovation, in which economic growth and jobs growth ensues as a result of a booming local economy. However, it should also be noted that innovation is the introduction of new technologies and procedures which can help streamline

processes and ultimately replace manual labour. Hence, it is also possible that innovation reduces the employment rate. As such, this indicator should be used with caution and in conjunction with other indicators of employment and innovation e.g. employment within scientific and technology occupations.

The analysis suggests the West and North Yorkshire region possess several of the attributes which will help to attract and retain high-performing talent. The region offers a good quality of life and has employment and average wage levels above or aligned with other LEPs. However, it will be essential to ensure that the region's offer attracts younger, highly-qualified persons to improve the local talent pool. As noted above, the region's HEI attract students in engineering and technology subjects and therefore retaining these graduates is a significant opportunity.

Ensuring that adequate and full communication infrastructure is in place is essential in facilitating innovation processes, particularly within an increasingly connected economy where digital technology adoption has the potential to deliver a significant step change within many businesses. The analysis suggests that the West and North Yorkshire region has lower download speeds than other regions which could inhibit economic activity and innovation by restricting access to new markets.

### 3.6 Knowledge Assets

Open innovation is crucial to the production of new knowledge and innovation. One of the key mechanisms which can support this is HEI/business interaction. Table 3.7 below summarises the number and value of HEI consultancy services.

**Table 3.7: Consultancy Services delivered by HEIs (2017-18)**

	SMEs		Other (non-SME) Commercial Businesses		Non-commercial Organisations		Total		Unit Value
	No.	Value (£000s)	No.	Value (£000s)	No.	Value (£000s)	No.	Value (£000s)	£
WY/NY	1,853	2,517	717	5,892	1209	11,584	3,779	19,993	5,290
YNYER	23	82	187	3,584	186	2,175	396	5,841	14,268
LCR LEP	1,830	2,435	530	2,308	1,023	9,409	3,383	14,152	4,183
D2N2	292	2,006	403	4,140	315	2,438	1,010	8,584	8,669
Lancashire	449	2,737	73	328	103	16,173	625	19,238	30,780
Greater Manchester	1,123	1,498	438	2,422	256	2,700	1,817	6,620	3,643
Oxfordshire	337	3,734	325	2,319	374	4,276	1,036	10,329	7,909
North East LEP	200	1,002	510	3,788	443	9,461	1,153	14,251	12,359

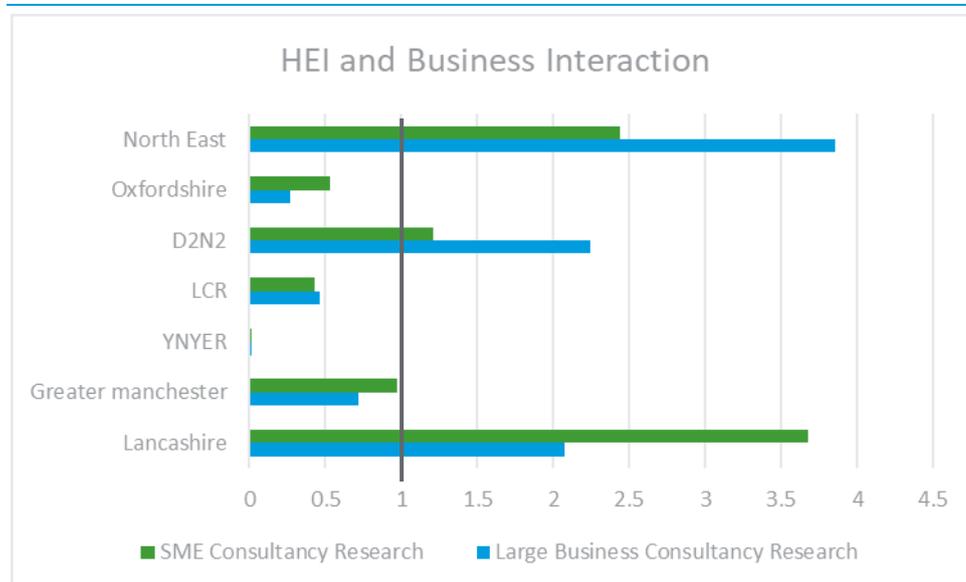
Source: Higher Education Statistics Agency ([hesa.org.uk](https://www.hesa.ac.uk) <https://www.hesa.ac.uk/data-and-analysis/business-community/services#>), April 2019. Based on aggregate data from institutions within each LEPs.

The region has more HEIs than other comparable regions and this is reflected in a higher number of total interactions in 2017/18 (3,779 compared with 1,817 in Greater Manchester). The region's average number of interactions per institution is 540 compared to 518 in Oxfordshire, 454 in Greater Manchester, 337 in D2N2 and 313 in Lancashire. The average is however affected by a particularly large number of interactions recorded by Leeds Beckett University which accounts for 61% of the region's total interactions (a high proportion of which are with the public sector). Removing Leeds Beckett University from the analysis results in the average number of interactions per WY/NY institution dropping to 208<sup>28</sup>.

In contrast, analysis of contract research shows the region's average number of interactions per institution is 265, with the majority conducted by the University of Leeds. The University of Leeds's number of interactions is comparable with University of Nottingham and University of Manchester, whereas the region's other HEIs fall far behind. Leeds Trinity University and York St John University contribute a total of interactions 5 between them which primarily reflects that these are not research-intensive institutions.

Benchmarking business/HEI interaction at LEP level, suggests that both LCR and YNYER regions have fewer interactions when compared with the national average (represented by 1 on figure 3.8 below).

**Figure 3.8: HEI / Business Interaction at LEP Level**



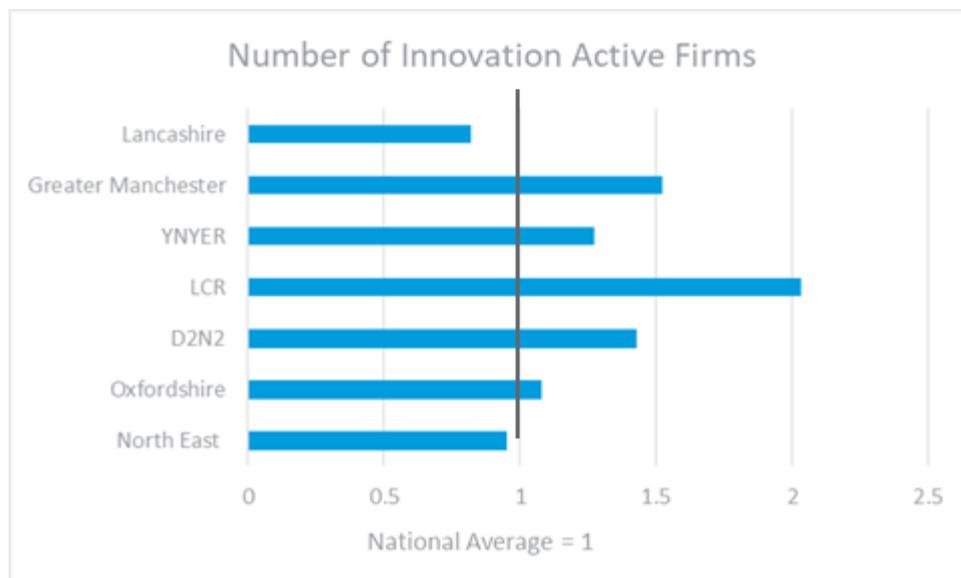
Source: Smart Specialisation Hub, LEP Profile data (December 2018).

It is evident that collaborations are taking place within the region between HEIs and businesses, although not on the same scale as nationally and in other LEP areas. Examining this in more detail, figure 3.9 shows that both YNYER and LCR LEPs have an above average level of businesses that are innovation active. Only the Lancashire LEP performs below the national average. It is interesting to consider this alongside the analysis of business/HEI interaction above

<sup>28</sup> Additional datasets provided in Appendix 1.

which suggests that although LCR and YNYER have above the national average of innovation active firms, this does not necessarily result in high levels of business/HEI interactions and may indicate that a lot of innovation activity within the region is occurring in-house or business to business.

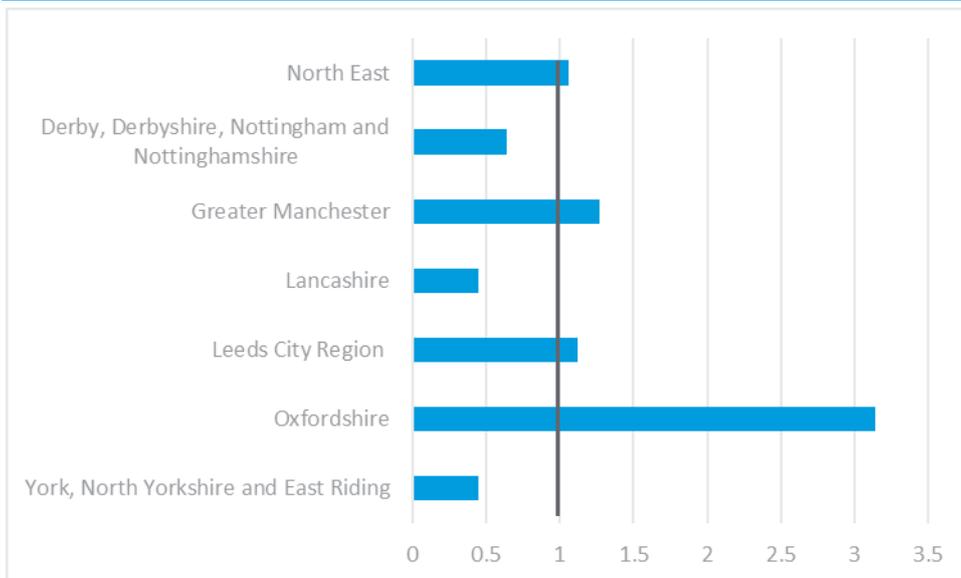
**Figure 3.9: Innovation Active Firms**



Source: Smart Specialisation Hub, LEP Profile data (December 2018). Based on UKCIS Data.

Analysis of HEI spend on R&D per FTE indicates that LCR HEIs spend above the national average on R&D, but significantly below Oxfordshire. Expenditure in LCR equates to £234 per FTE compared to £96 in YNYER and £266 in Greater Manchester. Spend per FTE in Oxfordshire is significantly higher at £659.

**Figure 3.10: HEI Spend on R&D per FTE**



Source: Eurostat 2014

Analysis of HEI research outputs published by the Smart Specialisation Hub does not suggest the LSC and YNYER LEP's research institutions are publishing significant levels of output relating to key innovative sectors. The exception being 'transport and urban living' expertise within LCR, which generated the highest output across all LEPs. Across most categories, Oxfordshire and the Solent LEPs were the highest performing regions.

However, other data sources present significantly different conclusions. BIS research undertaken in 2015, which drew on Scopus as well as other data sources (e.g. PubMed data), placed LCR in the top quartile of all LEPs for publications linked to the following Great Tech subjects: advanced materials; agri-science; and energy storage. While YNYER LEP was in the top quartile for advanced materials.

Interestingly, although Oxfordshire is well known for its academic capabilities, as a research-intensive centre, Oxfordshire HEIs do not perform significantly better than other regions in terms of their consultancy work with businesses (as illustrated in table 3.7). Although there has been considerable support to increase the proportion of businesses engaging with HEIs (particularly SMEs), Oxfordshire data may indicate that this is not necessarily a critical element underpinning an innovative economy. In terms of leveraging HEI assets, when compared to West and North Yorkshire HEIs, Oxfordshire HEIs:

- Produce more research outputs linked to Great Tech and/or InnovateUK research priorities;
- Undertake considerably more and higher value contract research;
- Produce more spin-off businesses – 21 in 2017/18 compared to 6 in West and North Yorkshire;
- Register more disclosures - 393 in 2017/18 compared to 139 in West and North Yorkshire;
- File more patents - 190 in 2017/18 compared to 89 in West and North Yorkshire;

- Grant more software licences - 632 in 2017/18 compared to 130 in West and North Yorkshire; and
- Grant more non-software licences - 2,498 in 2017/18 compared to 142 in West and North Yorkshire.

However, they also:

- Produced fewer graduate start-up businesses - 37 in 2017/18 compared to 131 in West and North Yorkshire<sup>29</sup>.

### 3.7 Innovation Outputs: Productivity

Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector. It is essentially the value of all goods produced less any input costs. Hence, a high GVA contribution indicates more efficient input-output processes which is usually brought about through the introduction of new inventions and processes. Table 3.11 below summarises GVA statistics for each comparator LEP.

**Table 3.11: Productivity: GVA and GVA per capita, 2016 – LEP level analysis**

LEP	GVA per Capita 2016 (£)	GVA per Job 2017 (£)
Greater Manchester LEP	£22,886	£48,561
LCR LEP	£21,803	£46,358
D2N2 LEP	£20,846	£45,728
Lancashire LEP	£20,754	£48,011
YNYER LEP	£21,146	£45,142
North East LEP	£19,254	£47,242
Oxfordshire LEP	£33,337	£57,407
<b>Great Britain</b>	£24,538	£52,462

Source: ONS Regional Gross Value Added (balanced) by Local Enterprise Partnership 2016.

GVA per capita is broadly aligned with other LEPs but lags the national average and Oxfordshire LEP. The productivity gap is a result of several contributory factors but does indicate there is a need to create ‘better’, higher value-added businesses/jobs, with innovation being one of several mechanisms to achieve this.

### 3.8 Conclusion

With analysis of innovation literature indicating that businesses ability to respond quickly to new opportunities and challenges is partly dependent on the effectiveness of the wider innovation ecosystem, it is important to identify any significant weaknesses which may hinder innovation capability. The above analysis seeks to provide some insight into the strength of the region’s innovation ecosystem through proxy indicators. However, it must be acknowledged that this only provides part of the picture and there are numerous other indicators which could be explored and

<sup>29</sup> <https://www.hesa.ac.uk/data-and-analysis/business-community/ip-and-startups>

additional data disaggregation and cross tabulation which could add to the insight. It must also be noted that, as identified in the literature review, it is often the intangible assets (such as the depth/scale of connections, activities of orchestrators etc) which are critical to creating an effective, dynamic and responsive ecosystem which supports innovation.

The analysis is helpful however in that it suggests that in relation to the key pillars which underpin an effective innovation ecosystem, the West and North Yorkshire region is, in most respects, comparable to other similar regions. A summary of findings is presented in Table 3.12 below. The RAG analysis is based on broad comparison against comparable LEPs and the national average.

**Table 3.12: Summary Findings**

Indicator	Result
Receipt of equity investment	Red
Receipt of Innovate UK grants	Green
Receipt of R&D tax credits	Red
Employment in science and technology occupations	Red
% population with no qualifications	Yellow
% population qualified to NVQ4+	Yellow
Level of innovation active firms	Green
Employment rate	Yellow
Life satisfaction	Yellow
Download speeds	Red
Gross annual earnings	Yellow
Total number of consultancy services delivered by HEIs	Green
Average number of consultancy services delivered by each HEI	Red
HEI spend on R&D per FTE	Yellow
Number of academic outputs (patents/disclosures etc)	Red
Productivity	Yellow

Average download speeds are however lower than other regions which is in part explained by lower download speeds in rural areas. However, performance in Leeds is also lower than other cities. With digital adoption a key opportunity for businesses to innovate, and one of the main mechanisms by which businesses in the region are innovating being the adoption of new technology (41% of businesses surveyed by RSM had innovated through the introduction of new technology), ensuring the region has robust digital infrastructure and capabilities will be important.

Although the region is broadly comparable to other northern LEPs, when it's compared with a highly productive region (Oxfordshire), the gap is evident. The Oxfordshire example demonstrates a region with strong knowledge assets, a highly skilled workforce and a good quality of life offer. These factors (alongside others) support productivity and a GVA per capita



which exceeds that of the YNYER and LCR regions and have supported the growth of a high value-added business base.

Oxfordshire however, has fewer innovation active businesses than both LCR and YNYER regions. It is difficult to draw firm conclusions from this without more granular analysis. While encouraging more businesses to identify opportunities to add value to their operations is undoubtedly a good thing to do to raise business competitiveness and productivity, increasing engagement alone may not deliver the outcomes desired, particularly if the majority of this is incremental innovation.

The findings may suggest that it is the type of innovation undertaken (rather than the number of businesses innovating) which is important and also how innovation is used (e.g. early adopters or just keeping up with the competition). Focusing support on businesses capable of more radical innovation driven by new market opportunities and which facilitates a step change in business performance may therefore be key to creating a virtuous cycle which not only raises business performance, but also supports the growth of the wider innovation ecosystem by attracting more talent, investment, and research expertise.

## 4. INNOVATION IN THE REGION

### 4.1 Introduction

This chapter presents an analysis of innovation in the region drawn from a survey of businesses. The analysis explores:

- Who is currently innovating, who is not and any variations in innovation activity;
- Correlations between innovation and access to business support, access to finance and skills needs; and
- Who businesses engage with on innovation activity?

Where possible, findings are benchmarked against national trends drawn from the UK Innovation Survey 2017 which examines innovation activity between 2014-2016.

The findings within this section are derived from a quantitative telephone survey of businesses predominantly located within North Yorkshire which secured 205 responses<sup>30</sup> and 398 responses from the 2019 LCR Business Survey<sup>31</sup>, giving a total sample of 603. Much of the analysis however separates the total sample into businesses that are innovating (419) and businesses that are not (184). The weighting of West to North Yorkshire responses reflects the comparative size of the business base within each region (i.e. 34% of the West and North Yorkshire region business base is located within North Yorkshire).

### 4.2 Are Businesses in the Region Innovating?

**Most businesses surveyed are innovating:** Nearly 70% of businesses surveyed carried out at least one of the following Research and Development / Business Innovation activities in the last three years:

- Introduced new or significantly improved goods;
- Introduced new or significantly improved services;
- Introduced new or significantly improved processes for producing or supplying goods or services;
- Introduced new technologies;
- Participated in knowledge transfer; and,
- Invested in Research and Development.

This is almost 20 percentage points higher than the proportion of businesses nationally that indicated they were innovation active (50%) in the UK Innovation Survey 2014-2016 (2018). Although regional analysis of the 2018 UK Innovation Survey has yet to be released, the 2015 findings indicated that Yorkshire and the Humber had the highest proportion of innovation active businesses. This therefore supports the conclusion that there is a good level of innovation activity occurring in the region.

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<sup>30</sup> This survey was conducted by RSM's survey partner.

<sup>31</sup> Provided by WYCA

### ***Most businesses that are innovating are engaged in more than one kind of innovation***

**activity:** From a base of 419 businesses that are innovating, 306 (73%) have carried out more than one kind of innovation activity in the past three years, whereas just 113 (27%) have carried out just one kind of innovation activity in the past three years. This suggests that focusing innovation activity on investment in R&D, may fail to capture a significant amount of activity within the region.

***Introducing new technologies is the most common innovation activity*** with 56% (236) of the 419 businesses that innovate undertaking this in the past 3 years. Just over 50% of businesses that innovate introduced new or significantly improved processes for producing or supplying goods or services and/or participated in knowledge transfer.

The least popular business innovation activity was “introducing new or significantly improved goods” which was undertaken by just 31.5% (132) of businesses and investing in R&D which was undertaken by 38.9% (163) of businesses.

***Whilst not conclusive, the findings could point towards a higher proportion of innovation activity within the region potentially being within lower value-added activities which focus more on process improvements/efficiencies.*** This may explain why high numbers of innovation active businesses has not translated into high GVA per capita. For instance, the introduction of new technologies and process improvements are likely to include a high proportion of activity which may be more incremental in nature such as the introduction of CRM systems, new online capabilities or financial management tools, although we must acknowledge that it could also include automation of a process which significantly improves a business’ productivity. There is also a low proportion of businesses investing in new goods and R&D which are typically more differential and radical in nature as they can provide businesses with access to new markets and customers which can deliver a step change in performance.

To understand the nature of innovation activity in more detail and why investment in innovation is not delivering the productivity results expected, there may be a need to re-consider the above categories which have typically been used to monitor innovation activity. Differentiating between ‘new’ and ‘improved’ activity for instance is important in understanding the extent to which the activity may be incremental or differential in nature. The literature review presented in chapter 2 indicates that understanding the reasons for undertaking the activity (e.g. to keep up with competition or to access a new opportunity) is also important, and increasingly innovation activity needs to focus on ‘new’ and ‘different’ rather than just ‘better’.

## **4.3 Which businesses are innovating?**

***There is a relationship between business size (in terms of number of employees) and propensity to innovate.*** Although ‘large’ businesses (250+ employees) only comprised a small proportion of the survey sample (14 businesses), 85.7% were engaged in innovation activity. The majority of SMEs (10-249 employees) were innovating (83%), but a smaller proportion of micro enterprises (59%, with 1 to 9 employees) were innovating. As such, the results mirror the UK Innovation Survey 2014-2016, with larger businesses more likely to be innovating; 63% of large firms in the UK were innovation active, compared to 49% of SMEs.

***Businesses reporting good performance are more likely to be innovating.*** Approximately half of the 419 businesses that are innovating report improved performance over the past 12

months, while approximately half of the 184 businesses that are not innovating report more stable economic performance. This could indicate that businesses are more likely to innovate when performance is good, or that engagement in innovation is supporting stronger business performance. The timing of innovation activity would need to be explored in more detail to draw firmer conclusions as to cause and effect. The findings do indicate however, that a higher proportion of business that don't innovate reported that performance got worse over the past 12 months (18.6%) than businesses that do innovate (12.6%).

***Businesses that are innovating are more likely to be positive about future trading conditions.*** Over the next 12 months, 38.3% of the 419 businesses that are innovating expect the climate in which they operate to improve, compared to 29.5% of the 184 businesses that are not innovating. Businesses that are not innovating are also more likely to report that they expect business climate to deteriorate (19% compared to 13% of innovating businesses).

***The majority of businesses do not export, however businesses that innovate are more likely to be exporting than businesses that don't.*** Most businesses surveyed do not export. However, 22.8% of the 419 businesses that innovate also export, compared to 15.5% of the 184 businesses that don't innovate. Based on data from the UK Innovation Survey (2014-2016), the proportion of businesses that innovate and export in the region is 8.2 percentage points lower than the proportion of innovators in the UK that export goods and services (31%). Whilst cause and effect is difficult to determine, the findings suggest that there is some correlation between innovation and exporting and therefore, increasing the proportion of businesses that are exporting and accessing new markets could positively impact on innovation in the region.

***Most businesses have not accessed finance, but businesses that innovate are more likely to access finance than businesses that don't.*** Most businesses surveyed have not applied for new sources of finance or credit, or renegotiated existing or credit in the past 12 months (79.7% of businesses that innovate and 87.0% of businesses that don't innovate). However, businesses that are innovating are more likely to have applied for new sources of finance or credit, or renegotiated existing finance or credit in the last 12 months (16.9%) than those that don't (6.0%).

***Businesses that innovate are more likely to have sought independent advice in the last 12 months.*** From a base of 419 businesses that are innovating, 53.7% have sought independent advice in the last 12 months, on issues such as finance, marketing, legislation or staffing, compared to just 23.4% of the 184 businesses that do not innovate. Whilst it is not possible to determine whether businesses that are innovating are more likely to seek support or if support is more likely to encourage innovation, the findings suggest that access to business support is an important component of the innovation ecosystem.

***Businesses that innovate are more likely to identify skills needs than those that don't.*** Most businesses (74.8%) that innovate identified a need to improve skills levels to meet business needs compared with only 34.2% of businesses that don't innovate. This highlights the importance of access to talent in unlocking business growth. Whilst skills agendas seek to build internal business capacity through workforce development and ensure there is a skilled labour market to support on-going business growth, from an innovation perspective, access to short term knowledge, expertise and skills can be important in allowing businesses to respond quickly to new opportunities and challenges. This may require different skills solutions through collaboration, mentoring and brokerage rather than direct recruitment or workforce development.

## 4.4 Do businesses that innovate collaborate?

***Businesses that innovate collaborate when developing new products or processes.*** Most businesses that innovate collaborate when developing new products or processes. 86.2% of businesses that innovate collaborate with at least one of the following: universities; research associations; business networks; partnerships with other companies; business support advisor/mentor.

***Business to business collaboration is a key feature of innovation in the region.*** Just less than half (48%) of businesses that are innovating collaborated in partnership with other businesses and a third collaborated with business networks. Universities and research institutions only accounted for a small proportion of collaboration (16.2% and 13.6% respectively). A focus on HEI/industry collaboration therefore risks missing a high proportion of innovation activity within the region.

## 4.5 Key Findings

The survey indicates that:

- There are strong levels of innovation activity within the region.
- Innovation activity is most commonly focused on technology, service and process improvements with fewer businesses engaged in knowledge transfer and new/improved goods. Whilst not conclusive, the findings suggest that innovation activity may be more focused on potentially lower value-added activities and incremental improvements rather than more strategic product development which may deliver a step change in performance.
- Innovation levels vary by size of business. As business size (number of employees) increases, so too does engagement in innovation activity. This is important given the nature of the business base in the region and lack of OEMs/tier one companies.
- Businesses that innovate are more likely to be exporting and to have accessed business support. They are also more likely to have identified skills needs.
- There is a relationship between investment in innovation and an improvement in overall business performance. Although cause and effect is unclear.

## 5. REGIONAL STRENGTHS AND WEAKNESSES

### 5.1 Introduction

Working with key stakeholders across the regions, the research has explored their perceptions of innovation in the region. Consultations have discussed the concept of innovation and how it relates to the current and future economic prospects of the regions.

The analysis is based on 21 stakeholder consultations (see Appendix 2), a quantitative telephone survey with a random sample of West and North Yorkshire businesses (outlined in section 4 above), and qualitative telephone consultations with eleven businesses involved in innovation. Through interviews, a survey of businesses, site visits and meetings, the following issues have been discussed:

- Understanding of innovation – what does innovation mean?
- How does the region's business infrastructure influence innovation?
- Which sectors are driving innovation, how and why?
- Which sectors are faring less well and why this is so?
- What are the barriers or enablers to innovation?
- What are the opportunities to develop a stronger culture of innovation in the region?

The discussions sparked considerable feedback and there was a good deal of consensus on the importance of innovation in the region and on the barriers and enablers to innovation activity. Equally there was some agreement on the way forward to promote a strong culture of innovation and entrepreneurship.

### 5.2 What Does Innovation Look Like?

Innovation is a nebulous concept which can mean different things to different people. However, from a business perspective there was some consensus that “innovation means creating value from ideas<sup>32</sup>” but should be differentiated from generic business improvement activities.

The findings supported the concept of a three-tiered approach to innovation outlined at section two. The majority of stakeholders suggested that the scale and nature of innovation activity within the region varies by business, but the focus of innovation investment is largely incremental. Innovation is predominantly low cost and low impact as the industrial base of the region is dominated by micro and small business that lack innovation and absorptive capacity. It was noted however, that some sectors appear to be more engaged in innovation, particularly those which need to collaborate to bring products to market and need external validation (e.g. health and med tech sectors).

Importantly, it was noted by several stakeholders that the region is relatively underrepresented in terms of large strategic businesses where investment in innovation may be more strategic and potentially higher impact. At a regional level, this reduces overall investment levels in innovation and reduces opportunities for investment by smaller companies who could play a role in local supply chains. Analysis presented in chapter two supports that OEMs and tier one businesses

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<sup>32</sup> Professor John Bessant, Professor of Innovation and entrepreneurship at Exeter University

can play an important role in innovation not only through investment in R&D, but also by challenging suppliers and using their capabilities to orchestrate wider connections and bring together different partners. Although chapter 3 suggests the region is not under-represented in terms of 'large' businesses, for stakeholders it is specifically the lack of OEMs which hinders innovation potential.

### 5.3 What Does Innovation Mean to Business?

A lack of understanding or agreement on what innovation is may result in an inaccurate picture of the nature and scale of innovation in the region. Stakeholders reported that while many small and micro business do invest in innovation, they do not recognise it as such. For example, one respondent to our business survey classed their constant and considerable investment in process development as "*responding to the competition*" rather than innovation. This could mean they under-report their investment in innovation. Nevertheless, as outlined in chapter 4, most businesses across the region are innovating, and over 56% have introduced new technologies over the past three years.

*"The area is no different than most other areas – most small businesses operate on a day to day basis, they don't see what they do as innovation. But many of them have been innovating incrementally for 30 years. The way they work is probably unrecognisable from the way they did back then" (stakeholder consultee)*

It was also suggested (although recognising that this was based on anecdotal evidence and perception) that most businesses in the region seem to predominantly innovate 'in-house' and may only engage with external partners when they run into difficulties. This can however impact the quality of innovation activity, if businesses are not benefitted from external knowledge and solutions which may improve innovation outcomes. Lessons from innovation support programmes in the region have also suggested that many businesses lack the internal and absorptive capacity for innovation and require consultancy/mentoring support to understand what innovation is, how it can help their business, and how to do it.

It was also suggested by most stakeholders that many businesses will only invest in innovation when it is critical to the business. The suggestion here therefore is that businesses are primarily reactive to challenges rather than proactively seeking to maximise the potential that new opportunities could offer. This is potentially significant for the region as it does not suggest businesses are necessarily using innovation to get ahead, i.e. to be the first to maximise new market opportunities or disrupt their industries, but instead, are using innovation when faced with a challenge or competitive pressure to which they must respond to safeguard their position. This suggests that innovation capacity within the region's business base may be weak and lacking a growth mindset and innovation culture. It could however also partly reflect the nature of the business base which may not necessarily be growth-oriented.

Consultations with businesses reflect the range of different perspectives of innovation. These include incremental improvements e.g. drawing on business support to improve marketing and business processes; differential innovation such as being, "*a problem solver for customers by using the best technology to meet their requirements*"; accessing new and untapped markets; and bringing new technology and practices to established industries.

### **Innovation in Businesses**

For Motion Rehab, a business operating in the field of Neurological Rehabilitation, innovation means implementing new practice within an established industry (i.e. a fundamental shift in products or processes). The business has integrated technology into a traditional rehab environment and therefore, changed the delivery of rehab in the sector e.g. upper limb technology such as a Saebo Glove enables people who are struggling with neurological and orthopaedic injuries to improve their hand functionally.

## **5.4 The Impact of the Region's Economic Base**

### **5.4.1 Business Size and Supply Chains**

The dominance of small and micro business has several impacts on innovation in the region. Stakeholders point to the high number of lifestyle businesses where innovation is low and, as noted above, there may not be a strong growth mindset which seeks to use innovation to gain competitive advantage. The survey of business (outlined in chapter 4) confirms the influence of size on innovation levels. However, it was noted by stakeholders that it is often size alongside sector which can influence innovation levels as it was perceived that some sectors (which comprise predominantly SMEs) tend to be more dynamic and innovative (e.g. creative, digital and med tech for instance).

Supply chains were recognised by several stakeholders as being drivers for innovation. It was identified that larger businesses can be catalysts for innovation in several ways, including:

- Raising standards of delivery;
- Driving cost savings and efficiencies;
- Supporting collaboration;
- Focusing support;
- Attracting new entrants and suppliers;
- Providing a critical mass for small companies; and,
- Access to more secure markets which can give more confidence to invest.

The impact of supply chains can be seen most recently in Humberside where the major investment by Siemens in the Port of Hull has seen significant wider investment in renewables across the Humber estuary. Stakeholders felt that the region was hindered by the lack of large companies which could provide comparable leadership of supply chains. There are of course examples of large businesses in the region, such as Nestle in York, but stakeholders identified a need to attract larger companies to the region as being instrumental in driving innovation.

### **Case study, Siemens and supply chain opportunities for innovation**

Siemens invested £160 million investment in wind turbine production and installation facilities in Hull's Alexander Dock. The combined investment from Siemens and ABP of £310 million will create up to 1,000 jobs directly, with additional jobs during construction and indirectly in the

supply chain. The investment is already having an impact on innovation in the region's supply chain. The Team Humber Marine Alliance, which represents 180 companies on the Humber, are tailoring advice and support to help local companies meet Siemens's supply chain requirements and promote collaboration between companies. Grimsby Institute for Further and Higher Education provided ERDF funded grants and business support to promote product and process improvements in renewables. And in Hull, the University has established Aura, a partnership of organisations including Siemens, the Humber LEP and Sheffield and Durham Universities to support offshore wind industries through supporting training and upskilling, supply chain development and research and development.

### 5.4.2 Sector Composition

The region's manufacturing base is seen by a high proportion of stakeholders as quite traditional in outlook and mindset and less engaged in innovation. It was also highlighted that as more traditional sectors have faced tough times, there may have been a tendency to focus activity on survival and sustainability rather than growth.

It was also noted by several stakeholders that the region has a shortage of businesses in high growth, high value-added sectors which attract skilled labour, help retain graduates and create a more dynamic economy. Although several clusters of activity were noted such as the bioeconomy in North Yorkshire and medtech sector in Leeds, these sectors were often viewed as still being in need of support and investment to become world-leading, there was also a lack of consensus regarding the region's key strengths. Key growth sectors highlighted by consultees included:

- Agri-food sector in North Yorkshire;
- Rail and infrastructure in North Yorkshire;
- Med-tech in Leeds;
- Bio-science in North Yorkshire;
- Science and engineering in West and North Yorkshire;
- Cultural, creative and digital in West Yorkshire;
- Finance in Leeds; and
- Textiles in Calderdale and Kirklees.

The relative strengths of these sectors and their growing importance across the region in some instances, reflects their historical presence and the need to maintain competitiveness and develop niche markets (textiles for example), but in other instances reflects capacity within potentially high growth sectors. Other growth sectors fall out of larger employers providing a natural home for development, such as the NHS and Med-tech in Leeds, or agriculture in North Yorkshire. The relocation of Channel 4 is also expected to provide a spur for greater investment in arts, culture and digital.

*"There are gems across all sectors, but it is these sectors (Med-tech, engineering, creativity and digital) that are leading the way in innovation" (stakeholder consultee)*

The burgeoning digital sector was also identified as fostering high levels of innovation across the Leeds City Region, and as noted in chapter two, as one of the key drivers and facilitators of innovation across all sectors, is a significant regional asset.

### 5.4.3 Alignment with Research Specialisms

For some stakeholders in the HE sector there is a mis-match between the region's main areas of research expertise and the local business base. It was noted that some areas of research specialism (e.g. robotics) are very niche and necessitate building collaborative relationships on a national or international basis. The shortage of OEMs and tier one businesses within the region, its rurality, and dispersed nature of the business base, was noted by HEI representatives as making local engagement more challenging. Typically, engagement with SMEs was noted as being time/resource intensive and often delivers limited returns.

### 5.4.4 Scale of Exporting Activity

Several consultees agreed that innovation activity tends to be higher amongst exporters. Stakeholders suggest the need to keep ahead of changing markets and operate in a global marketplace drives innovation in exporting companies. It was noted that this is going to be particularly important in a post-Brexit economy and several stakeholders indicated that Brexit may provide a good opportunity to engage businesses in exporting agendas.

*“Exporters have to be ready to invest in new products and processes if they are to survive. Many of our exporters have specialist niche products which rely on continued focus on improvement. It’s what they do best” (stakeholder consultee)*

## 5.5 Collaboration with Academia

Across the region, stakeholders and business recognised the importance and competitive advantage offered by universities and research institutions. Individual universities provide a range of support services to local businesses with direct access to knowledge, expertise and crucially, machinery. The provision of machinery, equipment and knowledge is providing local SMEs with access to facilities they could not otherwise have, and which is leading to tangible gains for both the business and university.

### **Case study of business and academic collaboration**

Polyglobal has launched innovative bespoke products such as the ‘Hyperpol’ which is series of polyurethane elastomers developed to meet the demanding requirements of a diverse range of engineering applications. The business started to innovate in 2015 and has since invested in new machinery and established a link with Bradford University. They have gone from ‘an order taker’ to a business able to offer advice and technical support to others. Working with the University had built their capacity and understanding of innovation and how it could give the company the competitive advantage it needs. The respondent noted that in this industry, competition and the needs of customers drive innovation. Without access to the knowledge bank and equipment in the University, the business would not have the resources to access the equipment needed to keep ahead of its competitors. Looking ahead, the business is set to

continue its collaboration with the University and continue to invest in innovation. The business owner stated that:

*“The university link is crucial for us and without it the cost of experiments and testing new processes would be too large.”*

The owner also suggested that more time was needed for ‘grass roots’ support and that some resources should be directed to lower level technology investment which was as important.

Most stakeholders recognise that there have been significant improvements in HEI/business collaboration, which has been driven by government policy and an evolving remit for HEI as civic institutions. Most stakeholders however also concede that there is more that could be done particularly regarding the effectiveness and efficiency of collaborative relationships. The key concerns expressed by stakeholders relate to:

- The language of business and academia. The two sectors communicate in such a way that shared objectives are not clear. Business cannot articulate what it wants from academia and universities cannot speak the language of business. Where academic leaders have a background or regular contact with businesses, these language barriers breakdown. Business relationship managers also perform an important function operating at the interface between businesses and academia;
- Difficulties in accessing/ awareness of support. There is a lack of awareness amongst businesses as to what HEIs can offer or how they can engage with them. Perceptions regarding costs can also prevent engagement;
- Inflexible terms and conditions. Difficulties associated with contracting, confidentiality and IP slow or block engagement;
- Timescales. Business feel that the timeframes that universities work to are slow and that, at times, the time taken to access support is too long and seemingly unnecessary; and
- Universities are perceived to be only interested in larger projects or companies which offer the chance of higher profile marketing and papers published. They are less willing or able to work with small business.

These issues and perceptions are widely understood by academia and there has been intervention to improve business (particularly SME) engagement. This is now a key feature of HEI’s strategic plans and has been supported by considerable investment in translational research facilities; outreach and engagement activity; the establishment of economic development teams; and the provision of financial and business support interventions.

*“We (universities) are getting better but we can and will do more. It’s about finding common ground”.*

Although the key elements and building blocks are present in the region, most stakeholders recognised there is scope to make them operate more effectively. While HEIs role as civic institutions was understood, research-intensive HEIs primarily operate to deliver world-class research. This is important for the region but may not always involve working collaboratively within the region. The fact that local business engagement is not usually core funded, presents a

challenge for many HEIs. Staff are usually committed to contract research and unable to respond quickly to short term consultancy assignments. There are therefore some restrictions on HEIs abilities to offer a responsive service to local businesses and to operate strategically within this arena.

Better communication within HEIs, between HEIs and with external partners was frequently raised by most stakeholders. Opportunities include:

- More proactive dissemination of research in a way which is understandable and engaging for businesses, and which provides space for businesses to be exposed to new ideas and thinking. It was suggested that the research expertise and capability is available within the region, but the mechanisms for knowledge diffusion are weak, fragmented and reactive;
- Creating conversations with other HEIs, businesses and other partners. Scotland was cited as having been particularly effective in bringing HEIs together to ‘start conversations’ regarding the bio-economy and circular economy. Creating conversations was viewed as an important first step in not just disseminating knowledge, but for HEIs to take a more proactive role in identifying how knowledge can best be used by regional partners and businesses. Within the region, Yorkshire Universities<sup>33</sup> is an important asset to facilitate this, but it needs to ensure it is effectively representing HEIs at a strategic level as well as supporting HEI communication, particularly across the new West and North Yorkshire geography.
- Improving communication and connections with complementary assets outside the region (e.g. across the Northern Powerhouse) and ensuring national assets (such as catapult centres) are effectively supporting the region. HEIs are an important mechanism through which external expertise can be brought into the region for the benefit of local businesses; and
- Leveraging HEIs national and international connections.

Overall it was noted that being realistic about where the region’s HEIs can best add value is vital. Often policy and funding has been targeted at interventions which are difficult for HEIs to engage with (e.g. basic skills and school engagement). Therefore, it was suggested that there is a need for a clear role and remit regarding innovation which allows HEIs to engage in a way which is aligned with their core activities, structure and strengths.

## 5.6 Collaboration with Other Businesses

*“Innovation and collaboration aren’t separate. Collaboration drives innovation and value creation, thereby helping businesses create wealth”<sup>34</sup>*

There is recognition that collaboration is an important tool for innovation. Supply chains, as we have seen, are one way of fostering collaboration, and the growing work with local universities is demonstrating how collaboration works. But business to business collaboration is still viewed by some entrepreneurs with scepticism. One business told us:

*“I wouldn’t ever use external partners. Innovation is something we do in house, but I would hire external expertise to add to the team’s skills”*

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<sup>33</sup> A representative organisation which provides a voice for HEIs in the region

<sup>34</sup> Don Tapscott, Innovation entrepreneur

However, the survey of regional businesses suggests there is strong evidence of business to business collaboration. Several stakeholders commented that, to date, there may have been too great a focus on business and HEI collaboration, largely driven by funding availability. However, with the challenges of HEI/business collaboration proving to be difficult to overcome, many businesses favour the immediate and flexible support private sector partners can provide. The Spark Fund has noted that the private sector has been very responsive to opportunities to collaborate and support other businesses, and good practice from other regions suggests that brokering business to business solutions can be an effective mechanism to unlock innovation and business growth and respond to businesses' short-term skills/knowledge needs.

## 5.7 Business Support

The quality of business support is generally regarded as much better than in the past and the sense of direction is positive but with room for further improvement. Businesses and stakeholders reported the quality of business advice had improved significantly since previous programmes and there was more of a bespoke approach to support. Given the diversity of business needs in relation to innovation, flexibility to respond and to work alongside businesses throughout their individual innovation journey was identified as being critical to raising innovation and absorptive capacity. It was noted by some stakeholders however, that publicly funded interventions do not always provide the continuity of support required to facilitate the full innovation journey that businesses may take. They particularly do not recognise the varied timescales over which innovation activity may occur or that businesses may need to dip in and out of support at particular points in the journey.

It was also suggested by some public sector representatives that innovation needs may not always be thoroughly explored and identified by support providers and therefore opportunities to support innovation may be being missed. Raising the capacity of support providers to identify and diagnose innovation support needs was highlighted as well as the use of a more standardised approach to diagnostic across the region (e.g. the KTN Innovation Canvas). The following issues were also raised by stakeholders and businesses:

- Extensive administration requirements which deter businesses from accessing support;
- A lack of marketing and awareness of grant opportunities; and,
- The focus and size of grant support doesn't always match business needs e.g. lack of support for business to business collaboration.

The perceived administrative burden of working with the public sector business teams and grant support remains a barrier to take up by businesses. Specifically, regarding innovation, there is a feeling that the public sector grant regimes are risk averse and focus on jobs created when the reality is that investing in innovation should carry risk and not be tied to job creation. Indeed, as one stakeholder noted, pure innovation linked to increased GVA may reduce employment but make the business more competitive and stable. Stakeholders felt there needs to be support to reduce the risk of early stage investment in research and development, perhaps through collaboration and knowledge transfer.

In terms of companies investing in innovation, the survey of businesses found that businesses that have invested in innovation have tended to access business support. Several businesses commented however that the levels of financial support available for innovation were often not

worth the time needed to prepare an application and then administer the project. One stakeholder echoed this need to move to a more strategic approach to innovation stating:

*“We might be spreading the jam too thinly – maybe we should focus on a few larger investments to make an impact rather than lots of small, minor changes”. (stakeholder consultee)*

Stakeholders also suggested that there was a gap in support provision and a need to offer specialist support delivered in-house by consultants who could act as a member of the team to support businesses more intensively on a one to one basis. This was also iterated by a business owner (see Trio Healthcare case study below) who indicated that external advisory support/mentoring could help to prevent lock-in and open up businesses to new ideas and opportunities.

*“Embed an innovation specialist who can help the business understand, think and act innovatively. This takes time” (stakeholder consultee)*

Offering ‘vouchers’ to buy-in expertise would allow businesses to access support they need with less administration. This would support businesses to raise their internal capacity to innovate, with mentoring in particular seen as an effective mechanism to support the development of the intangible skills and attributes required to raise innovation potential.

### **Trio Healthcare**

Trio Healthcare is a privately-owned company with offices in two UK locations – Great Missenden, Buckinghamshire & Skipton, North Yorkshire. They are dedicated to the provision of life enhancing healthcare solutions and have a strong history in developing innovative and advanced medical technologies. They have a focus on Stoma care. At one time or another, all ostomates will suffer from leakage and therefore damage to the skin, which has a dramatic impact on their social life and psychological wellbeing. To combat this, Trio has developed a unique, secure adhesive known as Trio Responsive® Silicone, that can be used around the stoma to provide a skin-friendly seal and a long-awaited alternative solution to hydrocolloid.

Trio has developed a secure but comfortable solution that allows the skin to breathe normally, even perspire, whilst maintaining a secure connection. Trio’s life changing silicone adhesive, that prevents abdominal stomas from leaking and provides a range of benefits for patients and healthcare professionals, has been awarded the prestigious Queen’s Award for Enterprise. Trio was presented the award under the Innovation category for its breakthrough patented silicone technology, which is improving the lives of ostomates around the world. It is the UK’s most prestigious business accolade which recognises the benefits offered to ostomates and their unique needs. Their direct contact with patients and clinicians enables them to fully appreciate the clinical and psychological problems that their products treat. Their products are developed in close consultation with patients and clinicians, ensuring their popularity when they are introduced to the wider community.

This respondent views innovation as a “paradigm change” (i.e. a fundamental shift in products / processes), however, the respondent notes that the industry has been dominated by 3 businesses and as such not a significant amount of innovation takes place. This therefore suggests that businesses are often driven by competitive pressures to innovate and a dynamic economy with start-ups, inward investment and churn within the business base may stimulate innovation.

The business is innovation active having developed: skin friendly stoma products; a new breathable silicon adhesive which can be used across different products in the stoma care industry; and specialised manufacturing, machinery and technology. The business started to innovate in 2013 and is now selling in 22 countries, has launched on global platform, and sells 5 types of products. Innovation is therefore an important aspect of the business's growth strategy.

The business is always looking to better their current product suite to open up new market opportunities, and currently has a large pipeline of products related to the stoma care and ostomy care markets. Interestingly, the business owner felt the need to innovate due to a moral and personal drive, as hundreds of thousands of people needed a better solution.

### **Barriers to Innovation**

Funding is a barrier to innovation, particularly the lack of risk capital. The businesses initially launched in 2006. It was successful, winning many awards and was extremely profitable before being sold in 2012. Once the business was relaunched in 2013 however, it was considered too high risk by some funding streams and the business struggled to secure investment.

The respondent noted that taking risks is the key to success and so they need a funding source that is prepared to support this. The scale of funding available was also noted. The amount of funding needed by Trio to launch their most recent product was £2million to launch.

### **Innovation Supports**

Collaboration with universities has been helpful to the business however the process to access funding is noted as being 'difficult'. The business successfully secured a small Access Innovation grant of £10,000 to test a formulation with Bradford University, although the funding application processes was time-consuming. Networks and representative organisations have also supported the business, with Medilink providing business contacts.

It was noted that in addition to funding, more mentoring support would be welcomed, particularly if it provided tailored advice. It is interesting to note that the business would welcome the input of a mentor to provide a fresh perspective on the business, ask challenging questions and in doing so, identify new opportunities to grow and develop the business.

## **5.8 Physical Assets**

### **5.8.1 Innovation Hubs**

The innovation and business hubs/translational research facilities provided by the regions academic institutions are regarded highly by many businesses and stakeholders. In the region there are several centres bringing academic expertise and business together such as 3MBIC and NEXUS. Collaboration in these centres promotes closer working and understanding between academia and business. Importantly, it provides small business with access to equipment it would otherwise be unable to buy-in. This allows businesses to develop new products and processes at less risk as well as develop processes it would have not been possible without this support.

#### **Case study 3M BIC Academic and business collaboration**

The 3M Buckley Innovation Centre (3M BIC) is Huddersfield University's knowledge and innovation hub. It offers world class facilities for local, high growth, hi-Tec business including

business start-ups, spin offs and growing companies. It provides access to machinery and services which would otherwise be out of the reach of local business. Facilities such as the Centre's Additive Manufacture and Prototyping and High-Performance Computing allow local business the chance to trial and develop new processes or products with less risk and access to business support.

The centre offers access to markets, finance, technology and skills, and is an important interface with the University to drive collaborative R&D, consultancy and employer engagement for students and graduates. Importantly, the centre benefits from strong leadership, with expertise and experience of both academia and business. This is an important bridge between the two sectors, overcoming the barriers identified in the report. Business and academia have a mutually beneficial and symbiotic relationship.

3M BIC houses the Duke of York Young Entrepreneur Centre (DOYYEC), an incubation facility supporting students and graduates wishing to establish business start-ups. Rather than being located on campus and within a careers and student services environment, which is typical of many facilities of this type in UK universities.

The Centre has 26 SME workspaces and now needs to expand. The Centre demonstrates the potential for expansion of the hub and spoke model of support we suggest in the report and the potential for significant business and academic partnerships when the right environment is in place.

## 5.8.2 Hub and Spoke Support

The network of hubs across the Yorkshire Universities is matched by other hubs of activity such as the York Science Park. Across the region there is a patchwork of support and office space available. However, a major concern of stakeholders is the lack of a major hub in the region to act as a magnet for large and small innovative businesses, and the lack of a clearly articulated offer to businesses. Ireland for instance promotes a network of branded Technology Gateways, each with a sector focus and linked to HEI and research assets, which clearly articulate to businesses the country's research offer and access points.

As an example of an innovation 'hub', stakeholders point to the Sci-Tech park at Daresbury as an example of what can be achieved if the right scale of facilities is available. Daresbury has been in operation for over 20 years and is recognised as a leading centre for innovation. Stakeholders point to the benefits of having a critical mass of companies close to each other, promoting an exchange of ideas and access to potential business opportunities. For some stakeholders, the lack of such a scaled-up location for innovation places the region at a disadvantage.

### **Case study: Innovation hub Sci-Tech Daresbury**

Located between Liverpool, Warrington and Manchester, Sci-Tech Daresbury 140 companies across five business centres and home to over 1,500 employees. The site was developed by building on the Daresbury Laboratory facilities which deliver scientific research in computer science, physics, chemistry, materials and engineering. Daresbury has become a magnet for innovation and technology led business development. Sci-Tech Daresbury's success was recognised last year when it was named as the science park which made the most significant

contribution to innovation in the UK.<sup>35</sup> Critical to its success was ease of access but also the culture of innovation created on the campus and the proximity of so many companies. The awards recognised the importance of a hub with sufficient critical mass to promote an exchange of ideas and provide business opportunities by being close to other businesses and supported by world class research facilities.

However, for others, it was noted that investment in physical infrastructure is not necessarily required. Instead, the region must more clearly articulate and market the numerous knowledge and research assets the region already possesses. Some stakeholders identified the need for the region to invest in and get behind 'big ideas'. This may focus on key innovation drivers which cut across all sectors and which provide a clear message to stakeholders regarding the region's innovation priorities. This approach was also identified as an opportunity to engage businesses in innovation in a way which is meaningful and understandable to them. Themes for consideration included the circular economy and digital adoption/Industry 4.0, with Scotland's zero waste commitment highlighted as a good example of the public sector being a driver for innovation. Exporting was also identified as something meaningful to businesses which could also support the move to more radical and differential innovation in the region.

#### **Cell Lane**

Cell Lane Ltd was established to develop a cell isolation and separation platform technology, based on intellectual property from the University of Leeds. The technology seeks to assist in the future treatment of chronic diseases such as cancer and AIDS and is intended to enable new fields of research such as stem cell research. The business is a spin out from the University of Leeds and is currently operating virtually with a small team of founding inventors and academics operating out of Leeds university.

For the business, innovation is new technology that is unique and there is nothing else like it on the market. Innovation should also be a 'game changer' and able to solve real world problems. Cell Lane identified that there was no commercial tool available to isolate stemcells which is a "real world R&D issue", as such, they have done something that no other businesses had previously managed to accomplish.

The respondent stated that "real world issues" drive innovation in his industry. However, businesses incubators and laboratory space are important. The consultee had previously been involved in the BioCity incubator in Nottingham and noted that these facilities are key to supporting innovative businesses. Although the region has office space, there is limited lab space and the region would benefit from a 'hub' offering easy access to business support.

## **5.9 Talent**

Businesses who are innovating report a shortfall in the right skilled employees and this is an issue of growing concern for businesses and stakeholders. With an estimated 15,000 new jobs in the digital sector alone the gap in skills is set to rise. Stakeholders point to a lack of degree level

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<sup>35</sup> UK Science Park Association

apprenticeships and businesses too feel greater emphasis is needed for apprenticeships, science and engineering focused degrees.

RSM's survey of business in the region indicated businesses that were innovating were more likely to report skills needs than businesses that were not innovating. This would suggest the skills gaps are in the growing and increasingly important sectors of the regional economy which if left unchecked could hinder innovation and growth.

Stakeholders also noted the importance of raising the capacity of business leaders to innovate. The research of the Scale Up Institute has illustrated the importance of a growth mindset to scaling businesses, and management and leadership skills have been identified as one of the key drivers of business productivity. Consultations with businesses support that culture, mindset and the capabilities of business leaders are important to raising innovation capacity within the region.

### **Semperfli**

Semperfli is a wholesale business to business manufacturer of fly-tying materials. The company is known for using "Nano Silk", the world's strongest fly-tying thread, and offers over 700 products in total. Semperfli's products are sold worldwide.

To Semperfli, innovation is doing things that their competitors are not and finding gaps in the market. When Semperfli first entered the market, their competitor's products were out of date and the business was able to offer something new such as the introduction of barcodes on what they sell and a digital electronic catalogue with embedded video as opposed to previous paper magazines that were used by competitors.

The business also sees marketing in new and more effective ways as innovation. For example, the business has increased their social media presence to raise brand awareness. The business is highly 'internet centric' and draw on a team of pro tyers (approximately 50 all around the world) who show people how to tie flies through video conferences where they also discuss and promote new products. The business' competitors do not offer these facilities, as such Semperfli have found gaps in the market. Semperfli have also created innovative products such as a wax thread, which they worked with a small sub group of their pro team to develop.

### **Innovation Supports**

The business accessed a PAPI grant from the University of York to purchase new machinery to support new product development work. The result was that they were able to reach their target for the new product development within three months rather than the anticipated one year.

Business support has also been helpful to fast-track and grow the business. This includes help with marketing, business processes and sourcing potential partners/contacts for the business. The business has recently been introduced to a digital voucher scheme through which they have bought a multi camera digital recording system which saves the business significant amounts of time editing.

The respondent notes that the support received has helped the business to overcome most barriers. It is also evident however that the business has benefited from a growth mindset and

innovative management staff. The respondent noted for instance that they regularly look outside the business at other market sectors to identify new developments which could be applicable to his business and sector. This supports the view therefore that innovation capacity within businesses and particularly the skills of business leaders is a driver of innovation.

## 5.10 Infrastructure

A small number of stakeholders and businesses pointed to inadequate transport infrastructure holding back the region as a centre for innovation. They highlighted:

- Good service timetables generally into Leeds although issues of overcrowding;
- Good services between London and Leeds;
- Poor services between other towns e.g. Huddersfield to Sheffield and Bradford; and,
- A motorway network operating at capacity.

Aside from transport, and as noted above, there was a perceived lack of large-scale science or technology parks in the region to compete with other areas and attract local and national businesses. Stakeholders stressed the importance and good reputation of university centres of excellence and some of the existing hubs such as York Science Park, but identified a need for large scale, easy access sites. Enterprise Zones in the region may however provide a focus for this activity.

Digital infrastructure was also highlighted by some stakeholders. Although it was recognised that connectivity has improved significantly, businesses in rural areas were highlighted as still being disadvantaged by poor ICT connectivity and performance. With digital adoption potentially an important driver of innovation across all sectors, this could therefore inhibit growth.

## 6. CONCLUSIONS & ISSUES FOR CONSIDERATION

### 6.1 Conclusions

#### **The majority of businesses in the region are innovating...**

This study was commissioned based on the assumption that despite strong innovation assets (e.g. HEIs) within the region, this expertise is not been used to full effect, and regional innovation rates are low. Low investment in R&D, low take-up of InnovateUK funding and low interaction between HEIs and businesses have been cited as weaknesses within the region's innovation ecosystem.

Analysis of the region's innovation ecosystem partly supports this view. Although the region's performance and the key factors which underpin a competitive innovation ecosystem are broadly comparable with other LEPs in the North and East Midlands, regions such as Oxfordshire demonstrate much stronger knowledge, talent and place assets and these are being levered to generate higher levels of productivity than in West and North Yorkshire.

#### **The number of innovation active businesses is above the national average...**

Interestingly however, Oxfordshire has fewer businesses that are innovation active. The same is also true for other 'innovative regions' such as Cambridgeshire and Peterborough, as well as northern examples such as Cheshire and Warrington where the number of innovation active businesses is below the national average.

#### **But it is important to consider not only who is innovating, but how and why...**

Despite most businesses surveyed indicating that they are innovating, and official statistics indicating the region has an above average number of innovation active businesses, it is evident that this is not supporting a productivity uplift or creating the critical mass and spill-over effects which improve talent and place metrics. The main issue for consideration therefore, is not the scale of innovation activity within the region, but the nature of innovation activity and how innovation is being used by businesses.

#### **Innovation activity is driven by a broad range of factors determined at the individual business level...**

Overall, innovation activity within the region is variable. It is driven and influenced by a broad range of factors which vary at the individual business level. While some businesses may be driven by new market opportunities and a desire to grow the business, others are driven by their personal experiences and a desire to 'do things differently' and solve 'real-world' problems. Discussions with businesses demonstrate that leadership/management capacity and motivation are important in creating innovative businesses, but external support structures can help to create the conditions which allow businesses to innovate efficiently and effectively to deliver business results.

It is widely accepted that innovation (i.e. using ideas to add value through the introduction of new/improved products, services or processes) is a mechanism through which the region can raise business productivity. Job creation is not however the primary objective of innovation at the business level. Although growth may lead to new job creation, innovation is primarily about building more competitive and profitable businesses.

### **It is difficult to generalise about innovation activity by sector...**

While broad conclusions could be drawn about innovation levels across different sectors, this risks oversimplifying a subject which is very diverse and dynamic. Mindset, culture, skills and other factors which impact a business's innovation capacity all have a bearing on when, how and why businesses innovate. Most stakeholders agree that some sectors are more likely to innovate collaboratively with research partners because the nature of their products and services requires this (e.g. med tech and bio economy sectors). However overall, most stakeholders felt that generalising about sectors risked masking variations within them, particularly as a lot of innovation activity is perceived to be unrecorded and not visible to external partners.

The sector focus for innovation activity may therefore need to consider where there is growth potential as innovation will play a key role in exploiting new opportunities in growing markets. The sectors identified as having the most growth potential within the region include:

- Agri-food sector in North Yorkshire;
- Rail and infrastructure in North Yorkshire;
- Med-tech in Leeds;
- Bio-science in North Yorkshire;
- Science and engineering in West and North Yorkshire;
- Cultural, creative and digital in West Yorkshire;
- Finance in Leeds; and
- Textiles in Calderdale and Kirklees.

### **Most innovation activity is perceived to be incremental, reactive and not focused on enabling technologies which will deliver radical change...**

Most innovation within the region is perceived to be incremental or differential i.e. predominantly low to medium cost and low to medium impact. Determining this with any degree of certainty however is challenging as quantitative statistics tend to focus on capturing the type of innovation undertaken and qualitative consultations with businesses tend to focus on those that are known innovators. Innovation is also understood to be reactive in a lot of instances e.g. undertaken when it is business critical or due to competitive pressures. The findings suggest that although businesses are innovating, it is not radical or strategic innovation which will deliver a step change in individual business performance and wider impacts on competitors or suppliers. Survey findings support this in part, indicating that businesses are more likely to be engaged in adopting or improving technology, processes and services rather than new goods, products or knowledge transfer.

### **This is partly due to the nature of the business base and innovation capacity within the region...**

The reasons for this may be partly attributable to the nature of the business base i.e. a high proportion of SMEs and few OEMs/tier one businesses, but also from low levels of innovation capacity within businesses and a lack of understanding as to what innovation is and how it can be used. Although business consultations and case studies indicate there are highly innovative businesses in the region, these are not perceived by stakeholder to be representative of the wider

business base. Highly innovative companies such as Dyson and Microsoft use innovation strategically to disrupt sectors and proactively create new market opportunities which leaves their competitors having to adapt just to keep up. Building a business base with the internal capacity and mindset to use innovation more strategically is therefore required, and it is evident from discussions with innovative businesses in the region that leadership and management capability to drive and use innovation is an important precursor to creating a strong innovation culture in the region.

#### **But also due to inefficiencies within the wider innovation ecosystem...**

Stakeholders identified a wide range of opportunities to improve the effectiveness of the innovation ecosystem. The challenges of business/HEI collaboration were highlighted, as well as opportunities to improve skills, business support, finance and the physical infrastructure to support innovation. Across all consultations, better communication and more opportunities for 'conversations' emerged as a common theme. This mirrors findings in the literature review which placed open and cross sector communication as the core of innovation ecosystems which are efficient and proactive - constantly presenting businesses with a flow of ideas/opportunities, providing space for interaction, and providing the dynamic structures/incentives capable of quickly bringing together key and uncommon partners. Businesses also highlighted the importance of their external networks and partnerships in supporting innovation and the role of external mentors who can provide a different perspective and challenge businesses to help the identification of new opportunities.

#### **Improving communication and the effectiveness of the innovation ecosystem could encourage more open and outward looking innovation...**

There is evidence that when innovating, businesses are not necessarily making full use of the support available to elevate the quality and impact of innovation activity. Although most businesses engage with external partners when innovating, approximately 43% do not. Where businesses are looking in-house to innovate, this can result in inefficient solutions being implemented and it can miss the potential benefits that new external insight can bring. As noted above, businesses with a strong innovation culture are typically keen to bring external perspectives into the business to stimulate knowledge creation and diffusion.

#### **Innovation is more than investment in R&D and collaborative research...**

Overall, businesses do not appear to associate innovation with investment in R&D, with only a minority having a dedicated R&D budget. Analysis of expenditure on R&D is therefore likely to exclude a large proportion of innovation activity within the region. Most partnership working is business to business rather than involving the knowledge base, although, as noted above, there is evidence of variations by sector where testing and validation support from a HEI is required. Many businesses favour the immediate and flexible support private sector partners can provide and good practice from other regions suggests that brokering business to business solutions can be an effective mechanism to unlock innovation and business growth. What remains unclear however is the depth of partnerships being developed within the region and whether these are strategic or transactional in nature.

#### **However, HEIs play a key role in the region's innovation ecosystem...**

Despite only a minority of businesses collaborating with HEIs, this remains an important component of innovation activity within the region. Most stakeholders suggested there is scope to better utilise

the region's HEI assets particularly their national and international connections and ability to attract funding and investment, including for physical infrastructure and equipment. Physical innovation hubs and translational research facilities which provide an opportunity for interaction were highlighted as being important not only to improve HEI and business interaction, but also due to their potential spill over effects and ability to attract inward investment. The recent McLaren investment in Sheffield's Innovation Corridor was highlighted as an example of this. However, the opportunity to bring partners together around 'big ideas' of importance to the region (e.g. the circular economy, digital adoption, design) was also identified as an opportunity.

## 6.2 Implications

The findings suggest the main building blocks for a successful, open innovation ecosystem are present in the region. There are however opportunities to make these elements work more efficiently and effectively through supply side interventions, as well as by stimulating demand from businesses which will encourage greater efficiency.

Understanding when and how innovation happens is not straightforward and the system needs to be geared to continuing to increase the number of businesses that are innovating and implementing process improvements, but also pushing more businesses to innovate differently and more strategically to unlock growth. Business need to be equipped to build dynamic relationships which allow them to increase the speed and quality of innovation activity.

Based on the findings and stakeholder feedback, the following sets out potential areas for intervention. Whilst disaggregated into supply and demand considerations, it should be noted that there is considerable overlap between the two 'sides'.

### 6.2.1 Stimulating Demand: Building an Innovation Culture

Key opportunities identified to build a stronger innovation culture and stimulate demand for innovation include:

**Big ideas and market building activities:** There is a need to engage with businesses differently. For most businesses, innovation is a process they implement in order to achieve something else. It is not an objective in itself. Talking to businesses about innovation can therefore have little meaning and value. Although the Industrial Strategy's Grand Challenges are intended to provide a focus for sectors and partners to come together to solve national problems, they are not necessarily issues which all businesses within the region can identify with and make a contribution to. Engaging businesses in campaigns which resonate, but will also, by their nature, stimulate innovation could therefore be explored. Engaging businesses in innovation via exporting, resource efficiency, digital adoption or design are possible options for consideration. These activities will also draw on sector strengths and expertise within the region, supporting market building and growth within these sectors.

**Maximising opportunities within the public sector:** Although austerity and public spending cuts have reduced the public sectors ability to stimulate demand, with a shortage of tier one businesses in the region, maximising the potential of public sector institutions to stimulate innovation through their supply chains remains important. This can include relatively light touch measures such as through procurement practices which incentivise innovation, or more intensive measures which lever the expertise of the private sector to improve the efficiency of public sector

investments and activities. The region's health assets also provide a key opportunity for innovation development and diffusion and engaging with NHS leadership could support this.

**Collaboration and networking to support knowledge diffusion and identify new markets:**

The region needs a process to encourage an exchange of ideas and a forum for business to business, business to HEI/research and user/producer meetings. This is required to speed up knowledge diffusion, exploit cross-over strengths between sectors, and increase demand for innovation by identifying new markets and functions for products and services (e.g. across businesses, sectors and supply chains). This is seen across the board as something the region needs. Business, support agencies and academia all recognise the importance of working collaboratively to break down artificial barriers and learn from each other. Providing such opportunities demonstrates that not all work to promote innovation must require significant resources. These forums are also vital in developing a more proactive approach to innovation which seeks to encourage more radical innovation rather than incremental innovation which is driven by competitive pressures.

The knowledge base needs to engage more proactively to provide a range of different mechanisms for knowledge sharing and conversations in addition to via collaborative research. HEIs are well placed to draw on their national and international connections for the benefit of regional businesses, with coordination and leadership viewed as key to successful networking. Networking across the region needs to be actively managed to encourage interaction between uncommon partners, encourage a more dynamic exchange of ideas and build multi-partner and cross border/cross sector relationships.

## 6.2.2 Supply Considerations

**Building leadership and management capabilities:** Innovation culture within businesses is driven by leaders and management teams. Within established businesses consideration could be given to strategic business mentoring/advisory support or, at a technical level, studentships which bring temporary external expertise into businesses to develop innovation strategies or R&D capabilities.

**Entrepreneurialism and maximising the potential of the region's graduate population:**

Taking a long-term view, creating more innovative business leaders should start within the education system and the development of entrepreneurial skills amongst young people. Measures to encourage start-up amongst graduates and early stage career researchers is also important to retain graduates and higher skilled individuals within the Region. Forums for researchers to interact with business leaders and commercial mentors to identify business opportunities and access practical support have been recommended, as well as increasing funding for academics to commercialise and take their research to industry rather than relying on businesses to lead collaboration.

**Branding and a place-based approach to innovation:** Attracting new investment to the region has the potential to drive innovation within indigenous businesses and create new market opportunities. The science parks in Daresbury, South Manchester, Liverpool and the AMRC in Sheffield have a clear identity, focusing largely on the brand of the City. If the region is to compete with other potential hubs to attract a critical mass of innovation led companies, there needs to be a strong and well understood brand and offer which can be marketed nationally and internationally.

The notion of clear messages and 'big ideas' which partners can buy into is linked to a place-based approach to innovation. The region, stakeholders and particularly its universities are focusing on the role of place in delivering economic goals established in the Industrial strategy, as well as wider social and cultural benefits. At its heart is the growing realisation that place plays a major role in driving innovation-led regional growth. Place based development is seen as having potential to:

- Drive clusters of business with the potential to innovate and contribute to the growth of knowledge intensive businesses;
- Accelerate innovation collaboration; and,
- Promote business and academic exchange of ideas to adopt new technologies.

The region is well placed to develop place based innovation as it brings together the research hubs and Knowledge Centres engaging local businesses at the forefront of economic growth and economic sectors with the greatest potential for innovation. The Leeds City Region has been successful in securing seedcorn funding to develop a full proposal for the UK Research and Innovation (UKRI) Strength in Places Fund (SIPF) and the Yorkshire Universities are driving forward thinking on place-based innovation. The role of place is also understood by UKRI and InnovateUK, and is increasingly reflected in their funding policies.

**Investment in infrastructure and digital connectivity:** The region needs investment in its physical and digital infrastructure to make it attractive for investment and to support knowledge diffusion. Interventions which facilitate the more effective and efficient movement of people, goods and services will create new opportunities, open new markets and bring new ideas and talent to the region. Whilst for some this requires investment in transport infrastructure, the potential of digital connectivity to facilitate interaction and exchange should not be overlooked. Leaders should also consider whether there is appetite to invest in a central hub for hi-tech industry and innovation, or whether existing assets and facilities could be enhanced/coordinated to support a hub and spoke approach to development.

**Targeted business support:** New approaches to business support should be considered. There needs to be an on-going programme of activity to raise the innovation capacity of businesses and this needs to be integrated into existing business support mechanisms. Flexibility to respond to individual business innovation needs is vital, as well as the provision of consultancy and mentoring support to enable businesses to develop the soft skills and intangible assets which underpin innovation activity. With the findings indicating a need to increase the scale of differential and radical innovation, partners may also need to consider whether there is a rationale for targeting supply side interventions on high value/high growth sectors which may have more opportunity and capacity for innovation-led growth. Work (which is on-going) to identify local supply chains to focus investment and identify high productivity sector will be important in informing this but should also look at opportunities for cross fertilisation of supply chains and sectors too.

**A clear HEI offer:** Consideration should be given to the development of a clear, branded and consistent offer to businesses to access industry-focused research support and near to market solutions. The Technology/Innovation Gateway model for instance provides clarity regarding industry access points to research expertise. They provide a forum for researchers to engage with industry and undertake market focused R&D and can be underpinned by a consistent

minimum support offer to businesses. Identifying gateways on the region's research specialisms also provides clarity regarding capabilities and priorities for growth.

In addition to physical gateways, businesses need a portal to access technology, expertise, IP, licences and facilities, and the research community need a forum to market their services as well as market specific projects and opportunities. Creating a research/knowledge 'marketplace' could help to stimulate greater collaboration and a culture of open innovation.

**Funding:** Funding is important to stimulate investment in innovation, particularly early stage and high-risk ventures and opportunities. Funding must support all stages of the innovation journey and should offer fast-track assistance for businesses requiring quick turnaround; small scale, flexible funding (such as innovation vouchers) to enable quick responses to technical challenges; strategic investment in radical innovation opportunities perhaps focused at supply chains, larger companies or disruptive technologies; and funding to allow businesses and organisations to better plan and improve the quality of innovation activity (e.g. funding for activities such as testing project viability, strategic thinking around disruptive technologies, engagement with partners outside of their own organisations for inspiration and for guidance, prototype development etc.) Awareness raising of tax credits for research and development as well as grants is key.

# APPENDIX 1: STATISTICAL ANALYSIS

## Innovation Indicators

This section explores the BIS 'Mapping Local Comparative Advantages in Innovation' framework by analysing selected performance metrics to provide a profile of the region's innovation ecosystem benchmarked against comparators and Great Britain figures. Where data for the new regional geography is not available, a 'next best fit' approach has been used and any limitations of this are cited.

### Money

#### Private Equity and Venture Capital Investment

Private equity investments and venture capital investments are important indicators of the scale of innovators that have viable business concepts with some scope for commercial application in the future. Often, access to this type of finance is very limited for start-ups, with only the high-flyers receiving funding at an early stage. Many receive this type of funding once they have broken through a certain revenue threshold, typically £1 million.

**Table 1: Companies in receipt of private equity investment per 1,000 VAT registered local units**

Government Office Region	Number of Companies (2016)	Number of private equity backed companies (2016)	Companies invested in per 1,000 VAT registered local units (2016)	Rank
North West (Greater Manchester LEP & Lancashire LEP)	294,205	78	0.27	1
South East (Oxfordshire LEP)	452,705	115	0.25	2
North East (North East LEP)	86,385	19	0.22	3
<b>Yorkshire and The Humber (LCR/YNYER LEP)</b>	<b>214,225</b>	<b>38</b>	<b>0.18</b>	<b>4</b>
East Midlands (D2N2 LEP)	202,045	23	0.11	5
Great Britain	2,925,755	708	0.24	-

Source: ONS UK Business: Activity, Size and Location 2016; BVCA Private Equity and Venture Capital Report on Investment Activity 2016-2017 (September 2018).

Data relating to Government Office Regions (GORs) rather than at a local authority or city level has been analysed as this is the lowest geographical level for which data is available. Table 4.1 above shows that the North West GOR (which includes the Greater Manchester and Lancashire LEPS) is the highest performing of our chosen comparators with 0.27 companies receiving private equity or venture capital investment for every 1,000 VAT registered local units in 2016. It performs better than the GB average (0.24) and the South East (0.25). The South East GOR is the second highest performing GOR (0.25), followed by the North East (0.22) as the third highest performing GOR. Yorkshire and The Humber (Y&H) (comprising the LCR and YNYER LEPS) (0.18) ranks fourth amongst the chosen comparators.

## InnovateUK

Analysis of InnovateUK investments provides an opportunity to examine investment trends across LEP areas. Grants are awarded based on the quality of applications rather than via regional allocations and therefore provides some insight into local comparative strengths and capabilities in key technologies/sector<sup>36</sup>. Table 2 below shows the number of grants secured by applicants in LCR and YNYER LEP areas since 2004.

**Table 2: InnovateUK Grants Since 2004**

LEP Area	No. of Grants Received
LCR	852
LCR and Sheffield City Region	30
LCR/YNYER	315
YNYER	121
YNYER and Humber	79
<b>LCR/YNYER TOTAL</b>	<b>1,397</b>
North East	1,073
D2N2 and D2N2/SCR	1,333
Greater Manchester	1,186
Lancashire	501
Oxfordshire	1,210

Source: InnovateUK

Of the 34,822 grants issued by InnovateUK since 2004, 4% were secured by applicants in Leeds City Region and/or YNYER. This compares to 3.8% in D2N2 and 3.4% in Greater Manchester. It is interesting to note that compared to Greater Manchester, LCR and YNYER applicants are more likely to engage in partnerships which cross LEP boundaries and include partners in the Humber and Sheffield City Region.

Analysis of grants awarded indicates that alongside private sector businesses, several of the region's HEIs (Leeds Beckett University, York, Leeds, Huddersfield and Bradford Universities) have acted as lead and supporting partners for grants. Several public agencies such as Make It York; Leeds City Council; York City Council and Bradford City Council have also been involved in successful grant applications. The exchange of knowledge and expertise across geographical boundaries and between different businesses and institutions is an important feature of successful

<sup>36</sup> Some investments (such as into Catapult Centres and Head Offices) may benefit regions across the UK but will be registered to one locality.

innovation ecosystems as it encourages knowledge diffusion, improves the quality of innovation activity and prevents lock-in.

Of the LCR/YNYER projects, the majority were in emerging and enabling technologies (see table 3). As InnovateUK set the sector priorities for grants, it is important not to attach too much significance to this, however it does provide some insight into local sector strengths which are aligned to the Industrial Strategy and UK Grand Challenges.

**Table 3: InnovateUK Grants in LCR/YNYER since 2004 by Sector**

Sector	Number of Grants Secured
AI and Data Economy	2
Development	22
Emerging and Enabling	591
Health and Life Science	220
Infrastructure Systems	135
Manufacturing and Materials	312
Non-Core Sectors	48

Source: InnovateUK

The region is particularly successful in accessing funding linked to enabling and emerging technologies. Table 4.4 below lists the sub-sectors targeted by InnovateUK. Stakeholder consultations suggest that the region has particular strengths in cyber security, data and robotics.

**Table 4: Sub-Sectors of Enabling and Emerging Technologies**

Enabling Technologies	Emerging Technologies
<ul style="list-style-type: none"> <li>• cyber security;</li> <li>• data;</li> <li>• the internet of things;</li> <li>• satellite earth observation;</li> <li>• electronics;</li> <li>• sensors and photonics; and,</li> <li>• robotics and autonomous systems.</li> </ul>	<ul style="list-style-type: none"> <li>• quantum technologies;</li> <li>• synthetic biology;</li> <li>• non-animal technologies;</li> <li>• biofilms;</li> <li>• energy harvesting;</li> <li>• graphene; and,</li> <li>• new imaging technologies.</li> </ul>

Source: InnovateUK

## Research and Development Tax Credits

R&D tax credits are a useful money-saving technique for both SMEs and large companies which can claim tax relief on certain research and development activities. R&D tax credits are a tax relief to encourage greater R&D spending, leading in turn to greater investment in innovation. They work by reducing a company's tax bill by an equal amount to a percentage of the company's allowable R&D expenditure. A company can only claim R&D tax credits if it is liable for Corporation Tax. The tax credits should act to encourage firms of all sizes to invest in innovative technologies and/or techniques at a 'discounted' rate. Table 5 below benchmarks Y&H uptake of R&D tax credits against comparable LEPs and the GB average.

**Table 5: R&D Tax Credits per 1,000 VAT registered local units**

Government Office Region	Total number of R&D tax credit scheme claims	Total amount of R&D tax credit scheme claims (£M)	Number of R&D tax credit scheme claims per 1,000 VAT registered local units	Rank
North East (North East LEP)	1,370	465	20.2	1
North West (Greater Manchester LEP and Lancashire LEP)	4,330	1,415	17.7	2
South East (Oxfordshire LEP)	6,300	4,910	16.1	3
<b>Yorkshire and The Humber (LCR and YNYER LEPs)</b>	<b>2,625</b>	<b>740</b>	<b>14.8</b>	<b>4</b>
East Midlands (D2N2 LEP)	2,430	885	14.1	5
Great Britain	37,575	23,200	15.1	-

Source: HMRC R&D Tax Credits Statistics 2016-2017 (September 2018); ONS Enterprise / Local Units by Broad Industrial Group and UK Local Authority Districts 2016.

HMRC has not provided a breakdown of this data at an LEP or city level, rather by Government Office Region. The North East GOR is the top performing geography of our chosen comparator areas by a considerable amount. Both Y&H and the East Midlands are below the national average. This is perhaps surprising given the proximity of world-class research centres such as the University of Leeds and the University of York to Y&H businesses. However, not all R&D undertaken by businesses will result in tax credits being claimed, therefore its value as an indicator lies more in understanding the extent to which businesses may be attuned to and aware of this type of financial opportunity than as an indicator of the scale of innovation activity. Typically, R&D tax credits are also better suited to more established businesses that can cash flow R&D activity before claiming tax credits. With a high proportion of the region's business base SMEs, this may be a factor in low levels of take-up.

### Summary: Money

The Allas framework identifies money as a key input into all parts of the innovation system, used to invest in infrastructure, new knowledge, absorptive capacity and innovation. Bringing more money into the region and encouraging more businesses to invest in R&D is important therefore in raising the region's capacity for innovation and also to increase the proportion of innovation activity which is more radial and differential in nature. The indicators analysed above suggest that the

proportion of businesses in Y&H accessing equity investment and R&D tax credits are below national averages which is supported by findings from RSM's survey of local businesses.

This may indicate there is a need to raise awareness of financial supports available to businesses and broker introductions to investors. The findings may however also reflect the nature of the business base in the region and high proportion of SMEs to which tax credits may have less relevance in unlocking innovation activity.

Analysis of InnovateUK data however does suggest that the LCR/YNYER LEPs are aligned with comparator LEPs in terms of the number of grants secured. The findings indicate that partners within the region are capable of successfully competing for funds in key growth sectors aligned with the Grand Challenges, and the number of businesses, HEIs and other public sector partners involved in applications (as well as evidence of cross border collaboration) suggests that there are examples of good networks and relationships within the region which can underpin knowledge diffusion.

It is important to note that money is an input into the innovation ecosystem which may, or may not, lead to knowledge adoption/commercialisation of research and, therefore, business/economic benefits. Unlocking innovation potential however requires the right type of investment which is accessible and fit for purpose. Stakeholder consultations (outlined in more detail in the main body of the report) noted that there appears to be sufficient money available to support innovation, the challenge is making sure it meets business and research partners' needs. There are funds available within the region to support innovation (e.g. Access Innovation; Finance Yorkshire/NPIF) which are successfully unlocking innovation capacity (see Abingdon Health case study). However, with some stakeholders suggesting a need for more risk capital there may be merit in undertaking further research to assess the scope and scale of funding available; any specific barriers/limitations to their use; and any gaps in the funding landscape.

#### **Abingdon Health, York – Northern Powerhouse Investment Fund (NPIF)**

A York-based diagnostics company secured a £1.5m investment from Mercia Equity Finance, which is managed by Mercia Fund Managers and part of the Northern Powerhouse Investment Fund. The funding will allow Abingdon Health to fulfil new contract wins and invest in new equipment and processes at its headquarters at the National Agri-Food Innovation Campus in York.

Abingdon specialises in 'point of care' tests, to diagnose disease in humans, animals and plants and to measure drugs, hormones and other biomarkers in a range of sample types. These single use devices, similar to a pregnancy test, allow testing to be carried out on site, in the field or at home and the results are easy to interpret by eye or using smartphone apps and reader devices. Point of care tests allow more rapid diagnosis and monitoring than traditional laboratory tests.

Abingdon develops and manufactures tests for clients worldwide in the healthcare, veterinary, food and agriculture sectors, with over 50 per cent of its output going to export markets. Founded by the CEO Chris Yates and Dr Chris Hand, the Chairman, the company employs around 40 people and also has laboratories in Birmingham. A series of acquisitions in recent years have

extended its capabilities and in addition to providing test development services and high-volume contract manufacturing, it offers its own range of tests, reader devices and other products.

Source: <https://www.npif.co.uk/abingdon-health/>

## Talent

One of the most important elements of the Allas innovation framework is talent which is referred to as “the human capital required to demand, develop, share and exploit new and existing knowledge”. Having the right talent is integral to having a fully mobilised innovation ecosystem. With a sizeable number of residents employed in professions that are notoriously innovative, this should act to raise business ambition to employ new processes; to share knowledge; and, to shift the dynamic of the region to become a cluster engaged in new technologies, production techniques and processes.

### Residents Employed as Science, Engineering and Technology Associate Professionals

Table 6 below summarises the number of residents employed as science, engineering and technology and associate professionals in the comparator LEPs.

**Table 6: Residents employed as Science, Engineering and Technology Associate Professionals**

LEP	Residents employed as science, engineering and technology and associate professionals	% of employed population	Rank
Oxfordshire	35,500	9.9	1
D2N2	50,400	5.7	2
Greater Manchester	65,400	4.9	3
Lancashire	33,200	4.8	4
<b>LCR</b>	<b>64,000</b>	<b>4.4</b>	<b>5</b>
<b>YNYER</b>	<b>24,700</b>	<b>4.4</b>	<b>5</b>
North East	38,900	4.3	6
<b>Great Britain</b>	<b>1,783,700</b>	<b>5.7</b>	<b>-</b>

Source: ONS (NOMIS) Labour Market Profile Data 2017, Regional / National Profile (Annual Population Survey) 2017.

This indicator helps to understand the scale of the local talent pool which is important to attract and retain business investment in the region and raise the absorptive capacity of businesses. The LCR and YNYER regions have one of the lowest proportions of residents employed as science, engineering and technology and associate professionals among our comparator areas, indicating that there may be factors that hinder attracting/retaining talent in the region. This could be due to several factors including the composition of the business base and number of high skilled opportunities available. Research has suggested however that innovation capacity is unlocked not

only by employees within higher skilled occupations, but also by those at intermediate and technical levels<sup>37</sup>. This is explored below.

### Economically Active Population – NVQ Levels

This indicator is useful in classifying the skill level of an entire Local Authority area population. Intended to be used with the indicator above, innovation is not only dependent on having a portion of the workforce at the upper end of educational attainment, it is equally important to have a workforce educated to a minimum requirement which can be used as a signal to attract highly innovative firms to the region. Table 7 below summarises the proportion of the population with varying levels of NVQ achievement in each of the LEPs.

**Table 7: Proportion of Economically Active Population with Varying NVQ Levels**

LEP	% with NVQ4+ (Aged 16-64)	% with NVQ3+ (Aged 16-64)	% with no qualifications (NVQ) (Aged 16-64)
Oxfordshire LEP	54.1	15.7	2.5
YNYER LEP	42.9	19.7	4.5
Greater Manchester LEP	40.8	18.0	6.5
WY/NY	39.7	18.9	5.3
Lancashire LEP	39.1	18.4	5.6
LCR LEP	38.9	18.8	5.4
D2N2 LEP	37.8	20.1	4.5
North East LEP	36.0	18.9	5.0
Great Britain	43.7	16.9	5.1

Source: ONS (NOMIS) LEP Profiles, 2018.

The analysis shows that although the West and North Yorkshire region performs relatively well against comparator areas, this is primarily due to a high proportion of more highly qualified residents in the YNYER LEP region. The North East LEP has the lowest proportion of its economically active population with an NVQ4+ level qualification (36%), although this is broadly aligned with other comparator LEP areas.

Analysis of qualification levels at the local area (table 8 below) shows significant variation across the region from over half the economically active working age population in Craven qualified to NVQ4+ compared to less than a third in Wakefield, Scarborough and Richmondshire. Whilst not a direct indicator of graduate retention, it is interesting to note that although Leeds does not have the highest proportion of residents qualified to NVQ4+, 30% of people with NVQ4+ in Leeds are aged between 20-29 compared with 21% in York and 0% in Ryedale. This is significant as a flow of highly skilled young people into the workforce can support the exchange of new ideas and new ways of working.

<sup>37</sup> <https://esrc.ukri.org/news-events-and-publications/evidence-briefings/workforce-skills-at-all-levels-boost-innovation-and-productivity/>

**Table 8: NVQ4+ Qualifications by Geography and Age**

Area	% of economically active with NVQ4+ - aged 16-64	% of economically active with NVQ4+ aged 20-29
Craven	52.4	20
York	51.9	21
Ryedale	47.7	0
Hambleton	47.6	19
Harrogate	47.6	5
Leeds	43.3	30
Selby	39.5	28
Calderdale	38.8	19
Kirklees	38.1	15
Bradford	33.2	23
Richmondshire	31.1	0
Scarborough	31.1	12
Wakefield	28.7	23

Source: ONS (NOMIS) LEP Profiles, 2018.

### Summary: Talent

A skilled labour pool is important to attract/retain businesses and raise absorptive capacity/innovation potential within businesses. Human capital is also the main mechanism through which knowledge is shared and diffused as labour moves between localities and businesses.

While employment in science, engineering and technical occupations can provide an indication of innovation capability within a region, it is the availability of skilled workers across all intermediate, technical and higher-level skills which are important to raise innovation potential. While YNYER has a high proportion of its working age population qualified to NVQ3+, skills levels in LCR are below the national average. This does however mask local geographical variations. There are also variations in the age profile of those with higher skills levels, with young people (20-29) accounting for a higher proportion of higher skilled residents in Leeds.

### Structures and Incentives

This element of the Allas framework attempts to capture “the institutions and interconnections that determine how effectively the actors in the system work together to generate outcomes”. This is a difficult aspect of the ecosystem to analyse using statistical indicators, as the effectiveness of the system is often determined by intangible factors such as how quickly institutions respond, the scale of personal networks, and appetite for innovation.

In addition to the indicators considered below, WYCA’s current research into local supply chains should provide additional insight into the sector strengths/clusters within the region which could be a focus for innovation support. WYCA’s research into productivity across the region could also add to this insight. The findings from Science and Innovation audits within the region also provide detailed insight into the region’s innovation assets within key sectors.

## Science and Technology Sectors Employment

The ONS has provided a full list of five-digit UK Standard Industrial Classification of Economic Activities 2007 (SIC07) codes assigned to science and technology sectors. Innovation is likely to be prevalent and sought after in science and technology sectors. Technological advancements are moving at momentous speeds and firms are constantly designing or acquiring new processes which improve their competitive edge. As such, having a strong working base in these sectors is likely to progress new innovative designs and share knowledge; a high proportion is indicative of an innovative culture. Table 9 below summarises ONS statistics for Professional, Scientific and Technical Activities employment in 2017 at the LEP level.

**Table 9: Professional, Scientific and Technical Activities Sectors Employment Count**

LEP	ONS Professional, Scientific and Technical Activities Sectors Employee Count	As a % of Total Employee Jobs in the Region	As a % of the Economically Active Population in the LEP	Rank
Oxfordshire LEP	38,000	10.6	10.3	1
Greater Manchester LEP	118,000	9.1	8.5	2
YNYER LEP	30,750	8.1	7.4	3
LCR LEP	111,000	8.1	7.3	4
D2N2 LEP	55,000	5.8	5.0	5
Lancashire LEP	35,000	5.6	4.8	6
North East LEP	36,250	4.5	3.8	7
Great Britain	3,013,000	8.8	9.1	-

Source: ONS (NOMIS) Labour Market Profile Data 2017, Employment by Occupation (Annual Population Survey) 2017.

With the exception of Oxfordshire, the Greater Manchester LEP has the highest employee count in Professional, Scientific and Technical Activities sectors (118,000) representing 9.1% of total employee jobs in the LEP and 8.5% of the total economically active population in the LEP. The YNYER and LCR regions follow closely behind Greater Manchester but are below national averages.

### 1.1.1 Broader Environment

The 'broader environment' element of the framework seeks to "capture the economic and social context with which the science and innovation system interacts". The indicators here are designed to capture the relative strengths of LEP local economies in terms of labour force participation, business and entrepreneurial activity, earnings, quality of life / place and local connectivity.

#### Employment Rate

The employment rate shares two messages regarding economic output and innovative behaviour within an economy. A high employment rate is indicative of a prosperous, well-functioning economy which can attract the right type of talent and limit the level of structural unemployment. The

employment rate can also be seen as an outcome of innovation, in which economic growth and jobs growth ensues as a result of a booming local economy.

However, it should also be noted that innovation is the introduction of new technologies and procedures which can help streamline processes and ultimately replace manual labour. Hence, it is also possible that innovation reduces the employment rate. As such, this indicator should be used with caution and in conjunction with other indicators of employment and innovation. Table 10 below summarises the employment rate for those persons aged 16-64 years in each LEP area in 2018.

**Table 10: Employment Rate aged between 16-64 by LEP**

LEP	Employment Rate (Aged 16-64) (%)	Rank
Oxfordshire LEP	81.3	1
YNYER LEP	78.2	2
D2N2 LEP	77.1	3
Lancashire LEP	74.3	4
LCR LEP	73.3	5
WY/NY LEP	73.9	6
Greater Manchester LEP	72.8	7
North East LEP	72.1	8
Great Britain	75.1	-

Source: ONS (NOMIS) Labour Market Profile Data 2018

The YNYER LEP area has an employment rate above the national average and other comparator regions. LCR is ranked fifth, only ahead of Greater Manchester and trailing the national average. A breakdown by local authority is provided in table 11 below. The variation within the West and North Yorkshire region is however significant in terms of employment, and these variations may adversely affect the innovation capacity and potential of some localities.

**Table 11: Employment Rate aged between 16-64 by Local Authority**

Local Authority	Employment Rate (aged 16-64)
Harrogate	83.2
Ryedale	81.3
Hambleton	79.5
York	79.3
Selby	77.0
Calderdale	77.0
Scarborough	76.0
Leeds	75.0
Wakefield	73.9
Craven	73.1
Richmondshire	71.2

Kirklees	71.1
Bradford	65.8

Source: ONS (NOMIS) Labour Market Profile Data 2018

## Quality of Life

An essential part of growing an effective innovation cluster is to attract and retain high-performing talent to the area. As such, building an environment that can offer an array of social and leisure facilities is key to improving the overall well-being and quality of life for the local population.

**Table 12: Quality of Life**

LEP	Average (mean) Life Satisfaction Rating	Rank
YNYER LEP	7.69	1
Oxfordshire LEP	7.67	2
Lancashire LEP	7.55	3
D2N2 LEP	7.54	4
WY/NY	7.53	5
LCR LEP	7.50	6
North Eastern LEP	7.43	7
Greater Manchester LEP	7.40	8
UK	7.53	-

Source: ONS Life Satisfaction Statistics 2012-2015 (ONS, 2017).

The YNYER LEP is the highest performing of our comparator areas with a (mean) score of 7.69%, followed by the Oxfordshire and Lancashire with scores of 7.67% and 7.55% respectively. The Lancashire (7.55%) and D2N2 (7.54%) LEPs rank third and fourth. The LCR average of 7.50% is ranked sixth, and scores marginally lower than the UK average of 7.53%. It is interesting to note that the more rural areas tend to score more highly in terms of life satisfaction and the findings will be highly influenced by those surveyed and the basket of variables explored.

## Communications Infrastructure

Ensuring that adequate and full communication infrastructure is in place is essential in facilitating innovation processes. With the emergence of new technologies, the invention process becomes heavily dependent on having the right communication assets including broadband, to enable other technologies to work effectively. Those regions in rural settings are less able to compete against urban environments which can benefit from fibre optics and, in the near future, 5G mobile Wi-Fi connectivity.

**Table 13: Average Download Speed**

Local Authority Area	Average download speed (Mbit/s)
Leeds	52.4
Bradford	51.2

Wakefield	39.1
Calderdale	39.9
Kirklees	48.8
York	44.0
Selby	30.1
Harrogate	48.7
Craven	48.6
Hambleton	32.8
Scarborough	31.0
Richmondshire	28.9
Ryedale	31.4
Oxford	62.9
Newcastle	49.8
Manchester	45.8
Nottingham	66.0
Derby	64.0
Lancaster	68.4

Source: Ofcom Connected Nations 2018<sup>38</sup>

The analysis suggests that except for Greater Manchester and Newcastle, comparator cities have average download speeds which exceed those of West and North Yorkshire local authority areas. Download speeds in rural areas are particularly low which could inhibit economic activity and innovation by restricting access to new markets.

### Business Size – The West and North Yorkshire Region

The structure of the business base has the potential to influence the scale and nature of innovation activity across the region. Business size can have a bearing on a businesses capacity and capability to innovate e.g. through leadership and management skills/capabilities, ability to access finance, ability to cash flow and invest in R&D. Tier one businesses and OEMs also have the ability to drive innovation activity through their supply chains by pushing suppliers to deliver more and also by attracting new businesses and competition to a sector and locality. Table 14 below summarises the business base within the study region.

**Table 14: Number of Businesses by Size (Number of Employees)**

Local Authority	Micro (0-9 employees)	Small (10-49 employees)	Medium (50-249 employees)	Large (250+ employees)	Total no. of businesses
Bradford	14,960	2,430	590	80	<b>18,060</b>
Calderdale	7,675	1,260	250	25	<b>9,210</b>

<sup>38</sup> <https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2018/data-downloads>

Leeds	28,140	5,065	1,245	215	<b>34,665</b>
Wakefield	9,510	1,790	450	75	<b>11,825</b>
Kirklees	13,890	2,215	475	55	<b>16,635</b>
York	7,135	1,480	295	35	<b>8,945</b>
Selby	3,850	490	95	20	<b>4,455</b>
Harrogate	8,925	1,240	235	20	<b>10,420</b>
Craven	3,635	480	65	5	<b>4,185</b>
Hambleton	5,280	745	115	5	<b>6,145</b>
Scarborough	4,110	790	105	10	<b>5,015</b>
Richmondshire	2,720	380	45	5	<b>3,150</b>
Ryedale	3,510	455	55	10	<b>4,030</b>
<b>Total</b>	<b>113,340</b>	<b>18,820</b>	<b>4,020</b>	<b>560</b>	<b>136,740</b>
<b>Average</b>	<b>8,718</b>	<b>1,448</b>	<b>309</b>	<b>43</b>	<b>10,518</b>

Source: ONS, UK business; activity, size and location, 2018.

Table 15 highlights that the majority of businesses in the Region are micro businesses with 0-9 employees (82.9%) whilst 13.8% of businesses are small businesses (10- 49 employees), 2.9% are medium sized businesses (50- 249 employees) and very few (0.4%) are large businesses (250+ employees). This is particularly important as large OEMs and Tier one businesses can drive innovation within their local supply chains and provide a focus for innovation support activity.

**Table 15: % of Businesses by Size**

Local Authority	Micro (0-9 employees) %	Small (10-49 employees) %	Medium (50-249 employees) %	Large (250+ employees) %	Total no. of businesses
Bradford	82.8	13.5	3.3	0.4	<b>18,060</b>
Calderdale	83.3	13.7	2.7	0.3	<b>9,210</b>
Leeds	81.2	14.6	3.6	0.6	<b>34,665</b>
Wakefield	80.4	15.1	3.8	0.6	<b>11,825</b>
Kirklees	83.5	13.3	2.9	0.3	<b>16,635</b>
York	79.8	16.6	3.3	0.4	<b>8,945</b>
Selby	86.4	11.0	2.1	0.5	<b>4,455</b>
Harrogate	85.7	11.9	2.3	0.2	<b>10,420</b>
Craven	86.9	4.6	1.6	0.1	<b>4,185</b>
Hambleton	85.9	12.1	1.9	0.1	<b>6,145</b>
Scarborough	82.0	15.8	2.1	0.2	<b>5,015</b>
Richmondshire	86.4	12.1	1.4	0.2	<b>3,150</b>
Ryedale	87.1	11.3	1.4	0.3	<b>4,030</b>
<b>Total</b>	<b>82.9</b>	<b>13.8</b>	<b>2.94</b>	<b>0.4</b>	<b>136,740</b>

Average	8,718	1,448	309	43	10,518
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## Population Earnings

Strong average wages are an important outcome indicator of innovation as they are a direct result of improved economic conditions brought about through business innovation and productivity changes. Table 16 below summarises the average annual gross full-time pay for each comparator LEP in 2018.

**Table 16: Average Annual Gross Full-time Pay**

LEP	Average annual gross full-time pay, 2018	Rank
Oxfordshire LEP	£34,413	1
D2N2 LEP	£28,207	2
YNYER LEP	£27,926	3
WY/NY	£27,428	4
LCR LEP	£27,212	5
Greater Manchester LEP	£26,819	6
North East LEP	£26,641	7
Lancashire LEP	£26,542	8
Great Britain	£29,661	-

Source: ONS Annual Survey of Hours and Earnings 2018.

Table 16 highlights that average wages in YNYER and LCR are comparatively high but still lag the national average. This is likely to be due to the North-South wage differential which is tipped in the South's favour due to e.g. elevated wage levels in London and the wider South-South East region.

### 1.1.2 Knowledge Assets

#### Open Innovation: HEI and Business Engagement

Open innovation is crucial to the production of new knowledge and innovation. One of the key mechanisms which can support this is HEI/business interaction.

Table 17a below summarises the number and value of contracts that HE providers have with companies to deliver consultancy related services. The analysis shows that the less research-intensive institutions within the region tend to be more active with SMEs, although it is evident that these interactions are relatively low value. As comparators, the Universities of Lancaster and Nottingham have comparatively high levels of SME engagement.

The analysis indicates that Leeds Beckett University is particularly active with SMEs. The institution undertakes outreach activities to engage with local businesses, but a high proportion of its activity is the delivery of consultancy assignments for the public sector. Therefore, whilst the data provides some insight into HEI collaboration, it is important to consider the nature of this activity in order to better understand how it may impact on innovation activity across the region.

**Table 17a: Consultancy Services delivered by HEIs (2017-18)**

HE Provider	SMEs		Other (non-SME) Commercial Businesses		Non-commercial Organisations		Total	
	No	Value (£000s)	No.	Value (£000s)	No.	Value (£000s)	No	Value (£000s)
The University of Bradford	56	93	50	213	162	404	268	710
The University of Huddersfield	253	571	312	789	16	177	581	1,537
Leeds Beckett University	1,482	1,534	73	422	767	8,355	2,322	10,311
The University of Leeds	39	237	94	876	74	451	207	1,564
Leeds Trinity University	0	0	1	8	4	22	5	30
York St John University	0	0	2	7	13	184	15	191
The University of York	23	82	185	3,577	173	1,991	381	5,650
University of Nottingham	242	1,797	376	3,522	180	2,161	798	7,480
Manchester University	53	372	79	1,064	81	1,149	213	2,585
Lancaster University	441	2,676	58	257	85	457	584	3,390
Newcastle University	58	704	281	2,140	184	2,623	523	5,467
The University of Oxford	289	3,399	312	2,085	271	1,706	872	7,190

Source: Higher Education Statistics Agency ([hesa.org.uk https://www.hesa.ac.uk/data-and-analysis/business-community/services#](https://www.hesa.ac.uk/data-and-analysis/business-community/services#)), April 2019.

Analysis of interactions for contract research (table 17b) indicates that only the Universities of Leeds and York have undertaken more contract research than consultancy research which reflects the research-intensive nature of these institutions. The University of Leeds completed 1,136 transactions valued at £54,552,000, while the University of York completed 412 transactions valued at £16,873,000.

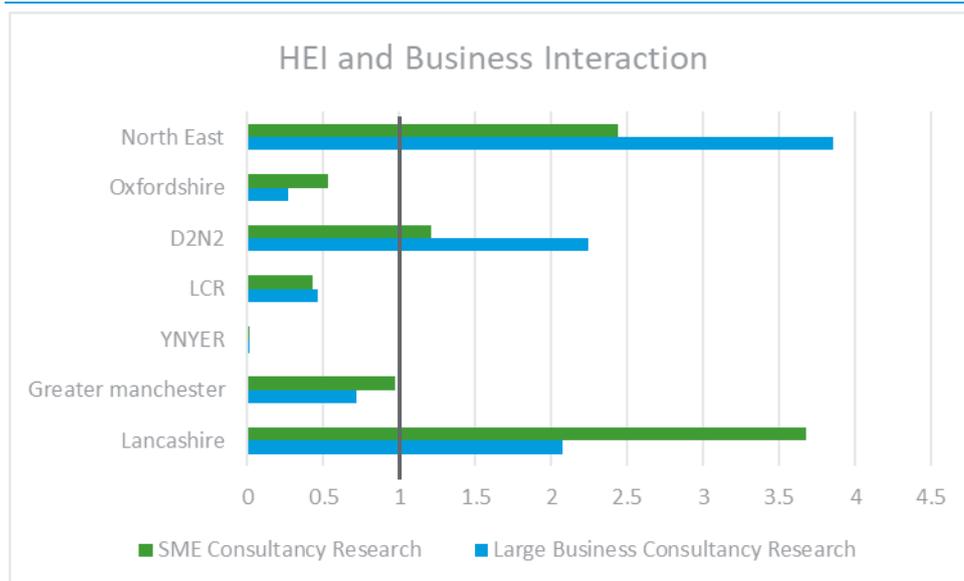
**Table 17b: Contract Research Services delivered by HEIs (2017-18)**

HE Provider	SMEs		Other (non-SME) Commercial Businesses		Non-commercial Organisations		Total	
	No	Value (£000s)	No.	Value (£000s)	No.	Value (£000s)	No	Value (£000s)
The University of Bradford	34	316	43	884	28	498	105	1,698
The University of Huddersfield	20	402	22	993	11	197	53	1,592
Leeds Beckett University	18	198	14	172	109	2,485	141	2,855
The University of Leeds	61	1,621	276	10,863	799	42,038	1,136	54,522
Leeds Trinity University	0	0	0	0	0	0	0	0
York St John University	0	0	0	0	5	159	5	159
The University of York	21	196	68	2,246	323	14,431	412	16,873
University of Nottingham	139	1,369	504	17,871	674	21,133	1,317	40,373
Manchester University	74	4,031	404	42,020	396	29,112	874	75,163
Lancaster University	120	1,293	129	1,601	283	6,812	532	9,706

Source: Higher Education Statistics Agency ([hesa.org.uk https://www.hesa.ac.uk/data-and-analysis/business-community/services#](https://www.hesa.ac.uk/data-and-analysis/business-community/services#)), April 2019.

Benchmarking business/HEI interaction at LEP level, suggests that both LCR and YNYER regions have fewer interactions when compared with the national average (represented by 1 on figure 18 below).

**Figure 18: HEI / Business Interaction at LEP Level**

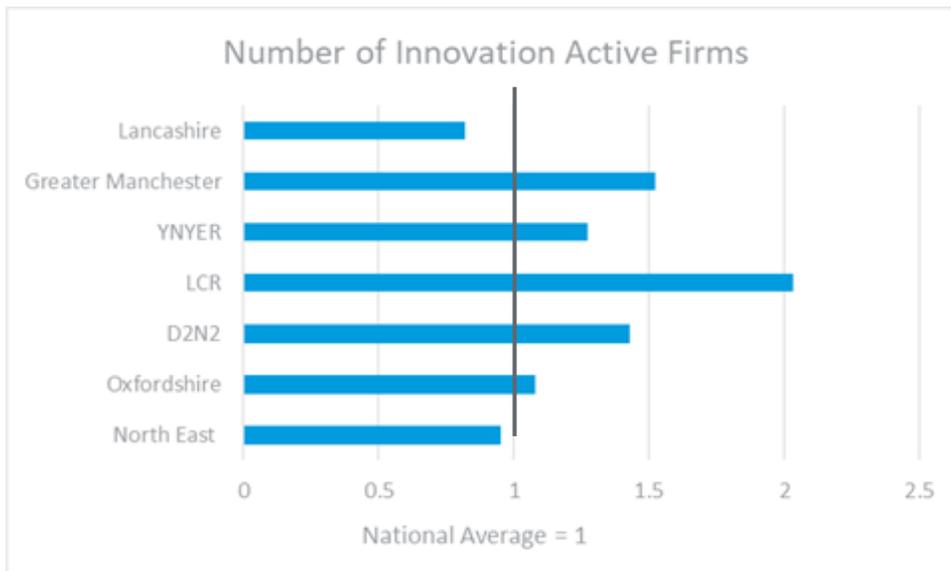


Source: Smart Specialisation Hub, LEP Profile data (December 2018).

It is evident that collaborations are taking place within the region between HEIs and businesses, although not on the same scale as nationally and in other LEP areas. Examining this in more detail, figure 19 shows that both YNYER and LCR LEPs have an above average level of businesses that are innovation active. Only the Lancashire LEP performs below the national average.

It is interesting to consider this alongside the analysis of business/HEI interaction above which suggests that although LCR and YNYER have above the national average of innovation active firms, this does not necessarily result in high levels of business/HEI interactions and may indicate that a lot of innovation activity within the region is occurring in-house or business to business.

**Figure 19: Innovation Active Firms 2018**

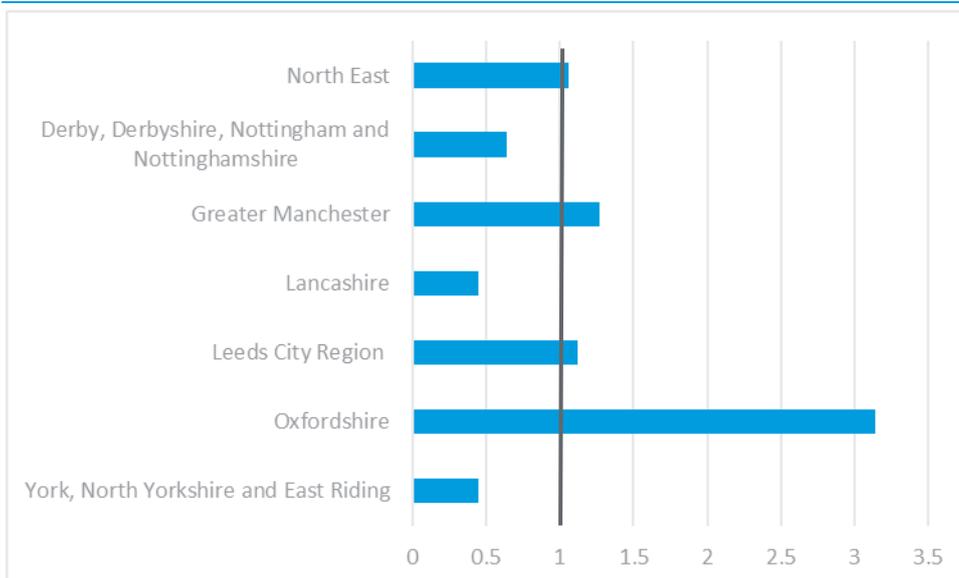


Source: Smart Specialisation Hub, LEP Profile data (December 2018). Based on UKCIS Data.

### HEI Spend on R&D

Analysis of HEI spend on R&D per FTE indicates that LCR HEIs spend above the national average on R&D. Expenditure in LCR equates to £234 per FTE compared to £96 in YNYER and £266 in Greater Manchester.

**Figure 20: HEI Spend on R&D per FTE**



Source: Eurostat 2014 and ONS BRES 2015

## Innovation Outputs: Productivity

Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector. It is essentially the value of all goods produced less any input costs. Hence, a high GVA contribution indicates more efficient input-output processes which is usually brought about through the introduction of new inventions and processes. Table 21 below summarises GVA statistics for each comparator LEP.

**Table 21: Productivity: GVA and GVA per capita, 2016 – LEP level analysis**

LEP	GVA 2016 (£M)	Rank	GVA per Capita 2016 (£)	Rank	GVA per Job 2017 (£)	Rank
Greater Manchester LEP	£23,413	6	£22,886	2	£48,561	2
<b>LCR LEP</b>	<b>£66,468</b>	<b>1</b>	<b>£21,803</b>	<b>3</b>	<b>£46,358</b>	<b>5</b>
D2N2 LEP	£45,402	2	£20,846	5	£45,728	6
Lancashire LEP	£30,821	4	£20,754	6	£48,011	3
Oxfordshire LEP	£22,775	7	£33,337	1	£57,407	1
<b>YNYER LEP</b>	<b>£24,337</b>	<b>5</b>	<b>£21,146</b>	<b>4</b>	<b>£45,142</b>	<b>7</b>
North Eastern LEP	£37,871	3	£19,254	7	£47,242	4
Great Britain	-	-	£24,538	-	£52,462	-

Source: ONS Regional Gross Value Added (balanced) by Local Enterprise Partnership 2016.

While overall GVA is high in LCR, GVA per capita and per job are lower than in Greater Manchester which suggests lower levels of productivity. LCR's GVA per job figure shows that on average, employees within the LEP contribute an additional £46,358 to the economy, net of any salary and other employment costs, with YNYER's GVA per job standing at only £45,142 which is below the national average. Although broadly similar to the D2N2 LEP, there remains room for improvement when compared to LEPs such as Greater Manchester and Lancashire.

## APPENDIX 2: CONSULTEES

### Stakeholder consultees:

Peter O'Brien	Professor, Uni of York
David Walmsley	Lead LCR CEX Innovation/Assistant Director of the CEO
Andrew Wright	Chair of Business Innovation and Growth Panel
Patrick Robertson	WYCA: Access Innovation
Liz Towns-Andrews	Director of Research and Enterprise, Uni of Huddersfield
Ceri Williams	Director of Research and Innovation, Uni of Leeds
Dean Cook	Innovate UK
June Smith	EEF
Lisa Roberts	MIT REAP
Andy Taylor	RTC North
Kieran Perkins	Bradford Uni / Grow Medtech
Mark Gunthorpe	PAPI
Sarah Hickingbottom	BioVale
Pauline Mitchell	SparkFund
Fraser Black	Centre for Crop Health
David Walmsley	Bradford City Council
Cathy Barnes	Leeds Beckett University
Andrew Wright	BIG Chair
Sue Cooke	3MBIC
David Smith	Nexus
Monica Antal	Yorkshire Universities

## APPENDIX 3: SURVEY DATA

**Figure 1: Are Businesses in the Region Innovating?**

Number of businesses that are innovating	Total number of businesses	Number of businesses that are innovating as a percentage of the total number of businesses in the sample
419	603	69.5%

**Figure 2: How many kinds of innovation activities do businesses that are innovating carry out?**

	Total	As a % of the number of businesses that are innovating
Businesses that have carried out just one Research and Development / Business Innovation Activity in the past 3 years	113	27.0%
Businesses that have carried out more than one Research and Development / Business Innovation Activity in the past 3 years	306	73.0%
Businesses that have carried out more than two types of Innovation Activity in the past 3 years	212	50.6%
Businesses that have carried out more than three types of Innovation Activity in the last 3 years	129	30.8%
Businesses that have carried out more than four types of Innovation Activity in the last 3 years	71	16.9%
Businesses that have carried out more than five types of innovation activity in the last 3 years	28	6.7%

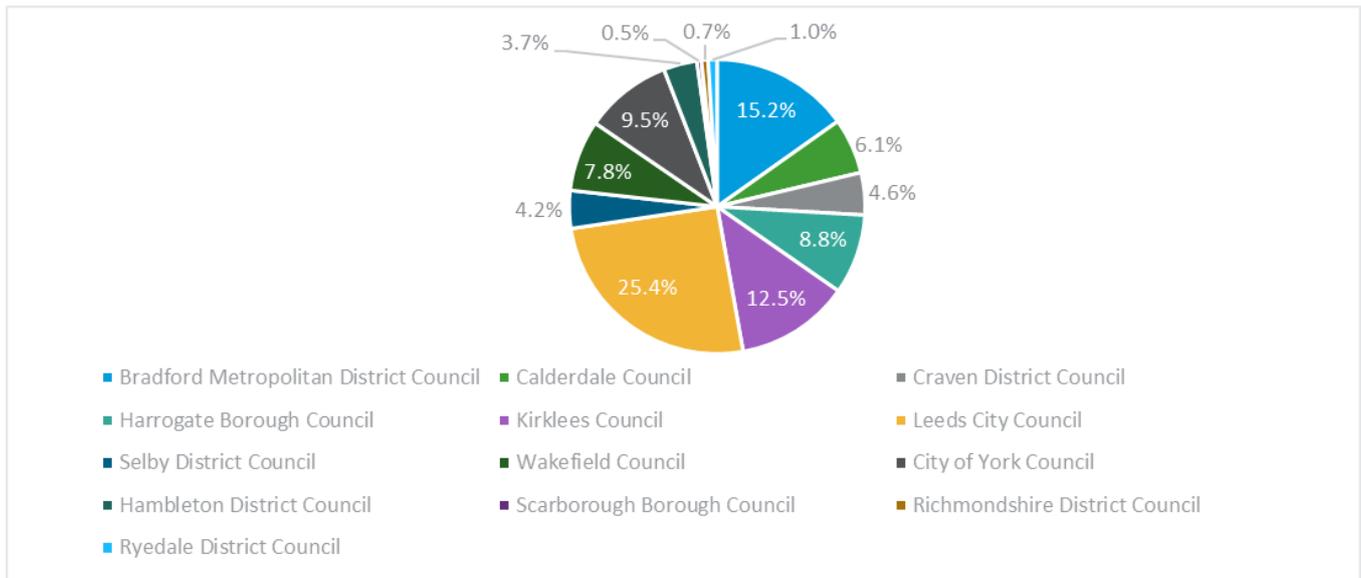
**Figure 3: Which businesses are innovating – Size of business (Number of employees)**



Base: 419

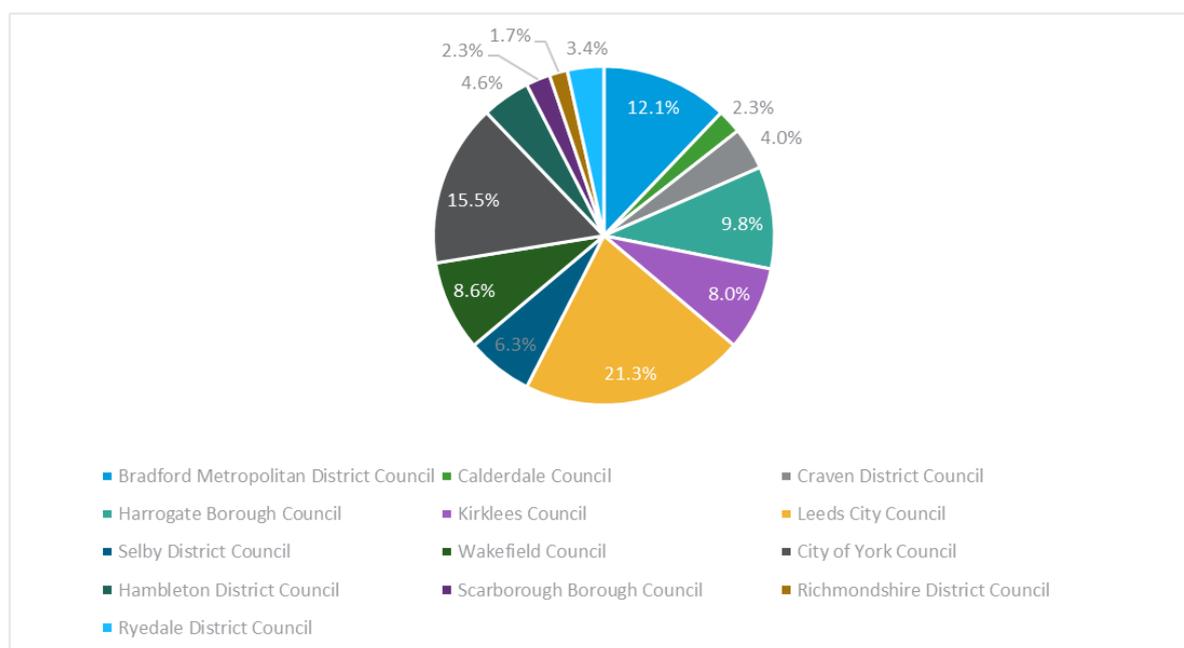
Base: 184

**Figure 4: Which businesses are innovating? (location)**



Base: 409

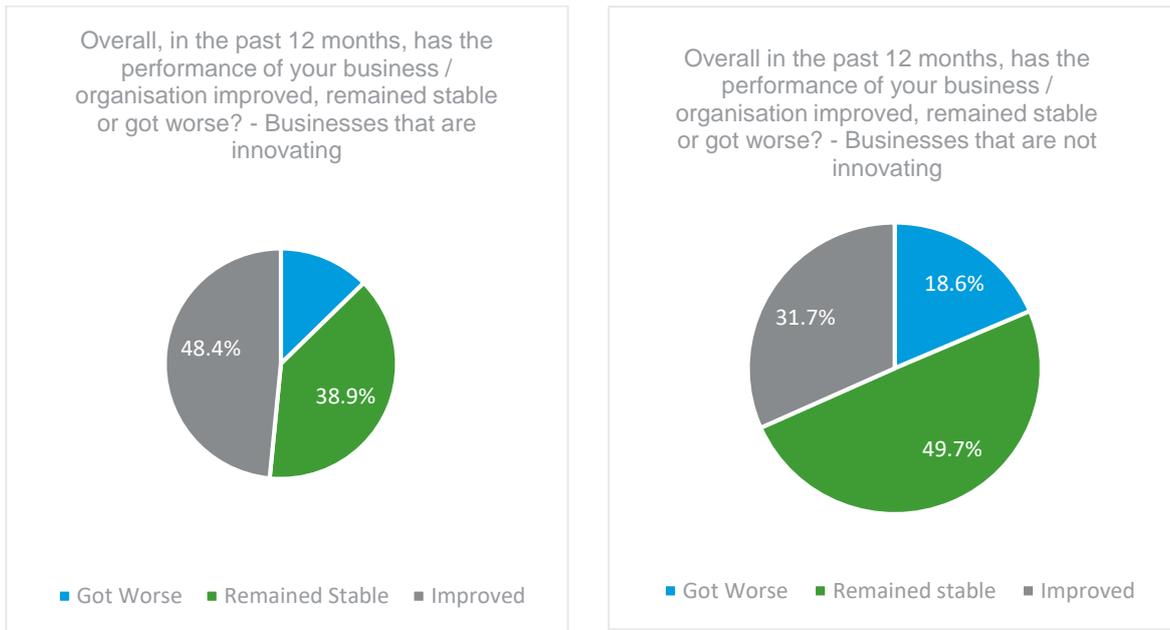
**Figure 5: Which businesses are not innovating? (location)**



Base: 174

Location of businesses that are innovating	Total number of businesses that are innovating in this location	Total Number of businesses that are not innovating in this location	Total Number of businesses in the area	% of businesses innovating
Bradford Metropolitan District Council	62	21	83	74.7%
Calderdale Council	25	4	29	86.2%
Craven District Council	19	7	26	73.1%
Harrogate Borough Council	36	17	53	67.9%
Kirklees Council	51	14	65	78.5%
Leeds City Council	104	37	141	73.8%
Selby District Council	17	11	28	60.7%
Wakefield Council	32	15	47	68.1%
City of York Council	39	27	66	59.1%
Hambleton District Council	15	8	23	65.2%
Scarborough Borough Council	2	4	6	33.3%
Richmondshire District Council	3	3	6	50.0%
Ryedale District Council	4	6	10	40.0%

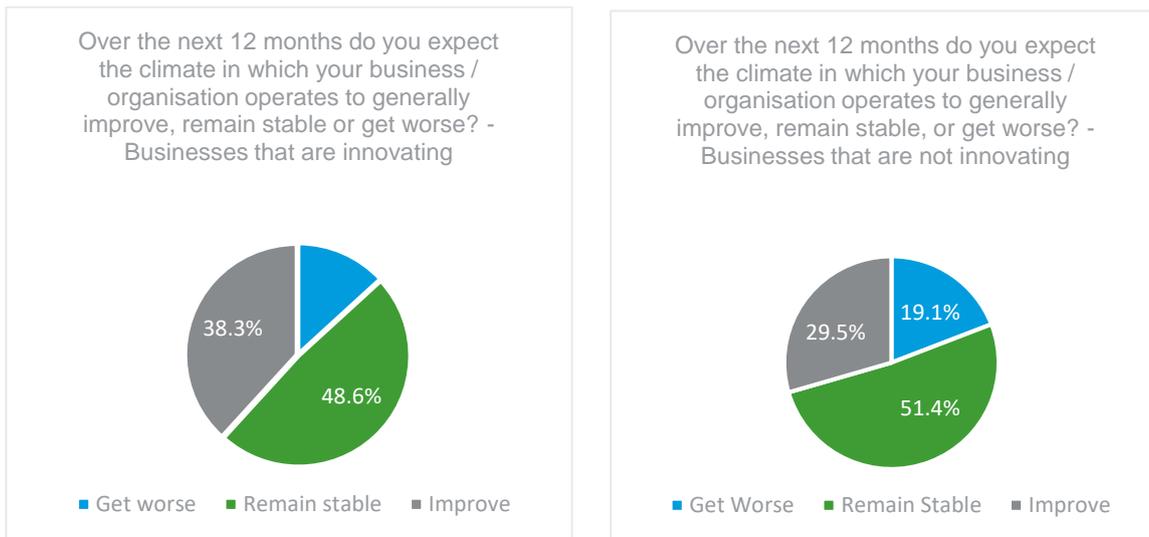
**Figure 6: The performance of businesses in the past 12 months:**



Base: 419

Base: 183

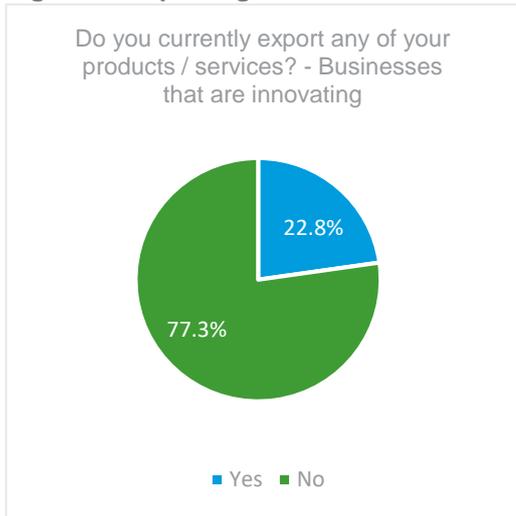
**Figure 7: The expected climate in which businesses / organisations operate in during the next 12 months**



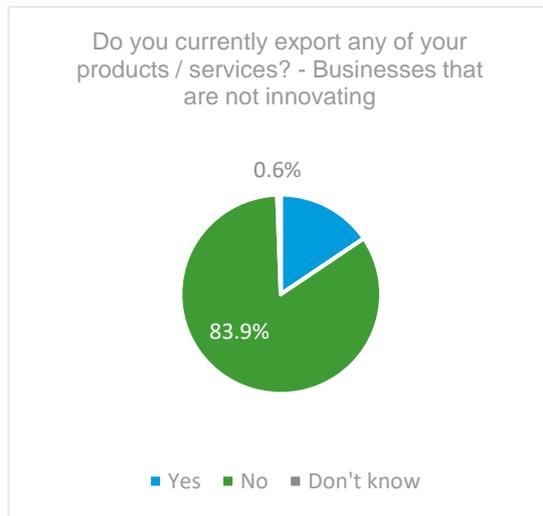
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**Figure 8: Exporting**

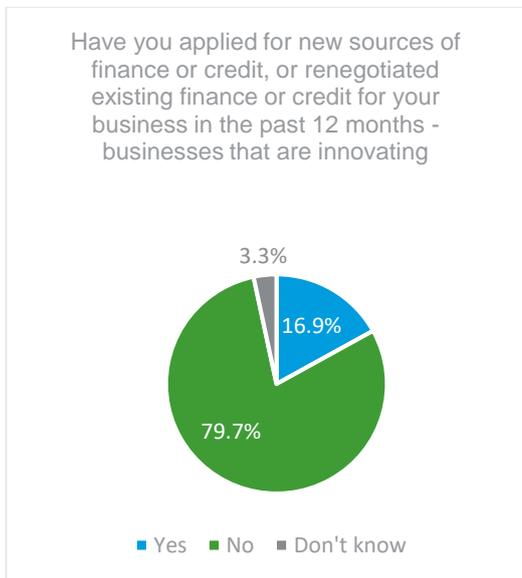


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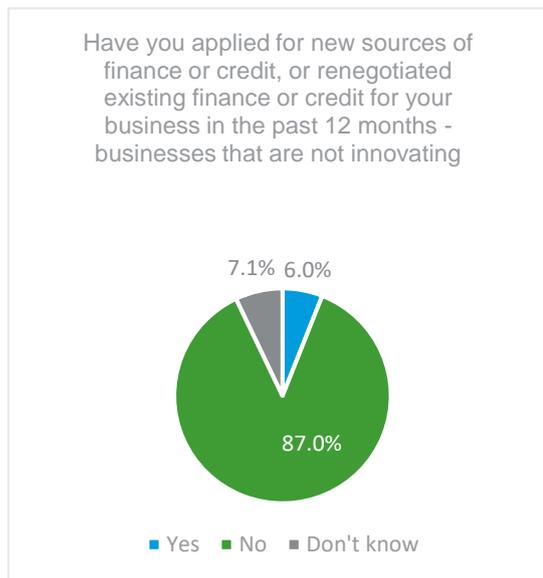


Base: 174

**Figure 9: Application for new sources of finance or credit in the past 12 months**

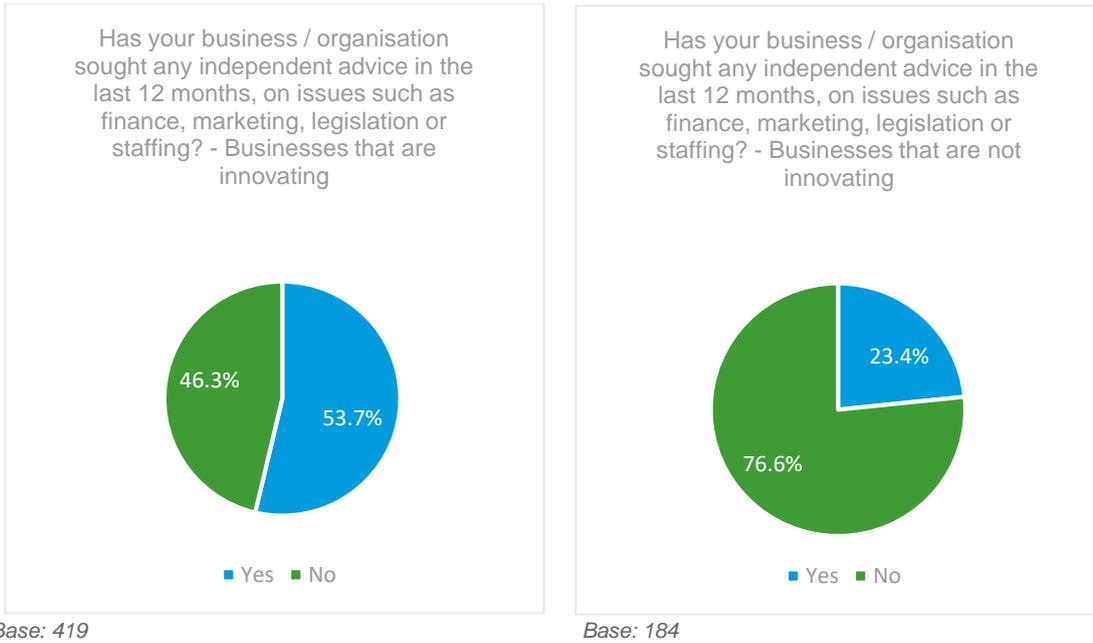


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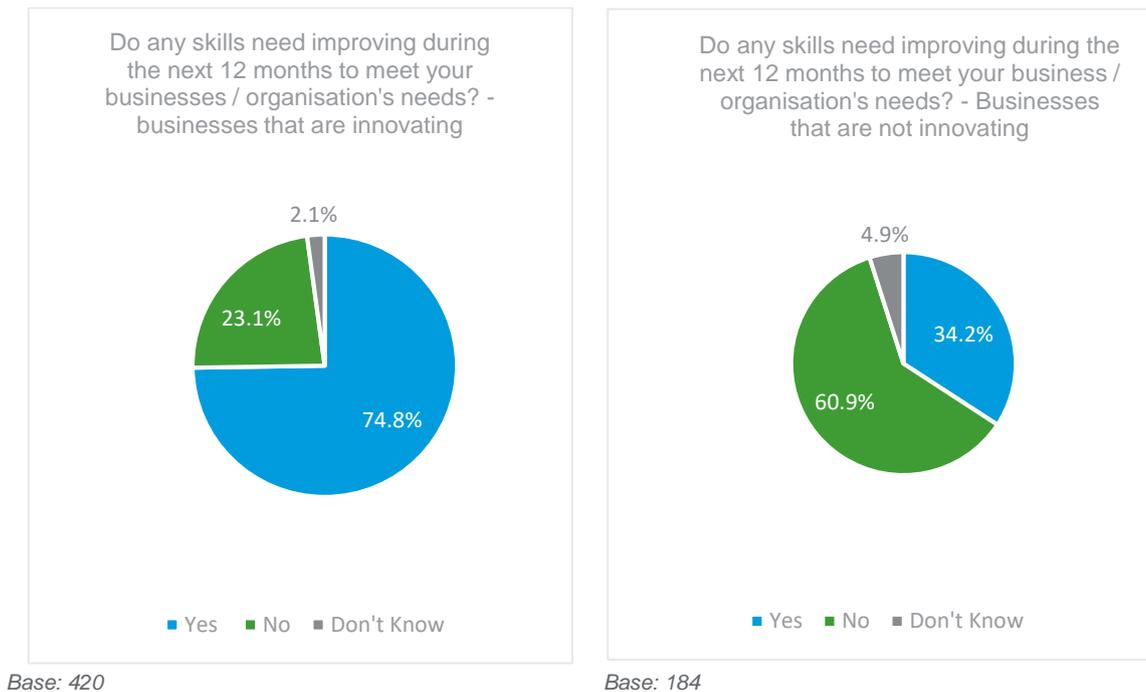


Base: 184

**Figure 10: Has your business / organisation sought any independent advice in the last 12 months, on issues such as finance, marketing, legislation or staffing?**



**Figure 11: Do any skills need improved during the next 12 months to meet your business / organisation's needs?**



**Figure 12: What types of innovation activity are businesses undertaking?**

During the past 3 years did your business....	Total	As a % of total number of businesses that are innovating (419)
Introduce new or significantly improved goods?	132	31.5%
Introduce new or significantly improved services?	209	49.9%
Introduce new or significantly improved processes for producing or supplying goods or services?	211	50.4%
Introduce new technologies?	236	56.3%
Participate in knowledge transfer?	214	51.1%
Invest in research and development?	163	38.9%

Base: 419

**Figure 13: Businesses that collaborate and innovate:**

	Number	% of total number of businesses that innovate
Number of businesses that collaborate	361	86.2%
Number of businesses that don't collaborate	58	13.8%
Total	419	

Base: 419

## APPENDIX 4: INNOVATION ASSETS

HEIs in the Region	Sector Specialisms / Research Priorities	How they support industry engagement
University of Bradford	<ul style="list-style-type: none"> <li>• Engineering</li> <li>• Applied Science</li> <li>• Advanced Materials</li> <li>• Automotive Engineering</li> <li>• Health</li> <li>• Computer Imaging and Sustainability</li> </ul>	Department of Research and Innovation Services - provides a service to the University of Bradford's research community by supporting academics to identify and apply for research grants, gain ethics approval for their research, protect their ideas, seek out commercial partners to exchange knowledge with, and handling contractual arrangements with funders / partners.
University of Huddersfield	<ul style="list-style-type: none"> <li>• Biomedical Sciences</li> <li>• Engineering</li> <li>• Physical Sciences</li> <li>• Social Sciences</li> <li>• Arts and Humanities</li> </ul>	The University have an Enterprise Team that support students and graduates in starting and running their own business.
University of Law, Leeds	<ul style="list-style-type: none"> <li>• Law</li> <li>• Business</li> </ul>	<p>Future Lawyers Network</p> <p>Strategic partnerships / connections with legal employers and professional bodies</p>
University of Leeds	<ul style="list-style-type: none"> <li>• Cities</li> <li>• Environmental Sustainability / climate change</li> <li>• Culture</li> <li>• Data analytics</li> <li>• Energy</li> <li>• Food</li> <li>• Health</li> <li>• Social change</li> <li>• Structural biology</li> <li>• Water</li> </ul>	<p>Nexus – a new £40m centre designed to drive innovation / collaboration</p> <p>Knowledge Transfer Partnerships</p> <p>The University of Leeds has bought the 10-acre 'North plot' of the Gateway 45 Leeds development to create space to build an Institute for High Speed Rail and locate its Centre for Infrastructure Materials. The university said the land would allow it to "collaborate with industry on major research initiatives."</p>
Leeds Beckett University	<ul style="list-style-type: none"> <li>• Sports Research</li> <li>• Art and the Creative Industries</li> </ul>	Enterprise and Innovation Hub Business Centre

	<ul style="list-style-type: none"> <li>• Creative Technologies</li> <li>• Built Environment</li> <li>• Clinical and Applied Sciences</li> </ul>	Partnerships with LEAN Business Efficiency and Compete In to support SME businesses
Leeds Trinity University	<ul style="list-style-type: none"> <li>• Humanities</li> <li>• Media / Communications</li> <li>• Social Policy</li> </ul>	Leeds Trinity Business Network  Trinity Enterprise Centre
Leeds Arts University	<ul style="list-style-type: none"> <li>• Art / Creative Industries and developing clusters' e.g. cross border, curatorial, pedagogies and technology</li> </ul>	Creative Networks (professional events programme)
University of York	<ul style="list-style-type: none"> <li>• Art and the Creative Industries</li> <li>• Culture</li> <li>• Environmental Sustainability / climate change</li> <li>• Health and Medical Technology</li> <li>• Justice and equality</li> <li>• Risk, evidence and decision making</li> <li>• Technologies for the future</li> <li>• Life Sciences</li> </ul>	Economic Development Team
York St John University	<ul style="list-style-type: none"> <li>• Science</li> <li>• Technology</li> <li>• Engineering</li> <li>• Maths</li> <li>• Arts and the Creative Industries</li> </ul>	Business Development Team
<u>Common sector specialisms across the HEIs:</u> <ul style="list-style-type: none"> <li>• Engineering / Advanced Manufacturing</li> <li>• Arts and the Creative Industries</li> <li>• Bioeconomy</li> <li>• Environmental sustainability / climate change / energy</li> <li>• Health</li> </ul>		All nine HEIs also have teams and/or programmes in place to support industry engagement through the university e.g. two HEIs have a dedicated business / economic development team whilst the remaining seven offer networking programmes or enterprise hubs to help support businesses and encourage collaboration to help boost innovation and R&D.

## Sector Specialisms

### Medical Technology SIA

The health and life sciences (of which MedTech is a significant sub-sector), is a priority area for the Leeds City Region, identified as a key sector in the Local Enterprise Partnership's Strategic Economic Plan. Medicinal and pharmaceutical products exports from the Leeds City Region totalled £2.5bn in 2015, accounting for 25% of all exports – the region's single largest export commodity. The MedTech sector accounts for 16% of all patent applications submitted by inventors in the Leeds City Region – 8.9% of all MedTech patent applications submitted in the UK.

### The Bioeconomy SIA

- 29% of UK bioeconomy research funding won by North of England
- £254 million invested in industrial biotechnology and agri-tech by Innovate UK in the past 14 years
- 30% of EU bioeconomy research funds won in the UK come to the North
- 78% growth in value of bioeconomy projects in the region over the past decade
- 25% of Industrial Biotechnology Catalyst grants won by the universities of York and Manchester

**The Northern Powerhouse Independent Economic Review** highlighted four 'Primes', where the North is strong - Advanced Manufacturing, Energy, Health Innovation and Digital) and in which innovation is vital. Steer Economic Development Report (2018) built on these prime areas and identified the following sectoral strengths in the North:

Sector	Sub-Sector
Low Carbon and Energy	<ul style="list-style-type: none"><li>• Biofuels</li><li>• Carbon capture</li><li>• Eco-innovation</li><li>• Geothermal</li><li>• Heat networks</li><li>• Hydrogen</li><li>• Low Emission Vehicles/Fuels</li><li>• Nuclear</li><li>• Offshore wind</li><li>• Tidal/Wave Energy</li></ul>
Advanced Manufacturing and Engineering	<ul style="list-style-type: none"><li>• Aerospace</li><li>• Automotive and propulsion/turbos</li><li>• Formulation and polymer chemistry</li></ul>

	<ul style="list-style-type: none"> <li>• Materials Chemistry and Advanced Materials e.g. 2D-materials, graphene, Fast</li> <li>• Moving Consumer Goods, and textiles</li> <li>• Process industries and chemicals</li> </ul>
Health and Life Sciences	<ul style="list-style-type: none"> <li>• Ageing</li> <li>• Anti-Microbial Resistance</li> <li>• eHealth Data</li> <li>• Infectious Diseases</li> <li>• MedTech</li> <li>• Precision Medicine</li> </ul>
Digital	<ul style="list-style-type: none"> <li>• Applied Digital Technologies</li> <li>• High Performance and Cognitive Computing</li> <li>• Gaming</li> <li>• Animation</li> <li>• Creative content</li> <li>• Cyber security</li> </ul>
Bioeconomy	<ul style="list-style-type: none"> <li>• Industrial Biotechnology</li> </ul>
Food and Drink	<ul style="list-style-type: none"> <li>• Agri-Tech</li> <li>• Processing</li> </ul>

**SEPs:** The above sectors are in line with the priority sectors outlined in the Region(s) SEPs. The YNYER Strategic Economic Plan identified that the region has assets in the following sectors: agri-tech, agriculture, food manufacturing / biorenewables and energy and states that these assets will drive the economy and be central to future prosperity. Whilst the Leeds City Region Strategic Economic Plan identified the following key sectors in line with the Northern Powerhouse Prime Capabilities: digital and creative industries, low carbon and environmental industries, health and life sciences and innovative manufacturing. The SEP expands this through its integrated approach, which focuses on supporting companies that want to grow, in any industry or sector. Noting that Leeds City Region has clusters of particular expertise and opportunity centred on:

- innovative manufacturing;
- financial and professional services;
- health and life sciences;
- low carbon and environmental industries;
- digital and creative industries; and

- food and drink.

### **Translational Capabilities**

- Biorenewables Development Centre is an open access R&D centre in York which was established by the University of York to work at the interface between academia and industry and support the development of the bioeconomy.
- Digital Creativity Labs (at the University of York) brings together over 100 partners and 30 researchers from multiple disciplines to deliver impact from research in the games and media industries.
- Nexus enables businesses from all sectors to connect with the expertise, talent and facilities at the University of Leeds. Working together to accelerate and de-risk innovation and maximise commercial returns.
- 3M BIC Huddersfield facilitates business growth, encourages business to academia collaboration and actively promotes innovation. The centre caters for all business needs, from start-ups, SMEs to large corporates. Facilities include hot desks and individual office spaces to rent in a variety of sizes, flexible workshops and state-of-the-art laboratories, as well as meetings and conference spaces kitted out with the latest audio-visual technology.
- EPSRC-funded Medical Technologies Innovation and Knowledge Centre brings businesses together with world-class experts from across 35 UK universities to accelerate the commercial development of new medical technology products and services.
- The NIHR Leeds Musculoskeletal Biomedical Research Centre is a collaboration between Leeds Teaching Hospitals NHS Trust and the University of Leeds.
- 'Translate – Realising Medical Technology Innovation in the Leeds City Region' is a £3m HEFCE funded programme focusing on developing nationally leading capability in Medical Technology Innovation. Led by the University of Leeds, in partnership with the Universities of Bradford, Huddersfield, Leeds Beckett and York, it is creating a sustainable working partnership between academics, clinicians and industry in the Leeds City Region, focusing on unmet clinical needs to drive innovation.