

# **Opportunities and Growth: Medical Technologies in the Leeds City Region**

**A Science and Innovation Audit  
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Energy and Industrial Strategy.**

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## Vision

**The UK will be the best place in the world to develop and launch innovative medical devices and diagnostics – contributing to a substantial increase in economic growth and productivity, reduced healthcare costs and improved patient outcomes.**

Our ambition is to deliver successful innovation through concentration, convergence and smart specialisation in a single geography, the Leeds City Region, aligned with national centres of excellence in science and technology and substantial growth in an already established UK-wide network of academic, clinical and industrial collaboration.

Taking advantage of projected growth in global medtech markets, focusing in particular on technology convergence, we will increase UK economic output, productivity and exports. Investments in clinical evaluation and multidisciplinary skills will be supported by continuous innovation across the value chain.

Targeted investment in medical technologies as a sector priority promises to tackle low productivity in the Leeds City Region. However, investment to support the Leeds City Region in a leadership capacity, as a driving force for medical technologies innovation across the UK, will deliver sustainable economic growth in the sector nationally.

## Medical technologies\*

The **global market** for medical technologies was estimated to be worth \$317bn in 2015. Driven by social, economic, technological and political factors, including a growing ageing population and the global need for an active and healthy older workforce, this is forecast to grow to \$529.8bn by 2022<sup>1</sup>.

There is an opportunity for the UK to substantially grow this industry sector and its global market share. However, the window of opportunity is imminent and there is an urgent need for strategic intervention nationally and regionally.

According to the Office for Life Sciences, 115,000 people are employed in the UK **medical technology sector** and service and supply chain, which generates £21bn turnover<sup>2</sup>.

However, the UK medtech sector is highly fragmented. **SMEs** with fewer than 250 employees make up 98% of UK medtech companies, and 82% have less than £5m turnover<sup>3</sup>. Despite geographical concentrations of medtech companies – notably in the Leeds City Region, the South East and the Midlands – there is a lack of business-to-business networking and pre-competitive collaboration.

\*Healthcare technology excluding pharmaceuticals

<sup>1</sup><http://info.evaluategroup.com/rs/607-YGS-364/images/mt-wp16.pdf>

<sup>2</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)

<sup>3</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)

# Leeds City Region

In terms of Gross Value Added (GVA), Leeds City Region represents the **largest economic area in the UK outside London and the South East**, generating £65bn GVA. A population of 3 million, of whom 1.9 million are of working age (2015), and over 120,000 businesses (Business Counts 2016), make the Leeds City Region an economy of international significance<sup>5</sup>.

Leeds City Region is at the heart of the UK's advanced manufacturing and engineering industry, and over 140,000 manufacturing jobs are based in the region (ONS Business Register and Employment Survey, 2015)<sup>6</sup>.

With nine higher education institutions and 14 further education colleges, the Leeds City Region represents one of the largest concentrations of education facilities in Europe.

Leeds City Region's universities are home to over 115,000 students<sup>7</sup> (HESA, 2015/16), and provide in the region of 40,000 graduates each year. These graduates feed into the largest science, research, engineering and technology workforce outside of London – in 2015, 101,000 people were employed in science, research, engineering and technology in the Leeds City Region<sup>8</sup>.

However, the Leeds City Region faces a number of economic challenges:

- Productivity levels, although comparable to other northern cities, are significantly lower than the national average (GVA per hour worked was £27.8 compared with £31.8 nationally in 2015)<sup>9</sup>.
- The rate of employment remains below the national average (73.2% compared with 74% nationally in 2016)<sup>10</sup>.

- The proportion of people with higher levels skills and qualifications in the Leeds City Region is lower than the national average. In 2016, 31% of the Leeds City Region's workforce had achieved NVQ4+ qualifications, compared to 38% in the UK overall<sup>11</sup>.

## Medical technologies in the Leeds City Region



Leeds City Region has a concentration of knowledge-based innovative health sciences organisations,

alongside broader healthcare industries and recognised strengths in digital health innovation and the manufacture of medical and dental instruments:

- Its public sector assets – hospitals and universities... double up as assets for the private sector; it is also home to NHS England and the NHS Digital
- It is home to medical equipment manufacturers such as Brandon Medical, Smith and Nephew, and DePuy International Ltd; leading pharmaceutical companies Thornton & Ross and Galpharm (International) Ltd; research-driven analytical service companies such as Covance, Unilabs, EMIS and TPP; tissue repair companies Tissue Regenix Group plc and Neotherix
- Major assets include the Medical Technologies Innovation and Knowledge Centre at Leeds University; plus Medipex Healthcare Innovation Hub and Medilink (Yorkshire & Humber) connecting the NHS with industry and academia (Health Innovation: Breathing Life into the Northern Powerhouse, IPPR North 2016).



The Leeds City Region hosts a distinctive concentration of **over 250 businesses specialising in medical technologies**, complemented by over 200 digital and technology businesses operating in the health and social care space. It hosts some of the leading medical device manufacturing and digital health companies in the UK, including the Global Development and Technology Centre for DePuy Synthes, a Johnson & Johnson company, RSL Steeper, Brandon Medical, TPP and EMIS.

The Leeds City Region has distinctive longitudinal patient population cohorts (such as Born in Bradford) and the unique 'Leeds Care Record', which has been developed in conjunction with leading healthcare software companies TPP and EMIS. It is host to four out of five NHS headquarters, 13 clinical commissioning groups and 12 NHS trusts<sup>12</sup>.

Moreover, the Leeds City Region has established a world-leading concentration of excellence in research and innovation in medical technologies in the Universities of Leeds, Bradford, Huddersfield, Leeds Beckett and York. Funding for medical technology research in the Leeds City Region exceeds £100m<sup>13</sup>, and accounts for more than 8% of all EPSRC medtech funding, with major national medtech research and innovation centres.

8.9% of medtech patents submitted by UK inventors have originated in the Leeds City Region<sup>14</sup>.

The Leeds City Region hosts 22% of UK digital health technology jobs<sup>15</sup>.

<sup>4</sup><https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/gvaforlocalenterprisepartnerships>

<sup>5</sup><https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabresp0p>

<sup>6</sup><https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds>

<sup>7</sup><https://www.hesa.ac.uk/data-and-analysis/key-tables>

<sup>8</sup>ONS Business Register and Employment Survey:

<https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds>

<sup>9</sup>GVA per hour worked indices; Local Enterprise Partnerships, 2004 – 2015 <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivitylabourproductivitygvaperhourworkedandgvaperfilledjobindicesbylocalenterprisepartnership>

<sup>10</sup><https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabresp0p>

<sup>11</sup>ONS Annual Population Survey (2016)

<https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabempoc>

<sup>12</sup>[http://investleedscityregion.com/system/files/uploaded\\_files/Med-Tech%20Brochure.pdf](http://investleedscityregion.com/system/files/uploaded_files/Med-Tech%20Brochure.pdf)

<sup>13</sup>ICK Annual Report 2017

<sup>14</sup>European Patent Office data, PATSTAT, for the period 2004-2014

<sup>15</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)

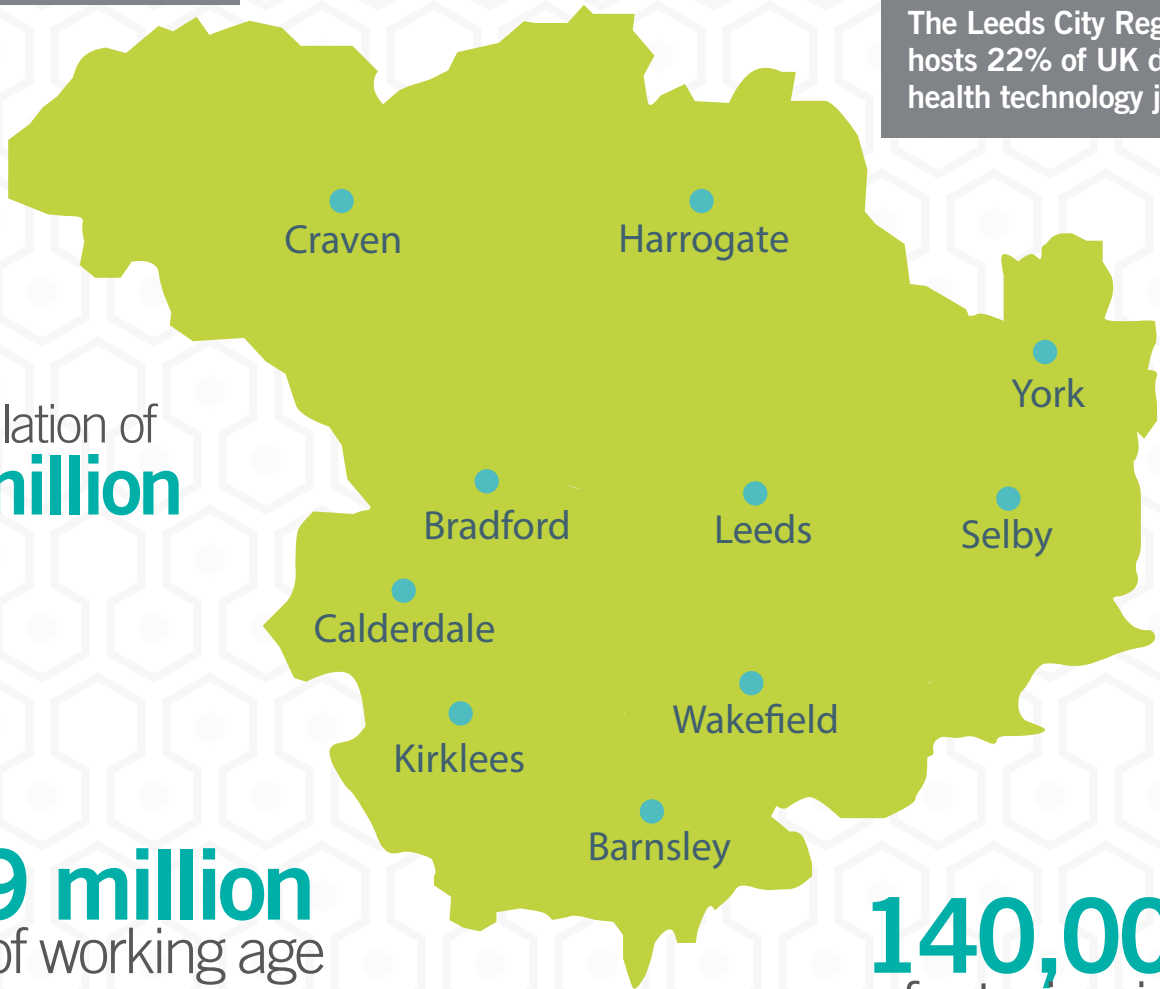
# The largest economic area in the UK outside of London

8.9% of medtech patents submitted by UK inventors have originated in the Leeds City Region<sup>14</sup>.

Generating **£65bn** GVA

More than **120,000** businesses

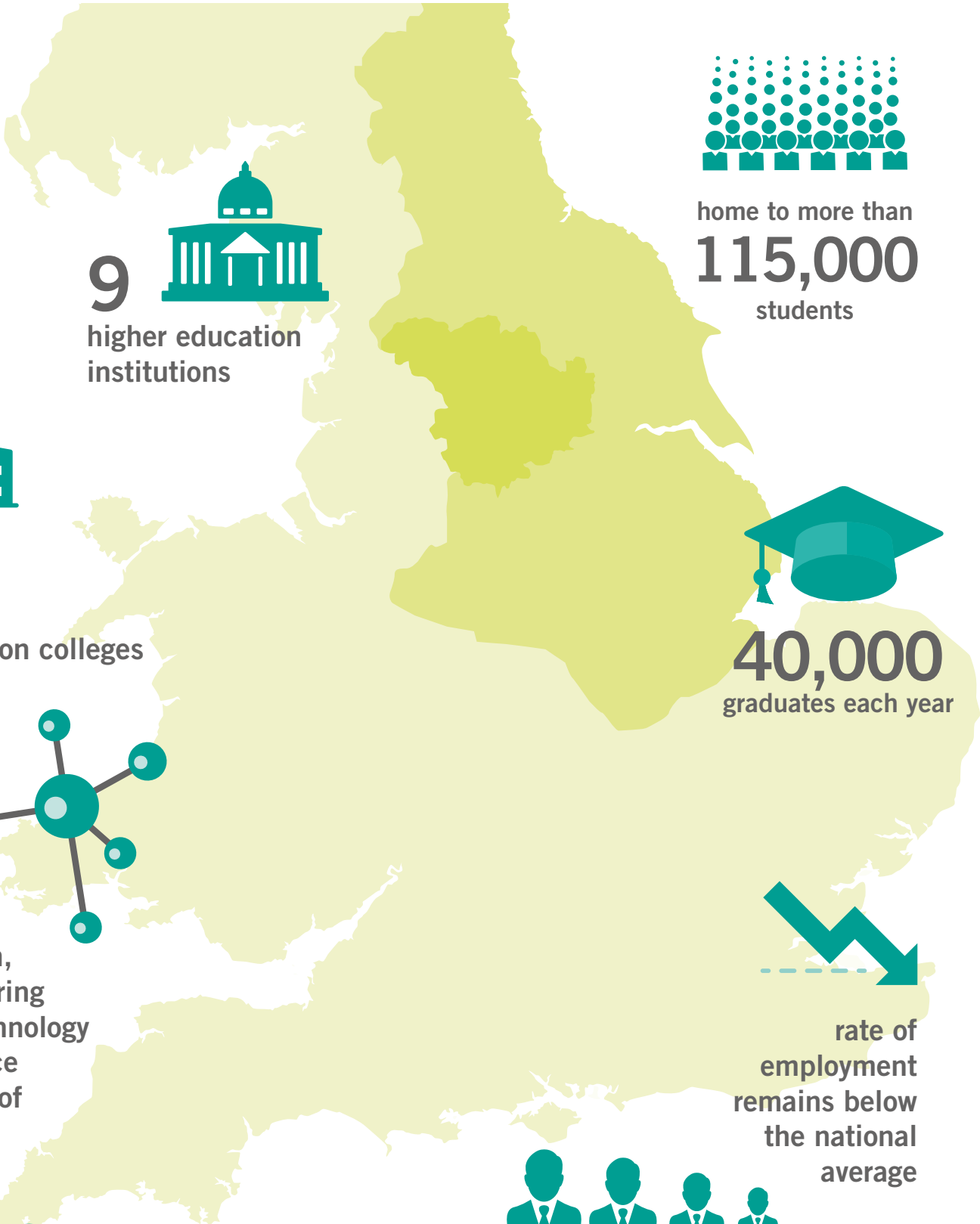
The Leeds City Region hosts 22% of UK digital health technology jobs<sup>15</sup>.



Population of **3 million**

**1.9 million** are of working age

**140,000** manufacturing jobs



9



higher education institutions



home to more than  
**115,000**  
students



14

further education colleges



**40,000**  
graduates each year



largest science, research, engineering and technology workforce outside of London



rate of employment remains below the national average



**only 40%**  
of graduates take jobs in the Leeds City Region



professional occupations are significantly lower in the region than across the UK





# Strengths in Science and Innovation

# 2



## 2.1

# Excellence in science and research

The Leeds City Region is home to seven universities. Together, they provide:

- research excellence – two Russell Group universities
- combined research power – comparable with UCL and Oxford
- a rich diversity of strengths

The Leeds City Region is home to **128 research organisations**, including **23 education providers** (universities and colleges), **49 healthcare facilities** and **32 research-active companies**.

The Leeds City Region has a strong tradition of excellence in science and research. According to RCUK's Gateway to Research for example, Leeds City Region universities have 887 active research projects totalling £0.83 billion funding.



University of Leeds has produced >100 spin-out companies

Seven of the Leeds City Region's higher education providers submitted to the 2014 REF. Together, the Universities of Bradford, Huddersfield, Leeds and York, Leeds Beckett, Leeds Trinity, and York St John provide a rich diversity of strengths in research and training.

The region is home to two members of the Russell Group of research-intensive universities: the University of Leeds and the University of York.

The University of Leeds is in the top 10 universities for research power in the UK according to the 2014 REF, and ranked 101st in the QS world rankings (2018). In 2015 the University of Leeds attracted research income totalling £132.6m = 11th in the UK. Since 1995 it has produced over 100 'spin-out' companies, including seven that are market listed with a value of over £500 million and employing over 720 people.

The University of York was ranked 14th for research power in the UK according to the 2014 REF. It was 129th in the Times Higher Education World University Rankings (2017), and 135th in the QS World University Rankings (2018).

The Leeds City Region accounted for 4.7% of research submitted to the 2014 REF. The region also had the highest number of research staff submitting to REF in STEM disciplines for any LEP outside of London<sup>16</sup>. The combined research power of the Leeds City Region universities is comparable with the University of Oxford and research power leader University College London.



7 with a market value of over £500 million



The proportion of research rated internationally recognised or higher was above 90% across the four research-leading universities in the region: **Universities of Leeds (98%), York (98%), Bradford (97%) and Huddersfield (93%).**

Key strengths (above average 4\* performance) include:

Allied Health at the University of Bradford; Mechanical and Electrical Engineering, and Biological Sciences at the University of Leeds; and Chemistry, Biological Sciences, Computer Science, and Psychology at the University of York.

More broadly, the region's seven higher education institutions provide complementary expertise and attributes. Each has an important role to play within the region's wider innovation ecosystem in terms of fundamental research, translation and knowledge exchange, support for innovation and enterprise, and training and skills development.



Employing over 720 people

<sup>16</sup>Data available from <http://smartspecialisationhub.org/observatory/Staff> submitted to REF 2014, HESA, 2013/14.

## 2.2

# Innovation strengths and growth points

The Leeds City Region is not yet realising its economic potential.

However, the scale and strength of its manufacturing base, coupled with an excellent research base, provide a platform for growth in the medtech sector.

With a concentration of medtech companies and allied growth in digital technology, the Leeds City Region is uniquely well-placed to address opportunities for growth associated with advances in biomedical (life) sciences and technology convergence.

Using GVA as a measure, **Leeds City Region represents the largest economic area in the UK outside of London and the South East**, generating £65bn in 2015<sup>17</sup>. A population of 3 million, of whom 1.9 million are of working age (2015)<sup>18</sup>, and over 120,000 businesses (Business Counts 2016)<sup>19</sup>, make the Leeds City Region an economy of international significance and a major driver of the Northern Powerhouse.

Leeds City Region is at the heart of the UK's advanced manufacturing and engineering industry, and over 140,000 manufacturing jobs are based in the region (ONS Business Register and Employment Survey, 2015)<sup>20</sup>.

Small business growth is understood to be crucial for driving economic growth and re-balancing the UK economy. However, data from the ERC Growth Dashboard (2015)<sup>21</sup> shows Leeds City Region business growth and job creation metrics lagging behind the national average across a range of indicators.

For example, the number of start-ups in an economy is often seen as a headline metric for enterprise and entrepreneurial ability. Although Leeds City Region exhibits high rates of start-up compared with other northern city-regions, they remain below the national average (42 start-ups per 10,000 population in 2015, compared to an average of 43 per 10,000 population across all LEPs)<sup>22</sup>.

In terms of survival rates, 54% of 2012 start-ups in the Leeds City Region had survived to

2015 (av. 55% across all LEPs), and 1.8% of surviving 2012 start-ups grew from <500k to £1m+ turnover by 2015 (av. 1.6% across all LEPs)<sup>23</sup>.

More positively, in terms of scale-up, an encouraging 6.3% of the region's £1-2m turnover businesses in 2012 had grown to a minimum of £3m by 2015 (av. 5.8% across all LEPs)<sup>24</sup>. The Leeds City Region also performs well with regard to its high growth firm rate – 7.8% of firms employing more than 10 people were high growth in the three years to 2015, compared to an average of 7.2% across LEPs as a whole<sup>25</sup>. This places the Leeds City Region in the top quartile nationally, and third among core city LEPs, suggesting the City Region is a place where entrepreneurs can flourish.

In 2015, the Leeds City Region was home to 91,242 private sector firms, 1,164,913 private sector jobs, and registered 12,694 new businesses<sup>26</sup>. Net jobs created in 2014-15 totalled 32,639 – an impressive net job creation ratio of 3.3% (av. 2.6% across all LEPs)<sup>27</sup>.

The UK Innovation Survey, undertaken every two years on behalf of the Department for Business, Energy and Industrial Strategy by the Office for National Statistics, investigates the extent and nature of innovation activity in business in the UK. Although data is unavailable at LEP-level, Leeds City Region is the largest economic area in the wider Yorkshire and Humber region. Encouragingly, the latest available data (2015) show a high level of

innovation in Yorkshire and Humber's business base: 65% of respondent firms stated that they actively innovated, the highest of any region of the UK; and 25% of firms reported that they had undertaken product innovation, again the highest proportion of any region in the UK<sup>28</sup>.

## Home to

**91,242**  
private sector firms

**1,164,913**  
private sector jobs

**12,694**  
new businesses

<sup>17</sup> <https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/gvaforlocalenterprisepartnerships>

<sup>18</sup> <https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabrespop>

<sup>19</sup> <https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabrespop>

<sup>20</sup> <https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds>

<sup>21</sup> <https://www.enterpriseresearch.ac.uk/wp-content/uploads/2016/11/ERC-UK-Local-Growth-Dashboard-FINAL.pdf>



Generating  
**£65bn**  
GVA



Population of  
**3 million**



**140,000**  
manufacturing jobs

More than  
**120,000**  
businesses

**1.9 million**  
are of working age

<sup>22</sup><https://www.enterpriseresearch.ac.uk/wp-content/uploads/2016/11/ERC-UK-Local-Growth-Dashboard-FINAL.pdf>

<sup>23</sup><https://www.enterpriseresearch.ac.uk/wp-content/uploads/2016/11/ERC-UK-Local-Growth-Dashboard-FINAL.pdf>

<sup>24</sup><https://www.enterpriseresearch.ac.uk/wp-content/uploads/2016/11/ERC-UK-Local-Growth-Dashboard-FINAL.pdf>

<sup>25</sup><https://www.enterpriseresearch.ac.uk/wp-content/uploads/2016/11/ERC-UK-Local-Growth-Dashboard-FINAL.pdf>

<sup>26</sup><https://www.enterpriseresearch.ac.uk/wp-content/uploads/2016/11/ERC-UK-Local-Growth-Dashboard-FINAL.pdf>

<sup>27</sup><https://www.enterpriseresearch.ac.uk/wp-content/uploads/2016/11/ERC-UK-Local-Growth-Dashboard-FINAL.pdf>

<sup>28</sup><https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds>

Northern Powerhouse Independent Economic Review (2016).



## The Northern Powerhouse Independent Economic Review highlighted five key areas of the Leeds City Region economy:

### Health & life sciences:

accounting for 2,800 businesses in 2015, an increase of 41% since 2010. This sector includes major firms across various sub-sectors, including medical equipment/device manufacturers, pharmaceuticals, orthopaedics, medical data analytics, digital technologies and clinical software developers. Prominent firms include DePuy Synthes, Brandon Medical, Thornton & Ross, Advanced Digital Innovation, Covance, Unilabs, EMIS and TPP, with the latter two having played a major role in developing Leeds' shared Single Patient Care Record model.

Other key organisations and assets include: Leeds Teaching Hospital NHS Trust, the largest in the UK and largest teaching hospital in Europe; four of the most important UK National Health Service bodies (NHS England, the Health & Social Care Information Centre, the NHS Leadership Academy and Health Education England); the Health Protection Agency; Medipex Healthcare Innovation Hub; and the Yorkshire & Humber Academic Health Science Network.

### Financial & professional services:

comprising 31,300 businesses in 2015, an increase of 37% since 2010. There are many very high profile businesses in the financial and professional services sector that are headquartered in the city region. These include First Direct, Yorkshire Bank, Skipton Building Society, Leeds Building Society and Yorkshire Building Society. The Leeds City Region economy also benefits from the presence of other major professional service firms including Aviva and Hiscox, as well as the Bank of England's only office outside London.

In addition, seven of the top 25 law firms have a base in the region: DLA Piper; Pinsent Masons; Irwin Mitchell; Eversheds; DAC Beachcroft; DWF; and Addleshaw Goddard. Major accountancy and other professional services firms include offices of the 'Big Four' accounting firms: PwC, Deloitte, KPMG and EY.

### Digital & creative industries:

covering 6,400 firms in 2015, an increase of 32% since 2010. The business base includes world-class games companies, firms specialising in communications, in media production, and in software development and product design (e.g. Isotoma). The sector also benefits from supporting assets, including IXLeeds, the one of the UK's three standalone internet exchanges outside London, the Media Centre (a digital cluster in Huddersfield), and the Digital Catapult Centre Yorkshire facility in Bradford.

### Food & drink:

encompassing 14,600 businesses in 2015, an increase of 12% since 2010. Leading food and drink producers have headquarters in the city region, including Haribo, McVities Cakes, Taylors of Harrogate (Yorkshire Tea). Leeds City Region also hosts the headquarters of two of the UK's major retailers: Asda and Morrisons. Other key organisations include the Food & Environment Research Agency, a joint venture between Capita and the UK Government's Department for Environment, Food and Rural Affairs, with specialisms in detection and surveillance technologies, including bioinformatics, and sustainable agriculture and environment.

### Advanced manufacturing & engineering:

2,400 businesses in 2015, an increase of 2% since 2010. The Leeds City Region is home to many leading firms in advanced engineering in particular, including Mitsubishi Power Systems, Fujitsu, a cluster of turbo technology companies, including Cummins Turbo Technologies, and gearing, pumps and valves manufacturers such as David Brown Gear Systems Ltd.

Clearly high level skills are needed to support high value growth. Leeds City Region's universities are home to over 115,000 students<sup>30</sup> (HESA, 2015/16), and provide in the region of 40,000 graduates each year. These graduates feed into the largest science, research, engineering and technology workforce outside of London; in 2015, 101,000 people were employed in science, research, engineering and technology in the Leeds City Region<sup>31</sup>.

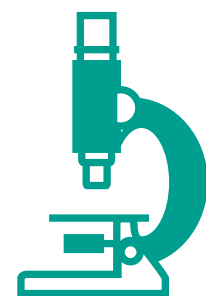
## Clearly high level skills are needed to support high value growth



home to more than  
**115,000**  
students



**40,000**  
graduates each year



**101,000**  
people employed in  
science, research  
engineering and  
technology

<sup>29</sup> Northern Powerhouse Independent Economic Review (2016)

<sup>30</sup> <https://www.hesa.ac.uk/data-and-analysis/key-tables>

<sup>31</sup> ONS Business Register and Employment Survey <https://www.nomisweb.co.uk/reports/imp/lep/1925185551/report.aspx?town=leeds>



## However, the Leeds City Region faces a number of economic challenges:

- Productivity levels, although comparable to other northern cities, are significantly lower than the national average (GVA per hour worked was £27.8 compared with £31.8 nationally in 2015)<sup>32</sup>.
- The rate of employment remains below the national average (73.2% compared with 74% nationally in 2016)<sup>33</sup>.
- The proportion of people with higher level skills and qualifications in the Leeds City Region is lower than the national average. In 2016, 31% of the Leeds City Region's workforce had achieved NVQ4+ qualifications, compared to 38% in the UK overall<sup>34</sup>. Moreover, the proportion of high-level occupations, defined as those in management/professional occupations, is significantly lower in the region (41.9%) than across the UK overall (45.5%)<sup>35</sup>.
- Analysis carried out by the Leeds City Region LEP on (HESA) Destination Survey data suggests that only around 40% of students at Leeds City Region universities who entered employment took up a job in the Leeds City Region following graduation<sup>36</sup>. It is likely that retention issues at least partly reflect relatively weak demand for high level skills. Providing professional-level employment opportunities for graduates within the Leeds City Region remains a challenge.

Driving excellence in science and innovation will only play one part in addressing the Leeds City Region productivity gap, and the challenges that underpin this. Nevertheless, this SIA process brings a significant opportunity, by recognising, and then exploiting fully, the assets and opportunities that make the Leeds City Region stand out in medtech, both nationally and globally.

<sup>32</sup> GVA per hour worked indices; Local Enterprise Partnerships, 2004 – 2015 <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/datasets/subregionalproductivitylabourproductivitygvaperhourworkedandgvaperfilledjobindicesbylocalenterprisepartnership>

<sup>33</sup> <https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabrespop>

<sup>34</sup> ONS Annual Population Survey (2016) <https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabempocc>

<sup>35</sup> ONS Annual Population Survey (2016) <https://www.nomisweb.co.uk/reports/lmp/lep/1925185551/report.aspx?town=leeds#tabempocc>  
[http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017\\_1.pdf](http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017_1.pdf)

# 2.3

## Business environment

The Leeds City Region is now accelerating the development and delivery of new business, innovation and growth strategies.

The **11 local authorities that comprise Leeds City Region** (Barnsley, Bradford, Calderdale, Craven, Harrogate, Kirklees, Leeds, Selby, Wakefield and York, alongside North Yorkshire County Council) have been working in partnership to improve the economy since 2004. The establishment of the Leeds City Region Enterprise Partnership ('the LEP') in 2011 and the West Yorkshire Combined Authority (WYCA) in 2014 strengthened joint working further, including direct private sector involvement in the partnership.

The LEP and WYCA are now working as one to drive economic success, and share a single economic strategy, the Leeds City Region Strategic Economic Plan, which sets out the vision for Leeds City Region "to be a globally

recognised economy where good growth delivers high levels of prosperity, jobs and quality of life for everyone". (SEP)<sup>37</sup>. The City Region aims to deliver upwards of **35,000 additional jobs and £3.7 billion of additional annual economic output by 2036**, becoming a positive, above average contributor to the UK economy.

To help realise these ambitions, the Strategic Economic Plan identifies ten headline initiatives, ranging from efforts to improve business productivity and exporting, increasing skill levels, transitioning to a zero carbon economy and progressing a single 'metro style' public transport network. These initiatives also include plans to "implement co-ordinated and wide ranging action to radically increase innovation" in the City Region, and a vision to become a global digital centre, with specialisms in data storage, analytics, digital health and tech skills.

Improvement in economic performance is necessarily a long term goal. The nature of the regional business environment is complex. While there is clustering around large corporates and multi-nationals in the finance and food and drink sectors, this is not the case

for manufacturing, tech or digital companies in the region. **Micro-enterprises make up more than 82% of the Leeds City Region business base**<sup>38</sup>. On the one hand this diversity and agility is a strength. However, the region's business base is also highly fragmented. This represents a significant challenge to the effective delivery of strategic support for economic development, innovation and global competitiveness.



**The LEP and WYCA are now working as one to drive economic success and share a single economic strategy.**

**35,000**  
additional jobs  
by 2036

**11 local**  
authorities

**£3.7bn**  
additional annual  
economic output by 2036

**82%**  
of the Leeds  
City Region  
business base  
are micro-enterprises

<sup>37</sup> <http://www.the-lep.com/LEP/media/New/SEP%20documents/SEP-2016-2036-FINAL.pdf>

<sup>38</sup> UK Business Counts (2016) <https://www.nomisweb.co.uk/reports/imp/lep/1925185551/report.aspx?town=leeds#tabjobs>





## The medtech sector in the Leeds City Region

The Leeds City Region medtech sector demonstrates economic strength and potential for growth.

The health and life sciences – of which medtech is a significant sub-sector – is one of the priority areas for the Leeds City Region, identified as a key sector in the Local Enterprise Partnership's Strategic Economic Plan<sup>39</sup>. Indeed, 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<sup>40</sup>.

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<sup>41</sup>.

Traditional medtech strengths in the region include implants, surgical instruments, and devices, e.g. DePuy Synthes, Surgical Innovations, Xiros and Brandon Medical. More recent start-ups and high growth companies are based on emerging technology areas, including biological materials and digital health, e.g. Tissue Regenix, Neotherix and Avacta; TPP and EMIS.

Allied to growth in medtech is an expansion in digital technology within the Leeds City Region, which now accounts for 22% of digital health jobs in UK<sup>42</sup>. NHS Digital is based in Leeds (responsible for 'Spine', known as the "digital backbone" of the NHS). The City Region's digital infrastructure helps to support this. Leeds is home to one of the UK's three standalone internet exchange outside of London, whilst there are also plans to build on this to make the City Region a globally recognised digital centre.

Between 2010 and 2014, companies in the Leeds digital and tech sectors experienced turnover growth of 47%, compared with a national average of 32%<sup>43</sup>.

There is clear evidence that the Leeds City Region has the necessary research and business strength to underpin a transformation in the traditional medtech (engineering) sector, with new business developments addressing opportunities for growth associated with advances in biomedical (life) sciences and digital technology and technology convergence.

Section three describes how the region's distinctive industry strengths align to growth in global markets and export potential, science and innovation assets and human capital and capacity.

Medtech sector accounts for  
**16%** of all patent applications submitted in LCR

**8.9%** of medtech patent applications submitted in the UK

<sup>39</sup><http://www.the-lep.com/LEP/media/New/SEP%20documents/SEP-2016-2036-FINAL.pdf>

<sup>40</sup>Leeds City Region Enterprise Partnership: Trade analysis, MDS Transmodal, June 2017

<sup>41</sup>European Patent Office data, PATSTAT, for the period 2004-2014

<sup>42</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)  
Tech Nation 2016: Transforming UK Industries, February 2016



# Medical Technologies in the Leeds City Region

3



## 3.1

## National and international trends and size of global markets

The UK has been punching above its weight in the global market place. Based on current growth rates, **turnover in the UK medtech sector could rise by more than £10 billion in the next five years.**

The global medtech market shows strong potential for growth, particularly in combined technologies (growth rates 20-50%).

However, the global market place is changing rapidly. There is an urgent need for the UK medtech sector to respond to emerging opportunities associated with the convergence of medical technologies, particularly digital health.

## Global markets for medical technologies

The global medtech market was estimated to be worth **\$371 billion in 2015<sup>44</sup>**. It is **forecast to grow to \$529.8 billion by 2022<sup>45</sup>** (representing an impressive compound annual growth rate (CAGR) of 5.2%). Market growth is being driven by a number of social, economic, technological and political factors:

- An increasing and ageing global population. Globally, life expectancy at birth is projected to rise from 70 years in 2010-2015 to 77 years in 2045 – 2050, and to 83 years in 2095 – 2100<sup>46</sup>. An important implication of an aging population is a burgeoning incidence of dementia.
- Lifestyle factors in the developed world, with an associated rise in levels of obesity and the prevalence of diseases such as diabetes, dementia, cancer and cardiovascular disease. It is estimated that 415 million people are

living with diabetes in the world, or 1 in 11 of the world's adult population<sup>47</sup>. The figure is expected to rise to 642 million people living with diabetes worldwide by 2040<sup>48</sup>.

- Increasing wealth in emerging economies, fuelling the adoption of the western lifestyle, is expected to progressively increase demand for medical devices in these regions. This is seen, for example, in the Asia-Pacific region, which was the fastest growing medical device market between 2008 and 2014, rising at a CAGR of 10%<sup>49</sup>. Market growth here was spurred by a rapid expansion of the healthcare industry and rising demand for healthcare.

The UK is punching above its weight in this global market place. The turnover of UK medtech companies has been increasing by 50% per year, significantly ahead of the international trend, and now totals £21bn<sup>50</sup>.

However, there is a clear opportunity for the UK to capitalise on the innovative business potential and scientific excellence that fuel this sector. This is particularly apparent in technology convergence and combined technologies.

global medtech market worth  
**\$371bn**

forecast growth by 2022  
**\$529.8bn**

aging global population rising from  
**70 to 77<sup>46</sup>**  
by 2045-2050

estimated  
**415m<sup>47</sup>**  
living with diabetes rising to  
**642m<sup>48</sup>**  
worldwide by 2040

<sup>44</sup><http://www.marketsandmarkets.com/PressReleases/top-10-medical-device-technologies.asp>

<sup>45</sup><http://info.evaluategroup.com/rs/607-YGS-364/images/mt-wp16.pdf>

<sup>46</sup>[https://esa.un.org/unpd/wpp/publications/files/key\\_findings\\_wpp\\_2015.pdf](https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf)

<sup>47</sup><http://www.diabetes.co.uk/diabetes-prevalence.html>

<sup>48</sup><http://www.diabetes.co.uk/diabetes-prevalence.html>

<sup>49</sup><http://blog.euromonitor.com/2016/02/medical-device-market-2016-opportunities-in-asia-pacific.html>

<sup>50</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)

# Sector analysis

Overall, the core UK medtech sector<sup>51</sup> has 2,683 companies employing 89,870 people with a turnover of £17bn<sup>52</sup>. Analysis of the size of companies shows that most are small: 41% are micro-companies with less than 5 employees, and only 3% have over 250 employees<sup>53</sup>. The medtech service and supply sector has just over 1,000 companies, over 24,600 employees and a turnover of £3.9bn<sup>55</sup>.

Prominent players in the global medtech market include Johnson & Johnson (USA), GE Healthcare (UK), Siemens Healthcare (Germany), Medtronic (USA), Philips Healthcare (Netherlands), Roche Diagnostics (Switzerland), Abbott Laboratories Inc. (USA), Smith & Nephew plc (UK), Stryker Corporation (USA), and Boston Scientific Corporation (USA). The industry is also characterised by a plethora of small to medium sized companies often developing and marketing their own proprietary products.



<sup>51</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)  
<sup>52</sup>Core Medical Technology includes all companies whose primary business falls under developing and producing their own medical technology products (ranging from single-use consumables to complex hospital equipment and including digital health products).  
<sup>53</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)  
<sup>54</sup>The Medtech Service and Supply (MTS&S) sector comprises companies which offer services to core medtech companies. This includes contract research and manufacturing organisations, suppliers of consumables and reagents for R&D facilities, providers of specialist analytical, IT, recruitment and logistics services as well as legal and regulatory expertise and finance companies specialising in medtech investments (but not counting their portfolio assets).  
<sup>55</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)

## Current and future trends

In 2015 the top 15 sectors in descending order of market size were: In-Vitro Diagnostics (IVD), Cardiology, Diagnostic Imaging, Orthopaedics, Endoscopy, Drug Delivery, Wound Management, Dental, General and Plastic Surgery, Diabetes Care, Nephrology, Ear Nose and Throat, Healthcare IT, and Neurology.

**Table 1** shows the relative size and forecast growth of the different product sectors from 2015 to 2022<sup>56</sup>.

DEVICE AREA	sales \$bn		CAGR
	2015	2022	
In-Vitro Diagnostics (IVD)	48.4	70.8	+5.6%
Cardiology	42.1	82.3	+5.7%
Diagnostic Imaging	38.9	50.3	+3.7%
Orthopedics	34.0	44.1	+3.8%
Ophthalmics	24.9	37.1	+5.8%
General / Plastic Surgery	20.2	28.1	+4.8%
Endoscopy	16.4	26.0	+6.8%
Drug Delivery	17.6	24.5	+4.8%
Dental	12.4	18.3	+5.7%
Wound Management	12.4	17.0	+4.7%

An **upward pressure on healthcare** costs in the developed world has caused publicly funded bodies and private insurers to initiate a strong drive to minimise costs for a given level of healthcare outcome. Evidence of value and comparative effectiveness (clinical proof of efficacy, safety and/or cost benefits) has become an important consideration for medtech companies. This has often meant an increasing emphasis on more vigorous clinical trial design to prove safety and efficacy.

At the same time, cost containment has been underpinned by new technologies and procedures that reduce hospital stays, shorten procedures and improve future outcomes. Key areas that have been targeted include: minimally invasive procedures; earlier diagnosis to reduce the cost of treatment; moving to point-of-care diagnosis systems; transferring some services, such as diagnostics tests, to the retail sector; and increasing care and assistance in the community by, for example, remote patient monitoring.



<sup>56</sup><http://info.evaluategroup.com/rs/607-YGS-364/images/mt-wp16.pdf>

## Emerging technological drivers will also shape the future of the industry:

- Minimally invasive devices are being developed to curb healthcare costs, with the promise of better outcomes and faster recovery.

- Gene editing and proteomics are expected to create new growth opportunities.

- Software will be a key competitive differentiator enabling devices that are patient portable and smaller.

- Digitally-enabled healthcare solutions that incorporate mobile health applications, sensor technology, data analytics, and artificial intelligence (AI).

- The development of devices with embedded sensors that will provide feedback on a range of physiological and performance parameters.

- Primary care delivery will be revolutionised by new handheld diagnostics and AI will push personalised medicine to another level.

However, market analysis indicates that the most significant trend in future healthcare product innovation is the **convergence of technologies**. Examples include the convergence of medical devices and information technology; artificial intelligence applied to medical devices; combining medical imaging with robotics to automate surgical procedures; digital health; smart drug delivery devices. Leading tech companies Apple, Google, IBM and Samsung are investing heavily in digital health initiatives, especially around wearables, life sciences and smartphones.

For example, Google began a collaboration in 2015 with Dexcom to develop a new continuous blood glucose monitor sited in a contact lens.

The convergence of medical technologies has impacted on almost all medtech sectors. Moreover, **new sectors that have developed out of combined technologies have seen market growth rates between 20-50%**<sup>57</sup>. This is significantly higher than the base growth rate of the medtech industry overall.

**The global digital health market alone (\$61bn in 2013) has been forecast to grow to \$233bn in 2020, representing a CAGR of more than 20%**<sup>58</sup>. Digital technology will drive growth in medical technologies – through convergence with other underpinning technologies, and as additions to existing medical technologies to deliver enhanced products and services.

For example, there is a clear role for enabling digital technologies in enhancing pre-clinical and clinical evaluation, and increasing precision in the design of new products for personalised healthcare.

### Other examples include:

- Artificial intelligence (AI) applied to medical devices, which aim to improve patient outcomes by assisting healthcare practitioners in using medical knowledge.

AI healthcare applications are expected to achieve rapid adoption globally with a CAGR of 42% to reach \$6.6bn by 2021<sup>59</sup>. In the future, chronic conditions such as cancer and diabetes are expected to be diagnosed in minutes using cognitive systems that provide real-time 3D images by identifying typical physiological characteristics in the scans

- Computer-aided surgery (CAS) (combining imaging with robotics) is already well-established in neurosurgery, allowing many procedures to be performed that would not be possible with conventional surgery. Global revenue from robot-assisted minimal access surgery was approximately \$4bn in 2016 and forecast to grow to \$20bn by 2025, an increase of 50% per annum<sup>60</sup>
- Smart drug delivery devices can analyse data, making it possible to ascertain how well a patient is responding to a treatment plan, allowing modifications to be made earlier in disease progression. They can provide pharma with key information on how well compliance relates to the safety, efficacy and economic benefits of the drug.

Leeds City Region has core academic excellence and industry strengths in traditional medical devices and materials, orthopaedics and instrument manufacturing. Combined with emerging strengths in biologics and digital, the region is uniquely well-placed to respond to the opportunities associated with technology convergence. (See section 3.2, across.)

However, it is important to stress that the rate of change associated with technology convergence is unprecedented. There is an urgent need for the Leeds City Region and wider UK medtech sector to adapt to exploit this opportunity – recognising the need for greater collaboration with the research base, greater networking and collaboration within the medtech sector itself, and the growing value of multi-disciplinary skills.

<sup>57</sup><https://www.forbes.com/sites/reenitadas/2016/03/30/top-5-technologies-disrupting-healthcare-by-2020/#14efa20b6826>; <https://www.weforum.org/agenda/2016/12/seven-global-medical-technology-trends-to-look-out-for-in-2017/> 33; Deloitte Report. 2016 Global Healthcare Outlook. Battling costs while improving care.

<sup>58</sup>Deloitte Report. 2016 Global Healthcare Outlook. Battling costs while improving care

<sup>59</sup><https://www.forbes.com/sites/reenitadas/2016/03/30/top-5-technologies-disrupting-healthcare-by-2020/#14efa20b6826>

<sup>60</sup><https://www.weforum.org/agenda/2016/12/seven-global-medical-technology-trends-to-look-out-for-in-2017/> 33

## 3.2

## Local science and innovation assets

**Research and innovation in medical technology is a distinctive strength and strategic priority for the Leeds City Region universities, with world-leading expertise in medical engineering, advanced metrology and health evaluation.**

The Leeds City Region is leading the way in the translation of medical technologies research, accelerating the commercial development of new medical technology products and services.

There is a unique and influential wider health innovation ecosystem in the Leeds City Region, which is home to four out of five NHS headquarters, 13 clinical commissioning groups and 12 NHS trusts, and the largest healthcare data platform in the world.

### Concentration of research excellence in medical technologies

Research and innovation in medical technology is a distinctive strength and strategic priority for the Leeds City Region universities. Current external funding for medical technology-related research in the region exceeds £100m<sup>61</sup>.

The leading UK funder for medical technology research is EPSRC. Leeds City Region universities currently attract 8% of the total EPSRC funding for medical technology research. The significant regional strength in medical technologies research of the Leeds City Region compared with the rest of the UK is further demonstrated by a field weighted citation impact of 2.05 compared with the wider UK (1.67) and globally (1.29)<sup>62</sup>.

The University of Leeds hosts the one of the world's top 10 bioengineering research institutes, the Institute of Medical and Biological Engineering (iMBE). Recognised for excellence in medical engineering through

the Queen's Anniversary Prize for Higher and Further Education in 2012, the Institute is renowned for its multi-disciplinary work with hospitals and its collaborative work with industry, charities and other academic institutions around the world.

With a goal of '50 active years after 50', it is dedicated to improving the quality of life of an ageing population. Its clinical challenged and solution-focused research centres on the fields of medical devices and regenerative medicine, innovating and translating novel therapies into practical clinical applications.

Core expertise is in the area of musculoskeletal and cardiovascular systems, focusing on the three main areas of joint replacement, tissue re-engineering, and functional spinal interventions.

Leeds' internationally-renowned test facilities boast globally unique facilities for preclinical testing in joint replacement and mechanical and biological assessment of regenerative devices.



**What we have in the Leeds City Region is real capability: large manufacturers, small companies, assets in the scientific base and a very good clinical infrastructure. Leeds does something different in making those connections, and we need to think about how we can grow that into a cluster – to grow outside of its regional boundaries and take the sector forward.**

**Sue Dunkerton OBE**  
Director  
The Knowledge  
Transfer Network



**The University of Leeds also hosts a substantial number of nationally funded medical technology research and innovation centres of excellence, including:**

- £13m EPSRC funded **Innovation and Knowledge Centre in Medical Technologies**
- £8m EPSRC and industry-funded **Centre for Innovative Manufacturing in Medical Devices**
- £10m **EPSRC Centre for Doctoral Training in Tissue Engineering and Regenerative Medicine**, which will provide postgraduate training for 50 students to research, develop and deliver regenerative therapies and devices.

Distinctive strengths in data analytics and health and bioinformatics come together in the Leeds Institute of Data Analytics (LIDA), with major programme funding from MRC (£7m) and ESRC (£5m). Additional strengths relevant to technology convergence include the Astbury Centre for Structural and Molecular Biology, expertise in textiles and non-woven materials, robotics, electronic engineering, and nanomaterials.

<sup>61</sup>IKC Annual Report, 2017

<sup>62</sup>Analysis of data from SciVal search syntax based on Scopus Keywords: ((("wound management" or "wound care" or "in vitro diagnostic\*" or "single use technology" or "diagnostic equipment" or "assistive technol\*" or "radiotherapy equipment" or "radiotherapy instrument\*" or "medical imaging" or "ultrason\*" or "anesthes\*" or "ventilator\*" or "artificial respir\*" or "orthop\*" or "orthop\*" or "orthop\*" or "heart assist device\*" or "cardiovascular device\*" or "stents" or "blood vessel prosthesis" or "vascular device\*" or "Neurology" or "Optical device\*" or "ophthalmic device\*" or "maxillofacial technology" or "dental technology" or "drug delivery systems" or "infection control" or "surgical instrument\*" or "Analytic Equipment" or "mobility access\*" or "hospital hardware" or "hospital information systems" or "ambulat\*" or "Monitor\*" or "telemedicine" or ((ICT or "information technology" AND (EHEALTH or e-health)) or ((Health technology and (Innovation" or adoption" or "market validation"))))



The **University of Bradford** is home to the internationally recognised Polymer Interdisciplinary Research Centre (IRC), which hosts the University's Centre for Advanced Materials Engineering (AME) and Centre for Polymer Micro and NanoTechnology. AME focuses on the development of smart materials for high added-value products aimed primarily at health and wellbeing: medical devices, biomedical products, and 'resource efficient' speciality materials and products. The Centre for Polymer Micro and NanoTechnology focuses on precision manufacturing of medical components, including surface feature control. The Polymer IRC also hosts the RCUK Bradford Science Bridges China, an international research platform in advanced materials for healthcare.

The **Digital Health Enterprise Zone** is a £13m partnership led by the University of Bradford, with investment from BT, City of Bradford Metropolitan District Council and the UK government (BEIS). It works in partnership with the Digital Catapult Centre, Yorkshire. These investments reflect the Leeds City Region's ambition to become the best place in the UK for entrepreneurs to set-up and grow innovative businesses in the digital healthcare sector.

The **University of Huddersfield** (partner National Physical Laboratory) hosts the £15m EPSRC, industry and University-funded Centre for Innovative Manufacturing in Advanced Metrology – part of the University's Centre for Precision Technologies, which has an international reputation in precision engineering, and metrology research and development. Advanced metrology is key to the precision manufacture of medical instruments and devices, and is paving the way for advancements in the design and manufacture of traditional medical implants.

In December 2016 it was announced that the Centre would host a new £30 million **EPSRC Future Metrology Research Hub** to help transform UK manufacturing. In 2012 NPL moved into a new purpose-built facility in the 3M Buckley Innovation Centre, hosted by the University of Huddersfield, which focuses on measurement services to industry and forging

closer research links with the University. **NPL Huddersfield** specialises in dimensional inspection and measurement of complex components and assemblies, Co-ordinate Measuring Machine (CMM) programming, and bespoke measurement training and consultancy.

**Leeds Beckett University** has invested in a £1m state-of-the-art clinical skills suite, which supports specialist clinical skills training and provides opportunities for product development. The University's Centre for Biomedical Science Research supports a diverse group of biomedical researchers working on human disease and wellbeing.

The **University of York** has expertise, strategic investments and key strengths in life sciences, neuroimaging and enhanced-sensitivity MRI. The University's Centre for Hyperpolarisation in Magnetic Resonance will explore methods that have the potential to revolutionise clinical imaging (£7m MRC grant in collaboration with the University of Leeds).

The Centre has received support from the Wellcome Trust, Wolfson Foundation, University of York, EPSRC and industrial collaborators totalling more than £13m. The University of York also hosts the York Health Economics Consortium, the largest and most active group of health economics research departments in the UK. It meets private and public sector needs in addressing questions of cost versus benefit for the healthcare sector, including expertise in health economics and evaluation for medical technologies.

These collective facilities, alongside leading scientific expertise, provide prime opportunities for industrial collaboration and translation.

Research excellence in medical technologies in the Leeds City Region is further enhanced through nationally-funded **partnerships across the UK** – with formal collaborative research contracts with over 45 universities and 300 industry partners, and a wider network of over 800 industry, clinical and academic members. Our national and international networks are outlined further in 3.4.



**UNIVERSITY OF LEEDS**



*University of*  
**HUDDERSFIELD**



# Leading translational capabilities

The strength and quality of the Leeds City Region research base is further evidenced in data from the European Patent Office, which indicates that 8.9% of all UK medical technology patents are generated in the city region.



The successful launch of a new medical technology product or service depends on successful progression through an innovation pathway – from identifying a need through to product launch. Our experience has shown that companies are focusing on projects with shorter term returns at higher Technology Readiness Levels (TRLs). As such, the gap between fundamental research and industrial investment is widening, presenting a need for specific and directed translational support.

**Despite the challenges, the Leeds City Region is leading the way in the translation of medical technologies research:**

- **The University of Leeds-led 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. It aims to bridge the gap between fundamental research in medical technologies and industrial investment by de-risking technologies and accelerating their development. Its proof of concept funding programme, industry partnerships in the form of co-development projects and industry-funded applied research, enable researchers to develop the robustness of their technologies.
- **The NIHR Leeds Musculoskeletal Biomedical Research Centre** (£13m 2009-2016, £7m to 2022) is a collaboration between Leeds Teaching Hospitals NHS Trust and the University of Leeds. This world-leading centre for translational research focuses

on individually targeted, patient focussed therapies across musculoskeletal diseases.

- **‘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.

These initiatives have developed and tested unique approaches to collaboration, enhancing technology readiness for progression to commercial product investment and development.

# Medical technology innovation ecosystem

There is a unique and influential wider health innovation ecosystem in the Leeds City Region. It is home to four out of five NHS headquarters, 13 clinical commissioning groups and 12 NHS trusts, including one of the largest NHS Trusts in the country, the Leeds Teaching Hospitals NHS Foundation Trust. A leader in clinical research, with a staff of 15,000 and an annual budget of £1bn, it treats 1.5 million people each year.

The Trust's strengths in cancer, cardiovascular and musculoskeletal disease mirror those of its lead partner, the University of Leeds. NHS England, NHS Digital, NHS Leadership Academy and Health Education England all have a sizable presence in the region, which is also home to the largest healthcare data platform in the world (NHS Data Spine, NHS Digital, EMIS and TPP).

The Leeds-based National Institute for Health Research (NIHR) Clinical Research Network Coordinating Centre (CRNCC), hosted jointly by Guy's and St Thomas' NHS Foundation Trust and the University of Leeds, manages the Clinical Research Network (CRN) on behalf of the Department of Health. The CRN provides the infrastructure that allows high-quality clinical research funded by charities, research funders and life-sciences industry to be undertaken throughout the NHS.

It has over 700,000 NHS patients engaged in research across 99% of all NHS Trusts in England. This powerful clinical research presence in the Leeds City Region is strengthened further by key academic-clinical partnerships, institutes and technology co-operatives which can support the effective development and translation of medical technologies.

## Examples include:

- The **Leeds Academic Health Partnership (LAHP)**, one of the biggest partnerships of its kind in the UK. It engages the educational and research capabilities of the three universities in Leeds with the health and care system to accelerate the adoption of research and new approaches.
- The **Leeds Institute of Clinical Trials Research**, a leading UK academic clinical trials unit (CTU) which specialises in the design, conduct and analysis of both early and late phase high quality academic clinical trials, influencing national and international clinical practice.
- The **NIHR Diagnostic Evidence Co-operative Leeds**, which facilitates the generation of high quality evidence on in vitro diagnostic medical devices (IVDs) for use in the NHS.
- The **NIHR Colorectal Therapies Healthcare Technology Co-operative**, which develops novel solutions to both the challenges faced by patients who suffer from colorectal disease and the needs of clinicians in treating those patients.
- The **NIHR WoundTec Healthcare Technology Co-operative (HTC)**, hosted by Bradford Teaching Hospitals Trust, which boasts an impressive wound care research record and is home to one of England's only dedicated wound healing research units.

Effective and accessible clinical evaluation is essential for the potential of medical technologies to be realised in the UK. The healthcare infrastructure of the Leeds City Region is strongly positioned to provide an ideal testbed for a UK medical device clinical assessment centre.

A unique feature of region's health innovation ecosystem is close collaborative working with patient and citizen networks in the development of new technologies, which has proved key to accelerating product development processes. For example, the LAHP works closely with Leeds City Council to reach effectively into multidisciplinary neighbourhood health and social care teams on the ground.



The City of Leeds is currently utilising core strengths in data analytics and data storage to deliver a tailored, whole system approach to 'population health'. Strengths in analytic modelling are supporting the rapid identification, targeting and recruitment of relevant cohorts of citizens or patients to further scale and extend the city's capability as a leading testbed centre for medical technologies.



## A concentration of NHS Infrastructure:

**4 out of 5**

NHS headquarters

**12**

NHS Trusts

**13**

clinical commissioning groups

## Leeds Teaching Hospitals Trust:

annual budget

**£1bn**

staff

**15,000**

treats

**1.5 million**

people each year



# Private sector innovation infrastructure

The Leeds City Region hosts a distinctive concentration of over 250 businesses specialising in medical technologies, complemented by over 200 digital and technology businesses operating in the health and social care space.

Traditional industry strengths in the region include implants, surgical instruments, and devices, e.g. DePuy Synthes, Surgical Innovations, Xiros and Brandon Medical.

## DePuy Synthes

The Beeston (Leeds) R&D Centre of DePuy Synthes (a Johnson & Johnson company) is one of the leading orthopaedic development facilities in the world. In 2013 DePuy Synthes received £4.4million from the government's Regional Growth Fund initiative to help support further R&D and innovation in the sector.

The funding was used to support the creation of the new Centre of Excellence at Beeston (Leeds) for joint replacement, which includes R&D and prototype manufacturing. DePuy Synthes has a long-standing collaboration with the Institute of Medical and Biological Engineering at the University of Leeds extending over 17 years which has led to improved understanding of joint replacements for millions of patients worldwide, new simulation test methods and equipment, and improved international ISO standards

## Surgical Innovations

Surgical Innovations was founded in 1992 in Leeds to develop retraction technology for use in the relatively new field of minimally invasive surgery. Surgical Innovations currently employs around 60 staff in space housing an extensive machine shop, two clean rooms, injection moulding, warehousing and office space. Surgical Innovations Limited is the main trading arm of Surgical Innovations Group Plc, which is listed on the Alternative Investment Market.

## Xiros

Originally called Neoligaments, the company was founded in Leeds in 1982. Neoligaments gained a reputation for innovation and technical excellence, and over the intervening years this has been reinforced by the successful development of an extensive range of implants, fixation devices and surgical techniques for a variety of orthopaedic indications. In 2000 the company name was changed to Xiros, to reflect the widening scope of its business activities. Alongside the development and manufacture of its own devices marketed under the Neoligaments brand, Xiros also provides extensive expertise in research, development, design, manufacture and marketing to others in the medical field.

## Brandon Medical

Leeds-based Brandon Medical is an award winning medical technology company with 65 years of healthcare experience. It is one of the leading manufacturers of high tech medical lighting, found in surgeries, clinics and hospitals throughout the world. In addition to healthcare and hospital lighting technology, Brandon Medical manufacture medical AV systems and operating theatre control panels, as well as isolated power systems and uninterruptible power systems.

More recent start-ups and high growth companies are based on emerging technology areas, including biological materials and digital health, e.g. Tissue Regenix, Neotherix and Avacta; TPP and EMIS.

## Tissue Regenix

Tissue Regenix is a leading medical devices company in the field of regenerative medicine. The company's patented decellularisation ('dCELL®) technology removes DNA and other cellular material from animal and human tissue leaving an acellular tissue scaffold which is not rejected by the patient's body which can then be used to repair diseased or worn-out body parts. The potential applications for this process are diverse and address many critical clinical needs such as treating vascular disease, heart valve replacement and knee repair.

Tissue Regenix was formed in 2006 when it was spun-out from the University of Leeds. The company commercialises academic research conducted by its partners around the World. Tissue Regenix listed on the Alternative Investment Market (AIM) on the London Stock Exchange in 2010, before opening the first subsidiary office Tissue Regenix Woundcare, Inc. in San Antonio, Texas in 2012.

## Neotherix

Neotherix is a regenerative medicine company specialising in the development of novel bioresorbable scaffolds for tissue regeneration and repair.

Neotherix develops innovative products for soft tissue repair and therapy in specific, selected applications where there is a clear clinical need. Neotherix applies and exploits unique knowledge of polymer electrospinning technology combined with wound healing biology to develop and then demonstrate the effectiveness of the resulting bioresorbable scaffold materials.

Neotherix was founded in September 2007 and spun-out from Smith & Nephew to develop and commercialise bioresorbable scaffolds for tissue regeneration and repair.

250   
businesses specialising  
in medical technologies



200  
digital & technology  
businesses



## 3.3

# Local science and innovation talent

Leeds City Region's higher education institutions host the highest number of STEM students outside of London, and produce a rich pool of graduates each year.

Leeds City Region has the largest workforce in medtech-related industries outside of the South-East of England.

However, graduate retention rates are low in the Leeds City Region (40%), and there are clear skills gaps across the sector in regulatory, digital, and core technical skills.

Regional Economic Model forecasts that total employment in the Leeds City Region will grow by 6% between 2014 and 2024, with the greatest numbers of projected job openings expected to be in medicine, allied subjects and health.

Leeds City Region's higher education institutions host the highest number of STEM students across all LEPs outside of London<sup>63</sup> – producing 12,000 graduates each year in subjects allied to medtech: engineering, medicine, and science (HESA 2014/15).

Medical technology draws on cross disciplinary expertise in engineering and the physical and life sciences. Specialised graduate and PhD programmes in medtech are provided by the Universities of Leeds and Bradford. Centres for doctoral training in bioengineering and regenerative medicine deliver high level skills to answer complex medical technology problems.

Moreover, Leeds Trinity and the University of Leeds are currently piloting new employer-led higher and degree apprenticeships in healthcare practice, management and supply chain management for individuals in employment, while Leeds Beckett University is offering apprenticeships in digital and technology solutions and chartered management which aim to help fill the growing digital skills gap in the region.

Analysis of data from the Business Register & Employment Survey, 2015<sup>64</sup> shows that the

Leeds City Region has the largest workforce in medtech-related industries outside of the South-East. Almost 6,000 people are employed in the sector in the City Region. A location quotient (LQ) of 97 suggests employment concentrations are broadly in line with the national average, but this is misleading because the Leeds City Region has high degrees of specialisation within this medtech cluster.

The sector has seen strong growth in the Leeds City Region in recent years, with average employment growth of 4% per annum between 2009 and 2015.

This growth rate is matched only by the Greater Cambridge area among the main centres of medtech employment, and far outpaces the national picture, where employment has been largely static over that time. It also outperforms the Leeds City Region economy as a whole, where employment has increased by 0.7% per annum since 2009.

Over a third of employment in the sector in the Leeds City Region is in the manufacture of medical instruments. With a location quotient of 138, this subsector also reflects a high degree of specialisation for the City Region.

Allied to growth in medtech is an expansion in digital technology within the Leeds City Region, which now accounts for 22% of digital health jobs in UK<sup>65</sup>.

**12,000**  
graduates each year  
in subjects allied to  
medtech

**5,000**  
people are employed  
in the sector in the  
city region

average employment  
growth per annum  
**4%**  
between 2009-2015

<sup>63</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/546999/bis-15-344-mapping-local-comparative-advantages-in-innovation-framework-and-indicators.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/546999/bis-15-344-mapping-local-comparative-advantages-in-innovation-framework-and-indicators.pdf)

<sup>64</sup>Business Register & Employment Survey, 2015: 21100, 21200, 26511, 26600, 32500, 47749, 72110

<sup>65</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/525102/bis-16-237-strength-and-opportunity-2015-UK-medical-and-biopharmaceutical-landscape.pdf)

## Existing skills gaps

However, medtech companies in the Leeds City Region face a number of challenges in recruiting skilled people. The Leeds City Region Business Survey (2015) showed that a quarter of businesses in the health and bioscience sector had vacancies in the past 12 months that they had struggled to fill.

Health and biosciences firms were also more likely to have challenges retaining staff, with 8% of firms surveyed in the sector saying challenges in retaining skilled workers acted as a barrier to their growth, compared to 2% of firms in the survey as a whole. Furthermore, 86% of companies in the sector said they had skills that needed improving in their business.

Further analysis of vacancies in the medtech sector in Leeds City Region has been undertaken using the Burning Glass Labour Insight. This analyses the content of vacancies advertised online for variables such as skills, competencies and salary levels. According to this data, the number of vacancies advertised by medtech firms in the Leeds City Region has increased rapidly in recent years. The number of vacancies has more than doubled from 350 in 2012 to 750 in 2016.

Within these vacancies there is increasing demand for technical skills. The most sought after skills cluster is expertise in clinical research, which featured in 265 vacancies. This is up from 39 vacancies seeking clinical research skills in

2012, when it was the 9th most sought after skills cluster. Expertise in medical procedure and regulation has also seen a marked increase in demand with the number of vacancies up by over 700% since 2012.

These findings are consistent with the feedback from industry in interviews and focus groups carried out as part of this Science and Innovation Audit, which cited regulatory, digital, business/project management, core professional competencies and greater industry awareness as clear skills gaps alongside core technical skills.

SMEs described a need to recruit experienced graduates, as they do not have the resource or capacity to provide extensive on-the-job training.

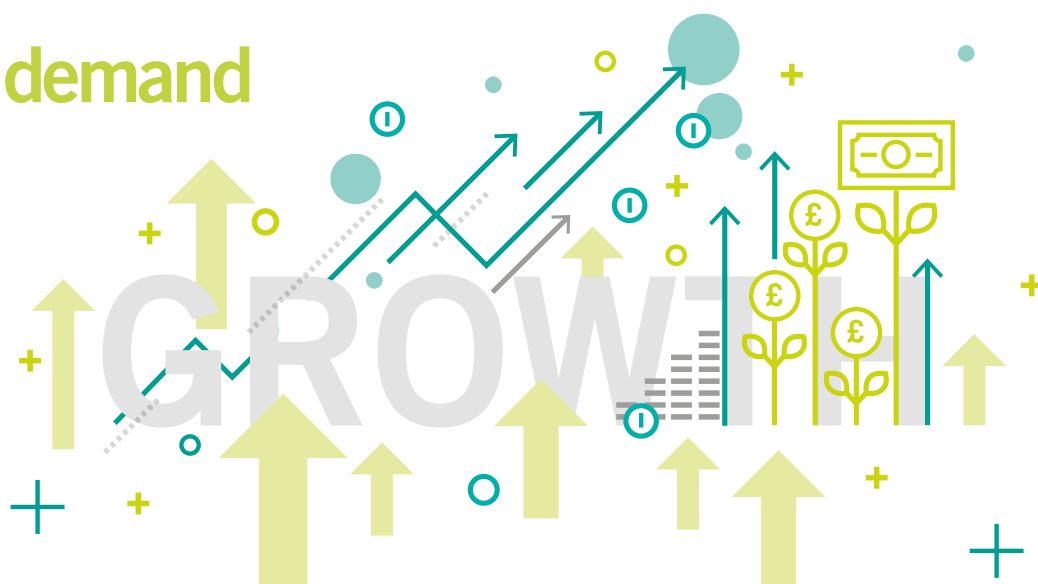
## Future labour demand

The Regional Economic Model forecasts that total employment in the Leeds City Region will grow by 6% between 2014 and 2024, with the greatest numbers of projected job openings expected to be in medicine, allied subjects and health<sup>66</sup>.

Information technology, which will underpin future medtech growth particularly in digital health, has one of the fastest forecast rates of growth of around 15%<sup>67</sup>.

Future recruitment needs are expected to be highest in high-skilled roles – in the decade to 2024 almost half of the projected growth in high skilled jobs in the Leeds City Region is expected to be in science, research, engineering and technology<sup>68</sup>. As only 40% of Leeds City region graduates currently remain in the city region

after graduation<sup>69</sup>, there is the potential to retain more in the future to support industry growth. However, the anticipated market growth potential outlined in 3.2 will require technology integration skills and the flexibility to operate across multiple disciplines, which are not well catered for in current training provision.



<sup>67</sup>Leeds City Region Labour Market Analysis, 2016/7: [http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017\\_1.pdf](http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017_1.pdf)

<sup>68</sup>Leeds City Region Labour Market Analysis, 2016/7: [http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017\\_1.pdf](http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017_1.pdf)

<sup>69</sup>[http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017\\_1.pdf](http://www.activeinformatix.com/wp-content/uploads/2016/03/Leeds-City-Region-Labour-Market-Analysis-2016-2017_1.pdf)



# 3.4

## National and international engagement

The Leeds City Region universities are well-connected regionally, nationally and internationally.

However, the wider medtech sector – particularly microenterprises and SMEs – remains poorly networked and connected, both within the Leeds City Region and across the UK.

Although the Leeds City Region has a concentration of medtech companies, there is limited clustering behaviour and pre-competitive collaboration.

The innovation ecosystem is complex, involving a large number of organisations.

Greater networking and pre-competitive collaboration is needed for companies in the Leeds City Region to take advantage of emerging market opportunities in the development of convergence technologies.

The Leeds City Region is well-connected nationally and internationally. Its universities have strong collaborations and partnerships in medical technologies with centres of excellence across the UK, including Sheffield, Newcastle, Liverpool, Hull, Manchester, Nottingham, Cambridge, Southampton, Birmingham, Cardiff, UCL, Imperial College, Oxford, UEA, Loughborough and Kings College. These collaborations substantially extend the region's capabilities and reach, both in the UK and beyond.

Scival analysis shows that 42% of medtech publications from the Leeds City Region involve international collaboration.

Examples of research-driven activities that support collaboration and connectedness, regionally, nationally and internationally, include:

**The HEFCE Catalyst funded Translate 'Realising medical technologies innovation in the Leeds City Region' programme (£3m 2015-18):** led by the University of Leeds in collaboration with the Universities of Bradford, Huddersfield, Leeds Beckett and York, Translate aims to establish a sustainable community of academic, industry and clinical medtech partners across the Leeds City Region, while developing their translational capability.

**The EPSRC Centre for Innovative Manufacturing in Medical Devices (MeDe Innovation) (£8m 2013-19):** hosted by the University of Leeds, MeDe Innovation was founded in 2013 in collaboration with the Universities of Bradford, Newcastle, Nottingham and Sheffield. 15 UK universities and 39 industry partners are now actively collaborating on a portfolio of over 100 research and innovation projects. MeDe has established a wider network in the UK of 800 members, with over 200 from industry. Internationally, MeDe is working with 27 institutions<sup>70</sup>.

**The EPSRC Medical Technologies Innovation and Knowledge Centre (IKC) (£13m 2009-20):** founded and funded in 2009 to advance and accelerate medical

technology innovation, the IKC is working with 46 research organisations across the UK as a national innovation centre. Originally focused on regenerative devices and convergence of regenerative medicine and medical engineering, its remit now includes a wider medical technologies focus, including digital technologies and precision in medical devices. The outcomes of its innovation activities include 32 patents, 6 spinouts, and the advancement of 84 technologies and products to development and commercialisation at TRL5 and higher, leveraging new private sector investment of around £120m to support commercial product developments<sup>71</sup>.

Further, **DePuy Synthes** have a **global research network** with six international universities, which includes a technology partnership with the University of Leeds.

The Leeds City Region LEP leads international trade and international inward investment in the region. It also provides an export network to encourage and support more companies to trade internationally, a growth service for small and medium-sized businesses in the region to find the right support and funding, to realise their growth ambitions and grant and loan funding.

<sup>70</sup>EPSRC Centre for Innovative Manufacturing in Medical Devices Annual review 2016

<sup>71</sup>EPSRC Medical Technology Innovation and Knowledge Centre Annual review 2017



**We believe that the ability to share learning and best practice between the region's universities is essential to growth in this key sector. At the same time, building networks of expertise, knowledge transfer and common ways of working will build the region's capacity.**

**Emily Wolton**  
Executive Director  
Yorkshire Universities

Stakeholders in the health and medtech industry in the Leeds City Region extend their regional connectedness through membership and participation in a number of local and regional networks, such as: the Leeds Academic Health Partnership, which brings together key stakeholders from the NHS, the universities and Leeds City Council to provide strategic oversight and connectedness in Health and Social care across a population of about 1 million in the city of Leeds; the Yorkshire & Humber Academic Health Science Network; the Northern Health Science Alliance; and the Yorkshire and Humber Medilink.

At a national level, there are a number of medtech trade associations, such as the Association of British Healthcare Industries; the Medilinks, which provide health technology business support; and the Academic Health Sciences Network, established to connect NHS and academic organisations, local authorities, the third sector and industry.

However, the health innovation ecosystem is complex, involving a large number of stakeholders. Moreover, no single organisation has strategic oversight for medical technologies across the Leeds City Region or indeed the UK.

The concentration of medtech businesses in the Leeds City Region presents considerable opportunities for connectivity and collaboration. Yet businesses currently demonstrate limited clustering behaviour.

The complexity and fragmented nature of the medtech sector itself means that the strategic goals of different stakeholders have not yet been aligned to realise the full potential for economic growth in medical technologies.

Closer business-to-business networking and pre-competitive collaboration in the medtech sector is needed – both in the Leeds City Region and across the UK – to improve clustering behaviour, to take advantage of emerging market opportunities in the development of convergence technologies, and ultimately to boost exports and increase economic growth.

**42%**  
of medtech publications  
from the Leeds City  
region involve  
international collaboration



# 3.5

## Developments in the wider funding landscape

EPSRC is the primary funder of fundamental medical technologies research.

However, the wider funding landscape for research and innovation is complex, and coherent support for applied research and translation is lacking.

The medical technology translation pathway is complex, and poorly understood.

A new and focused approach is needed to address imminent change and transformation in the global medtech market.

EPSRC is the major funder of research in medical technologies in the UK, with a portfolio of current grants exceeding £400m. The EPSRC Charter defines the advancement of knowledge and technology: to meet the needs of end users and contribute to economic output and quality of life. This is articulated through the current EPSRC delivery plan of in terms of supporting a prosperous nation and a healthy nation.

Medical technology research is supported through two of the EPSRC's themes: the Healthcare Technologies theme, with the aim of accelerating translation to healthcare applications; and the Manufacturing the Future theme, with the aim of addressing some of the most serious challenges facing the UK (manufacturing industry) today and in the future.

Other funders of medical technology research include MRC, BBSRC, ERC, Innovate UK; learned societies, such as RAEng and Royal Society; and charities, including Wellcome Trust, NIHR, Alzheimer's Society, Arthritis Research UK, British Heart Foundation, Heart Research UK, Muscular Dystrophy UK, MS Society, Stroke Association, Kidney Research UK.

The Wellcome Trust's Innovation for Impact scheme, NIHR's Invention for Innovation (i4i), EPSRC's Impact Accelerator Awards, and the MRC/Innovate UK's Biomedical Catalyst provide the main source for post-proof of concept funding.

Medical technology research and translation is also supported by charities, such as Arthritis Research UK, and the NIHR.

For SMEs in the Leeds City Region, the LEP Access Innovation business support project (2017-20) will use European Regional Development Funding to deliver a three year project to support research, development and innovation. The funding will assist SMEs with the costs of developing and commercialising new and innovative products and processes which could involve academic and other partnerships.

Nationally, the Small Business Research Initiative for Healthcare (SBRI Healthcare) provides funding for theme-driven small company research projects at both proof of concept stage (£100k) and later (up to £1m).

Grant funding is essential to support early stage ideas, preclinical work-up and early translation. Since the global financial crisis of 2008 the translation and commercialisation of novel medical technologies has become more difficult due to the lack of early-stage private sector 'risk' finance.



Since the global financial crisis of 2008 the translation and commercialisation of novel medical technologies has become more difficult due to the lack of early-stage private sector 'risk' finance.



## There are well established gaps in the translation pathway:

- The first gap in translation, the ‘valley of death’ at TRL 3 to 5 (advancing technologies towards developing products and services) is critical for this sector, but is not fully addressed
- The second gap, clinical evaluation and then adoption and subsequent market development, is not merely a valley of death but more of a canyon, with the challenges identified by UK industry in early stage clinical evaluation in the UK (see section 4).

For later stage technology advancement and product development in particular (TRLs 4-7), public support remains vital, but is not being effectively delivered.

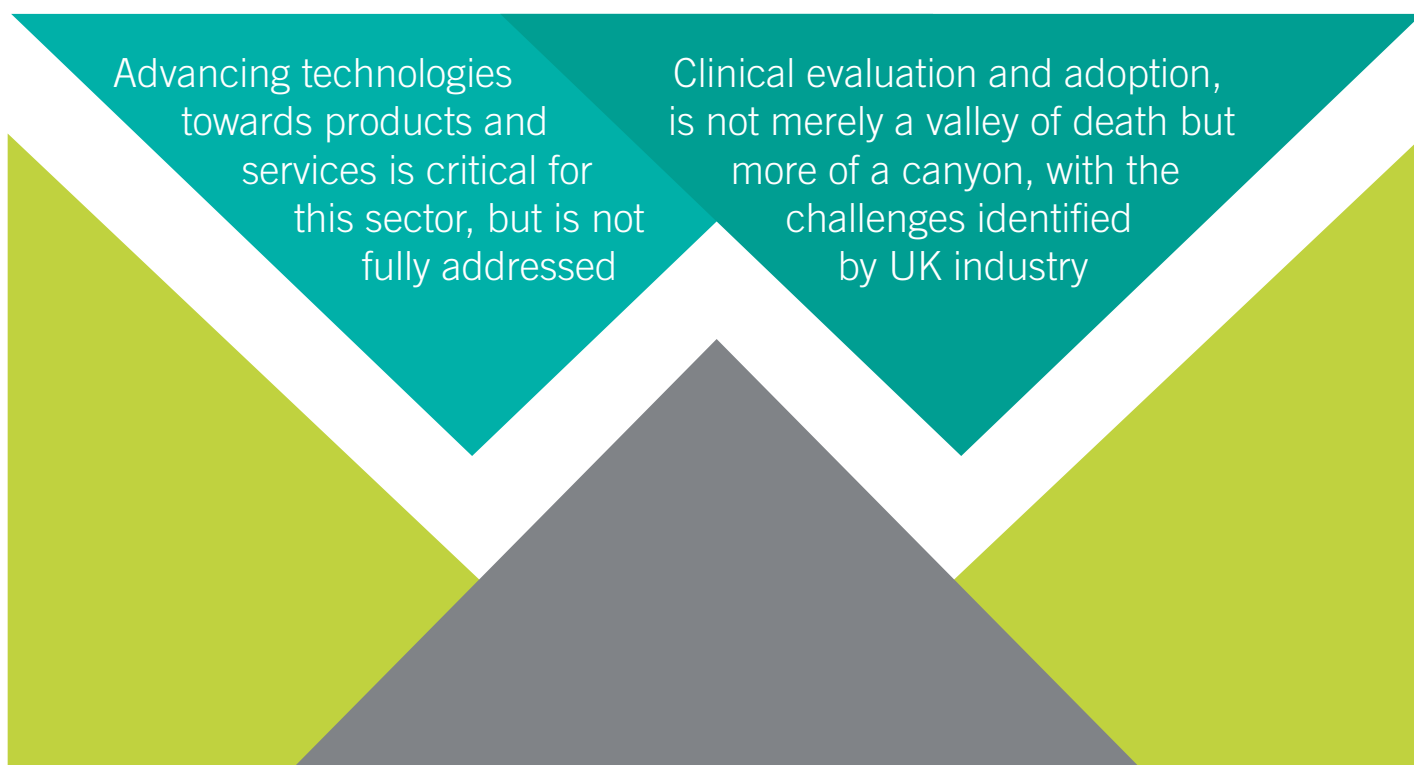
Overall, the funding landscape is highly fragmented and discontinuous, and coherent support for applied research and translation is lacking. This was recognised, for example, in the House of Lords (2013) Regenerative Medicine report, which argued that there is insufficient TRL 6-8 funding available to support this fast developing field<sup>72</sup>.

The complexity of the medical technology translation pathway – the fact it is often necessary to have a fully developed product to undertake clinical studies, and that different types of technologies and products have different translation (and regulatory) pathways – means this is an area is not well understood, which creates points of failure.

A new and focused approach is needed to address imminent change and transformation in the global medtech market.

The current UK medtech funding landscape for is simply not adequate to support the future convergence of technologies and the growing need for evaluation and evaluation technologies.

## Innovation Valleys of Death



<sup>72</sup>House of Lords Science and Technology Committee, 2013



## Conclusions

# 4

# 4.1

## Conclusions

The global market place for medical technologies is changing rapidly. This is being driven by multidisciplinary approaches to the advancement of knowledge across engineering and materials, life and information sciences, and the convergence of emerging and existing technologies into new products and services – enabled by digital technology, data analytics and enhanced evaluation. Together, these changes offer significant opportunities for the medtech sector in the Leeds City Region and across the UK.

This Science and Innovation Audit of the Leeds City Region medtech sector has demonstrated a concentration of excellence in research, public health and industry. National centres of excellence in medical engineering and future manufacturing of medical devices provide an excellent platform for growth.

However, to take advantage of opportunities in a rapidly changing global medtech market, there is an urgent need for strategic intervention, nationally and regionally – to support continuous innovation along the value chain, to drive medtech innovation and economic growth. The window of opportunity is now.

In this section we lay out the barriers to be overcome, define the 'medtech place' and an agreed "strategic common purpose", outline five strategic propositions to address the global medtech opportunity and the gaps and barriers

to growth in the region and UK, and the next steps for development of the propositions into business and investment plans.

## Gap analysis and barriers to growth

In-depth consultation with medtech industry leaders and other stakeholders in the sector has provided an important input to this Science and Innovation Audit. Their views on issues that will influence the ability of the Leeds City Region (and the UK) to fully exploit opportunities in the medical technologies market have been captured through five mechanisms:

One-to-one interviews with 30 individual industry leaders using a framework of questions to interrogate the hypotheses underpinning the audit. These were carried out by AlacraMed and by the SIA core team.

Four focus groups involving more than 20 business leaders from medical technology companies in the Leeds City Region and a focus group for innovation enablers (facilitated by SQW).

An open online survey, which attracted over 50 responses, primarily from industry, academics and innovation enablers.

Discussions sessions with a number of individuals and groups with stakeholder interests in medical technology innovation, including medical technology innovation programme Advisory Boards and Executive Groups, the LEP Business Innovation Group, the LEP Innovation Working Group and the Leeds Teaching Hospitals NHS Foundation Trust/University of Leeds Joint Partnership Board.

An open event for stakeholders with an interest in the competitiveness of the medical technologies sector (held on 25th April 2017 in Leeds and attracting more than 130 participants).

## These information gathering exercises produced in-depth insights into industry and broader stakeholder perspectives on the challenges and barriers to growth for the medtech sector, and the steps that might be taken to address these.

Rapid growth and transformation in the nature of markets, products and technologies generates opportunities and challenges. Future medtech products and services will include more complex combination devices and increased use of, and dependency on, digital technology. The main requirements companies felt they needed to enable them to embrace convergence opportunities were **funding**, the **development of a more entrepreneurial culture in the sector** and **enhanced networking and collaboration** between different organisations in the Leeds City Region.

**The UK medtech sector is highly fragmented.** It is dominated by micro-enterprises and SMEs. There is **poor connectivity and clustering** activity across the sector, across the region and across the UK. This was recognised in interviews, focus groups and in the online survey, and stakeholders felt this needed to be addressed.

There are significant **skills shortages and changing skills needs** in the medtech sector, both regionally and nationally. There are skills shortages and gaps in specialisms, including medtech, digital, and regulatory, particularly at graduate level and for early career professionals. There is also a significant lack of 'industry ready', graduates with medtech industry experience – SMEs need experienced graduates because they do not have the resources to provide on-the-job training. Companies provided a range of ideas for how these issues could be addressed, including co-development with industry of

new educational programmes, companies providing projects for students to undertake, work experience (e.g. through secondments and internships) and industry taking responsibility for education after graduation. Finally, there is a need to diversify the skills of the existing workforce to address the challenges of industry transformation – advanced multi-disciplinary skills are needed to address emerging market opportunities for combined technologies.

For companies based in the **Leeds City Region**, the **economic environment remains challenging**. There is a low level of regional investment in R&D<sup>73</sup>, an absence of targeted regional and sector specific investments in innovation, and a lack of infrastructure, such as grow-on space.

Companies felt that there were numerous organisations in the region that could potentially help the industry, but that the boundaries were unclear and that there is a **need for coordination** and a unifying voice.

Engagement between companies and the science base was seen as a real strength in the region, and there is a **need to sustain science capacity and capability in the region through centres of research excellence**.

A **shortage of funding** was recognised for translation (pull through) research and collaborative funding with industry and need for continuation of targeted support for research

to support medical device manufacturing. Companies cited huge challenges in navigating a discontinuous and disconnected pipeline of funding for different stages of the innovation pipeline. The lack of support for the more **costly clinical trial phases** hampered company development.

Companies cited **poor access to the NHS** for UK industry and limited ability to **evaluate clinical efficacy and effectiveness**. Some companies felt that a local opportunity increasing their ability to do this would encourage them to remain in the region.

Finally, it was noted that the **regulatory environment is complex**, slow to adapt to the latest technological developments but rapidly changing to meet wider regulatory requirements e.g. new European Medical Devices Regulations. There are **long lead times on product development** and market entry, and there is increasing complexity with stratified and personalised markets and product ranges as we see an increase in the use of precision medical devices.

**Companies find the regulatory process for gaining a CE mark complicated** and while most companies used regulatory consultants, these were seen as an expensive external resource. Future planned changes to European and UK medical device regulations are a significant challenge.



The Leeds City Region has much to commend it to Neotherix as a micro-SME. However, we have struggled to find the ideal laboratory and manufacturing incubator space – somewhere where we can scale-up our process and grow our team. More of this type of infrastructure would benefit us and the region.

**Dr Mike Raxworthy**  
Founder and CEO, Neotherix

We've got one of the biggest teaching hospital trusts in the country and a Russell Group university on our doorstep. Having the opportunity to interact with both of these organisations early on in product development is fantastic, but you need to have all players talking to each other to make it happen. We need leadership that can bring us all together to support the right innovations to get to patients.

**Dr Neville Young**  
Head of Commercial Development Yorkshire and Humber Academic Health Science Network



<sup>73</sup>In 2013, Business Enterprise R&D Expenditure in the Leeds City Region was £440m, which equates to £399 per FTE – significantly below average for the size of workforce: bis-15-345-mapping-local-comparative-advantages-in-innovation-framework-and-indicators-appendices.pdf

The online survey asked the medtech community what single investment or intervention they would like to see delivered in the next five years to enable either the Leeds City Region or the wider medtech sector to realise its science and innovation potential.

The following themes emerged:

- Effective funding of R&D collaborations between universities and industry, which allows businesses to access skills to develop ideas cost effectively
- More (and easier access to) innovation funding
- Opportunities to connect with other medtech companies in the region
- Connecting and stream-lining the innovation and business support infrastructure, to simplify access for businesses
- Improved infrastructure to support interdisciplinary research and innovation involving local universities, research institutions, companies and the NHS
- Greater connectivity between key players in the innovation pipeline (e.g. universities, Trust Boards (NHS), research support (CRNs), innovation tech support (AHSNs) and industry (SMEs) with easier access to funding opportunities, regionally and nationally
- Investment in university-business links to stimulate growth and trade within other markets
- Support for businesses to grow through improving skills.





## 4.2

# Our strategic propositions and targeted opportunities

To address the challenges identified above, we outline below a series of propositions – targeted opportunities for developing the Leeds City Region medtech sector and supporting the industry across the UK.

An important outcome from this Science & Innovation Audit has been the definition of a new **Medtech Place**, a connected group of institutions, locations and industry partners for the sector with an agreed **common strategic purpose**:

- **Driving economic growth, improving productivity, increasing exports into a growing global market**
- **Supporting innovation and growth in existing companies who export**
- **Increasing the number innovative companies who are exporting medical technologies**
- **Transforming the sector, addressing the growth in new global markets with new products, through convergence of technologies, enabled by digital technology, data analytics & enhanced evaluation**
- **Establishing UK as a world leader for development, pre-clinical & clinical evaluation of medtech**
- **Supporting growth through continuous strategic investments & development along the value chain**
- **Supporting evaluation, adoption & efficient use of medical technology from UK companies in the NHS**
- **Improving the effectiveness of medical technology, reducing healthcare costs.**



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## Five key propositions will be developed:

# 1

### **Clinical evaluation: a national 'test bed' clinical evaluation hub and network for medtech devices.**

A national network of clinical evaluation centres for new products and medical technologies, with a national coordinating hub linked to existing NIHR infrastructure, will act as a beacon to attract inward investment into the UK. Early stage clinical evaluations will provide evidence to support regulatory approvals and later stage health technology assessments, increase the precision of clinical adoption and feed back to upstream product developments, and further refine the stratification of patient needs.

NIHR will be closely involved in the development of this proposition.

# 2

### **Enhanced high level skills: a medtech skills academy.**

The collaborative development of new education and training programmes to deliver highly skilled industry-ready, multidisciplinary graduates/postgraduates, to meet the needs of the new industry in medtech, digital health, and regulatory science. The academy will support people and skills exchange programmes, training new graduate and post graduate engineers and upskilling existing professionals in the industry, focusing in particular on addressing the needs of SMEs in the medtech sector.

# 3

### **Joined up connected and continuous innovation support: an integrated medtech innovation hub with soft and hard infrastructure with connected, interactive and collaborative medtech nodes across UK.**

A flexible, joined-up and continuous industry-focused research and innovation development programme, providing support throughout the value chain for medtech innovation, supporting early stage research, product development and manufacturing, preclinical and clinical evaluation, business development and access to finance for UK medtech innovation in public and private sectors.

# 4

### **Sustainable infrastructure: grow-on and scale-up space, support for businesses to start and grow, coupled with continued infrastructure investment in national centres of research excellence.**

Specific regional needs have been identified for additional grow-on space for start-up and spin-out technology companies, as they emerge or grow-out from university incubators.

With an industry so reliant on the excellence of university research and innovation, continued support is needed to support the sustainability of science infrastructure in our national centres of research excellence.

# 5

### **Strategic leadership, providing vision, direction and common purpose: strategic leadership for medtech innovation.**

We have defined a distinctive 'place' for the medtech sector in the Leeds City Region and across the UK industry, bringing together excellence in medtech science with industry partners and NHS. We will establish a Medtech Sector Council to provide strategic leadership for industry, academia and the NHS, to deliver our vision, the goals defined in our strategic common purpose and the development of our propositions to deliver economic growth in the region and across the UK.





Our work going forward will be guided by our strategic common purpose and the following guiding principles.



- Common purpose across stakeholders and partners



- Continuity along the value chain



- Connectivity across geographies in UK



- Convergence of technology and working across disciplines



- Collaborative development of enhanced skills and capabilities



- Coherence of excellence in Science-NHS-Industry



- Creation of sustainable infrastructure

## Our ambition

UK medtech economic output to grow

**£10bn**  
per year by 2025

potential portfolio

**£50m**  
investment per year

The **next steps** are to work with key stakeholder groups and partners across the UK, the Local Enterprise Partnership, BEIS and the Office for Life Sciences, industry, universities, NIHR and the NHS, to develop each of the five propositions into business development and investment plans.

Reflecting the scale of our ambition – **to grow UK medtech economic output by at least £10bn per year by 2025** – we estimate a potential portfolio for investment of the order of £50m per year is required to support the development of the propositions described above.

# Appendix 1: Contributors

The following people have contributed to the Medical Technology Science and Innovation Audit:

## Core Delivery Team:

John Fisher CBE	Professor of Mechanical Engineering	University of Leeds
Josephine Dixon-Hardy	Director of Medical Technologies Innovation	University of Leeds
Lisa Hill	Innovation Development Manager	University of Leeds
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## SIA Support Team:

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Danielle Miles	Technology Innovation Manager	University of Leeds
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Thomas Baboolal	Post-Doctoral Research Fellow	University of Leeds
Kelly Broadbent	Project Administrator	University of Leeds
Beverley Croft	Team Secretary – Medical Technologies Innovation	University of Leeds

The following consultants supported industry interviews, industry focus groups, market assessments and regional economic assessments:

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Christopher Wilkinson	Economic Development Consultant	SQW
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## Strategic advice was taken from:

Martin Doxey	Managing Director / Member of Leeds LEP Business Innovation & Growth Panel	Claro Precision Engineering Ltd / LEP
Graham Isaac	Distinguished Engineering Fellow	DePuy Synthes
Mike Barker	Vice President, Worldwide Research and Development, Joint Reconstruction, Mitek and Power Tools	DePuy Synthes
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**The following people provided operational direction as members of the SIA Executive Group:**

Julian Sorrell	Business Manager	Leeds Beckett University
Ian Rowe	Director of Business Development	Leeds Trinity University
Liam Sutton	Head of Knowledge Transfer	University of Bradford
Ian Pitchford	Head of Strategy, Policy and Engagement	University of Huddersfield
Alexandra Smyth	PhD Researcher	University of Leeds
Christopher Herbert	Research & Innovation Development Manager	University of Leeds
Josephine Dixon-Hardy (Chair)	Director of Medical Technologies Innovation	University of Leeds
Lisa Hill	Innovation Development Manager	University of Leeds
David Moore	Associate Director, Healthcare & Life Sciences	West Yorkshire Combined Authority   Leeds City Region Enterprise Partnership
Emily Wolton	Executive Director	Yorkshire Universities

**The following industry and innovation leaders contributed through participating in Industry Focus Groups:**

John Eaglesham	Chief Executive	ADI
Kadem Allamee	Managing Director	Arterius Ltd
Mick Karol	Managing Director	Blueprint design Ltd.
Liz Pryde	Project Manager	D4D
Keith Jackson	Non-Executive Director	Devices for Dignity and Medilink Y&H
Mark Gibson	Global Informatics Consultant	Gibson Consultants
Alex Gutteridge	Director	GSK
Bill Pigg	Director	Holdon Consultants
Dean Cook	Lead Technologist	Innovation UK
Bryn Sage	CEO	InTechnology
Kevin Kiely	Chief Executive	Medilink Y&H
Miranda Stead	Director	Mednet Ltd
Janette Benaddi	Director of Clinical & Consulting Europe	NAMSA Medvance
Chris Fowler	Managing Director	Niri Ltd
James Pink	VP (Senior Partner)	NSF-DBA
Jerry Coffey	Business Manager – Scientific, Analytical and Medical	Reliance Precision
Ian Crabbe	Managing Director	Royston Lead
Graham Turner	Sales and Marketing Director	Sidhil Ltd.
Matthew Tully	Owner	Single Use Surgical
Stuart Anderson	Director	Sunflower Medical Ltd.
Melanie Ross	Chief Operating Officer & Chief Financial Officer	Surgical Innovations
Steve Nixon	Sales and Marketing Director	Viamed Ltd.
Neville Young	Head of Commercial Development	Yorkshire and Humber AHSN

## The following industry leaders contributed through interviews:

Adar Pelah	CSO and Reader at University of York	Asuuta Ltd and University of York
Tony Veverka	Group CEO	BioEden Ltd
Martin Doxey	Managing Director / Member of Leeds LEP / Business Innovation & Growth Panel	Claro Precision Engineering Ltd / LEP
Stephen Smith	Founder / University of York	ClearSky Ltd / Reader
Steve Parker	CEO	Creavo Medical Technologies Ltd
Graham Isaac	Distinguished Engineering Fellow	DePuy Synthes
Mike Barker	Vice President, Worldwide Research and Development, Joint Reconstruction, Mitek and Power Tools	DePuy Synthes
Paul Unwin	Formerly Managing Director of Stanmore implants, now providing consultancy	Freelance consultant
Brendan Loughran	Commercial Director – UK & Ireland	GE Healthcare
Gisela Abbam	Global Executive Director Government Affairs and Policy	GE Healthcare
Ila Dobson	Director Strategic Accounts & Government Relations, UK	GE Healthcare
Karl Blight	General Manager Northern Europe	GE Healthcare
Declan Service	Managing Director	Innovenn Ltd
Adam Briscoe	Orthopaedic Technology Manager	Invio Ltd
Ian Revie	Business Manager – Knees	Invio Ltd.
Simon Chandler	Director, New Business Partnerships	IP Group plc
Matt Chapman	Knowledge Transfer Manager, Medical Technologies	Knowledge Transfer Network
Simon Collins	Research & Development Director	MatOrtho Ltd
Mike Raxworthy	CEO	Neotherix Ltd
Peter Iddon	Development Manager	Neotherix Ltd
Richard Paxman	Managing Director	Paxman Coolers Ltd
Michael Denver	Export Manager	Pelican Feminine Healthcare Ltd
Peter Dettmar	Director / Managing Director / Director	RD Biomed Ltd / Technostics Ltd / Selfnostics Ltd
Gareth Jones		Simpleware Ltd, acquired by Synopsys in 2016
Philippe Young	Managing Director	Simpleware Ltd, acquired by Synopsys in 2016
Phil Evans	Technical Director	Techceram Ltd
Anthony O'Dell	CEO	Tissue Regenix Ltd
John Parry	Clinical Director	TPP UK
Steve Bloor	CEO	Videregen Ltd
David Farrar	Head of New Technologies	Xiros Ltd
Matthew Taylor	Director	York Health Economics Consortium (University of York)
Gary Green	CTO	York Instruments Ltd



The following people contributed through the following Advisory Boards and Executive Groups:

**Translate Advisory Board:**

<b>Translate 'Realising Medical Technologies Innovation in the Leeds City Region' Advisory Board:</b>		
Taz Aldawoud	Clinical Board Member at NHS Bradford Districts CCG	Bradford Teaching Hospitals NHS Foundation Trust
Ian Sharp	Chief Executive	DHEZ
Amanda Wilcox	Regional Consultant	HEFCE
Simon Chandler		IP Group
Julian Sorrell	Business Manager	Leeds Beckett University
Elaine Taylor-Whilde		Nine Health CIC
Edward Draper	Managing Director	Ortheia
Pete Twigg	Reader in Medical Engineering	University of Bradford
Robert Parkin	Pro-Vice-Chancellor (Research and Knowledge Transfer)	University of Bradford
Liz Towns-Andrews	Director of Research and Enterprise	University of Huddersfield
Danielle Miles	Technology Innovation Manager	University of Leeds
John Fisher (Chair)	Professor of Mechanical Engineering	University of Leeds
Josephine Dixon-Hardy	Director of Medical Technologies Innovation	University of Leeds
Lisa Hill	Innovation Development Manager	University of Leeds
Rowan Grant	Communications and Engagement Manager	University of Leeds
Sean Clarkson	Technology Innovation Manager	University of Leeds
Mark Mortimer	Director of Research and Enterprise	University of York
David Moore	Associate Director, Healthcare & Life Sciences	West Yorkshire Combined Authority / Leeds City Region Enterprise Partnership
David Farrar		Xiros

<b>MeDe Innovation Advisory Board</b>		
Alan Silman	Director of Policy & Health Promotion	Arthritis Research UK
Andrew McCaskie	Consultant Orthopaedic Surgeon	Cambridge University
Martin Champion	Healthcare Portfolio Manager	EPSRC
Richard Underwood	Manager, Biomedical Engineering	Exponent
Sue Dunkerton	Director	KTN
Simon Collins	Director of Research & Development	MatOrtho
John Wilkinson OBE (Chair)	Director of Devices	Medicines and Healthcare Products Regulatory Agency
Janette Benaddi	Director of Clinical & Consulting Europe	NAMSA Medvance
Kenny Dalgarno	Deputy Director – MeDe Innovation	Newcastle University
Peter Gore	Professor of Practice	Newcastle University
Simon Denegri	NIHR National Director for Patients and the Public and Chair, INVOLVE	NIHR
Tim Morley	Senior Director Preclinical Research	Smith & Nephew
Tony Miles	Professor of Biomechanics	University of Bath
Phil Coates	Professor of Polymer Engineering	University of Bradford
Jane Jiang	Director of EPSRC Centre in Advanced Metrology	University of Huddersfield
Jane Wilcox	Reporting and Information Systems Manager	University of Leeds
Josephine Dixon-Hardy	Deputy Director – MeDe Innovation	University of Leeds
Kelly Broadbent	Project Administrator – MeDe Innovation	University of Leeds
Rowan Grant	Communications and Engagement Manager	University of Leeds
David Grant	Professor of Materials Science	University of Nottingham
Paul Hatton	Professor of Biomaterials Science	University of Sheffield

<b>Medical Technologies Innovation and Knowledge Centre Executive Group</b>		
Kirste Mellish	Director of Operations Leeds Musculoskeletal Biomedical Research Centre	Chapel Allerton Hospital / University of Leeds
Krsto Pandza	Professor of Strategy and Innovation	Leeds University Business School
Andrew Aldridge	Technology Innovation Manager and IP Development Manager – IKC	University of Leeds
Andy Duley	Director of Commercialisation	University of Leeds
Beverley Croft	Team Secretary – Medical Technologies Innovation	University of Leeds
Eileen Ingham	Chair of Medical Immunology	University of Leeds
Graeme Howling	Technology Innovation Manager – IKC	University of Leeds
Jane Wilcox	Reporting and Information Systems Manager	University of Leeds
Jennifer Kirkham	Professor – Oral Biology	University of Leeds
Jenny Spear	Technology Innovation Manager – IKC	University of Leeds
John Fisher (Chair)	Director – Medical Technologies – IKC	University of Leeds
Josephine Dixon-Hardy	Director of Operations – IKC	University of Leeds
Philip Conaghan	Professor (Clinical) Leeds Institute of Rheumatic and Musculoskeletal Medicine	University of Leeds
Rowan Grant	Communications and Engagement Manager	University of Leeds
Ruth Wilcox	Director of the Institute of Medical and Biological Engineering	University of Leeds

The following people were panel members for an open question and answer session at the ‘The Future of Medical Technologies in the Leeds City Region’ event in Leeds on the 25th April 2017:

Amanda Lennon	Managing Partner	innov8tive Minds Ltd
Sue Dunkerton (Panel Chair)	Director	Knowledge Transfer Network
Peter Iddon	Development Manager	Neotherix Ltd
John Fisher CBE	Professor of Mechanical Engineering	University of Leeds
Josephine Dixon-Hardy	Director of Medical Technologies Innovation	University of Leeds
Neville Young	Head of Commercial Development	Yorkshire and Humber AHSN

The following people attended ‘The Future of Medical Technologies in the Leeds City Region’ open event in Leeds on the 25th April 2017 and were encouraged to provide their insights for the SIA:

Mark Wickham	Principal	Alacramed Ltd
Geetha Upadhyaya	Professor	Axxonet Global Ltd
Jennifer Turner	Physiotherapist / Innovator	Best You Can Be Physiotherapy
Brian Thomon	Researcher	Bradford University / AedStem Ltd
Walied Mowafi	Consultant Neurologist	Calderdale Royal Infirmary
John Dias	Operations Director	Click Symptoms Ltd
David Turner	CEO	Codera Ltd
Kaleigh Haeg	Head of Life Sciences	Colliers International
Graham Isacc	Director	DePuy Synthes
Allan Kellehear	Academic Director	DHEZ, University of Bradford
Ian Sharp	Chief Executive	DHEZ
Samar Betmouni	Deputy Director	DHEZ
Clive Carey	Healthcare Enterprise Business Architect	DXC
Jack Ackroyd	Marketing/Business Development	GSPK Design Limited
Vincent Scaife	Personalised Technology Co-Ordinator	Hft
Martin Connors	Patents Director	HGF
Abayomi Salawu	Consultant in Rehabilitation Medicine	Hull and East Yorkshire Hospitals NHS Trust
Ben Golland	PhD Student	IMBE, University of Leeds
Philippa Bowland	Research Assistant	IMBE, University of Leeds
Amanda Lennon	Managing Partner	innov8tive Minds Ltd
Simon Chandler	Director New Business and Partnerships	IP Group plc.
Sue Dunkerton	Director	KTN
Laurence Hogg	Programme Manager	LAHP
Suzanne Morton	Innovation Project Officer	LCC / LBU
Akbar Sheikh Akbari	Senior Lecturer	Leeds Beckett University
Dawn Knibbs	Senior Lecturer	Leeds Beckett University
Dorothy Monekosso	Director of Research	Leeds Beckett University
John Skamarauskas	Senior Lecturer	Leeds Beckett University
Joy Tasker	Senior Lecturer	Leeds Beckett University
Julian Sorrell	Business Manager	Leeds Beckett University
Marc Fabri	Senior Lecturer	Leeds Beckett University
Mario D Marion	Senior Lecturer	Leeds Beckett University

Nathaniel Milton	Principal Lecturer	Leeds Beckett University
Pooneh Bagheri Zadeh	Senior Lecturer	Leeds Beckett University
Rowena Wright	Senior Lecturer	Leeds Beckett University
Sareen Galbraith	Senior Lecturer	Leeds Beckett University
Shumei Zhang	Research Fellow	Leeds Beckett University
Graeme Howling	Technology Innovation Manager	Medical Technologies IKC
Jenny Spear	Technology Innovation Manager	Medical Technologies IKC
Tom Wright	Innovation Officer	Medilink
Agnes Crutchard	Market Intelligence Manager	Medipex Ltd
Miranda Stead	Director	Mednet Ltd
Andrew Basu-McGowan	Policy Manager	National Centre for Universities and Business
Robert Woollin	Business Development Manager	National Physical Laboratory
Neil Garner	Director	Neo Garner Ltd
Mike Raxworthy	CEO	Neotherix Ltd
Peter Iddon	Development Manager	Neotherix Ltd
Nick Jones	Managing Director	Nicholas Jones Associates
Vee Mapunde	Programme Manager	NIHR
Andrew Hewitt	Quality Manager	NIRI Ltd.
Simon Renault	Project Engineer	Omega Security Systems
John George	CSO	Oppilotech
Earle Jamieson	Director	ReSolve Research Engineering Ltd.
Peter Cowey	Director	Resurgent Growth Ltd
Peter Roll	Mechanical Design Engineering Consultant	ROLL Design Limited
S. Chakrabarty	Lecturer in Neuroscience	SBMS, University of Leeds
Ross Burton	Stakeholder Manager	Smart Specialisation Hub
Andy Smith	Consultant	Sphera Solutions
Luke Delahunty	Director	SQW
Astrid Lorenz	Patent Attorney	Symbiosis IP Limited
Adrian Sewell	Patent Attorney	Tandem Patents Limited
Ian Davie	Senior Consultant	TBAT Innovation Ltd
Phil Evans	Managing Director	Techceram Limited
Robin Simpson	Science and Research analyst	The Department for Business, Energy and Industrial Strategy
Anna LeMoine	Project Leader	Tissue Regenix
Sean Clarkson	Technology Innovation Manager	Translate
Farshid Sefat	Lecturer in Tissue Engineering	University of Bradford
Pete Twigg	Reader in Medical Engineering	University of Bradford
Stephen Williams	Programme Lead in Psychological Therapies	University of Bradford
Andrea Denton	Senior Lecturer	University of Huddersfield
Barry Timmins	Head of Business Development	University of Huddersfield
Dhruba Dutta	Researcher	University of Huddersfield
El Hassane Larhib	Senior lecturer in Pharmaceuticals	University of Huddersfield
Gemma Sweeney	Business Development Officer	University of Huddersfield



Joe Sweeney	Professor of Catalysis and Chemical Biology	University of Huddersfield
Liz Towns-Andrews	Director of Research and Enterprise	University of Huddersfield
Rajlaxmi Basu	Researcher	University of Huddersfield
Roger Phillips	Professor	University of Huddersfield
Warren Gillibrand	Senior Lecturer	University of Huddersfield
Alexandra Smyth	PhD Researcher	University of Leeds
Andrew Aldridge	Technology Innovation Manager	University of Leeds
Bethny Morrissey	Programme Manager	University of Leeds
Giuseppe Tronci	Lecturer	University of Leeds
Jane Wilcox	Reporting and Information Systems Manager	University of Leeds
John Fisher	Director	University of Leeds
Josephine Dixon-Hardy	Director of Medical Technologies Innovation	University of Leeds
Lisa Hill	Innovation Development Manager	University of Leeds
Rowan Grant	Communications and Engagement Manager	University of Leeds, Medical Technologies
Thomas Baboolal	Research Fellow	University of Leeds
Agnes Noy	EPSRC Research Fellow	University of York
James Walsh	Business Development Manager	University of York
Stephen Smith	Reader / Director	University of York / ClearSky Medical Diagnostics
Thomas Krauss	Professor of Photonics	University of York
Viswadeep Sarangi	PhD Student	University of York
Stella Johnson	Research Manager	West Yorkshire R&D
Sarah Bowes	Senior Policy Officer	WYCA
David Farrar	Head of New Technologies	Xiros Ltd
Neville Young	Head of Commercial Development	Yorkshire and Humber AHSN
Sophie Bates	Commercial Partnerships & Projects Officer	Yorkshire and Humber AHSN

**The following people provided national, regional and local policy and government perspectives:**

Andrew Battarbee	Area Director for Yorkshire, Humber and the North East	BEIS and the Cities & Local Growth Business Unit
Farhana Quasem	Policy Advisor, Innovation and Place	Department for Business, Energy and Industrial Strategy
Judith Blake	Leader	Leeds City Council
Tom Bridges	Chief Economic Development Officer	Leeds City Council
Tom Riordan	Chief Executive	Leeds City Council
Fran Spawls	Senior Policy Advisor	Office for Life Sciences
Peter Whittington	Senior Policy Adviser, Medical Technology and Finance	Office for Life Sciences
Usama Edo	Senior Policy Adviser, Regions & Resilience	Office for Life Sciences
Sir John Bell	Regius Professor	University Oxford and Office for Life Sciences
David Walmsley	Head of Economic Development	West Yorkshire Combined Authority   Leeds City Region Enterprise Partnership
James Hopton	Research & Intelligence Officer	West Yorkshire Combined Authority   Leeds City Region Enterprise Partnership
Marc Eatough	Policy & Strategy Manager	West Yorkshire Combined Authority   Leeds City Region Enterprise Partnership
Roger Marsh	Chair	West Yorkshire Combined Authority   Leeds City Region Enterprise Partnership
Sarah Bowes	Senior Policy and Projects Officer	West Yorkshire Combined Authority   Leeds City Region Enterprise Partnership

**The following people provided public health perspectives:**

Allison Page	Non-Executive Director	Leeds Teaching Hospitals NHS Foundation Trust
Julian Hartley	CEO	Leeds Teaching Hospitals NHS Foundation Trust
Linda Pollard	Chair	Leeds Teaching Hospitals NHS Foundation Trust
Simon Neville	Director of Strategy and Planning	Leeds Teaching Hospitals NHS Foundation Trust
Stephen Smye	Director of Research and Innovation	Leeds Teaching Hospitals NHS Trust and Director, NIHR CCRN
Jonathan Sheffield OBE	Chief Executive Officer	NIHR Clinical Research Network Coordinating Centre

**The following people provided research and higher education perspectives:**

Laurence Hogg	Change Manager	Leeds Academic Health Partnership
Paul Smith	Deputy Vice Chancellor	Leeds Beckett University
Peter Slee	Vice Chancellor	Leeds Beckett University
Mark Birkin	Director	Leeds Institute for Data Analytics
Philip Waywell	Research and Innovation Development Manager	Leeds Institute for Data Analytics
Patricia Connolly	Director	Strathclyde Institute of Medical Devices/University of Strathclyde
Joseph Sweeney	Professor of Chemistry	University of Huddersfield, Department of Chemical Sciences
Ceri Williams	Director of Research and Innovation Development	University of Leeds
Julia Brown	Director Clinical Trials Research Unit	University of Leeds
Lisa Roberts	DVC	University of Leeds
Paul Stewart	Dean of Medicine and Health	University of Leeds
Peter Jimack	Dean of the Faculty of Engineering	University of Leeds
Ruth Wilcox	Director of the Institute of Medical and Biological Engineering	University of Leeds
Trudie Roberts	Director, Leeds Institute of Medical Education	University of Leeds
Vania Dimitrova	Associate Professor, School of Computing & Leeds Institute of Medical Education	University of Leeds

**The following people provided regional innovation perspectives:**

Luke Raikes	Research Fellow	IPPR North (author of 'Health innovation: Breathing life into the northern powerhouse')
Darren Clark	Chief Executive	Medilink East Midlands

# Appendix 2: Case studies

## DePuy Synthes-University of Leeds Partnership: Impact and Future Opportunities



DePuy Synthes, part of the Johnson & Johnson Family of Companies, is one of the largest orthopaedics companies in the world, providing innovative solutions for hip, knee and shoulder replacement. A DePuy Synthes Research and Development Centre is based in Leeds, and is a key hub in the worldwide DePuy Synthes Innovation network.

The world-leading Institute of Medical and Biological Engineering at the University of Leeds has a long standing strategic research partnership with DePuy Synthes extending over 17 years.

The partnership supports research, innovation, product development, high level skills and training. It has led to improved understanding of joint replacements for millions of patients worldwide, new simulation test methods and equipment. During this time investment by Johnson & Johnson as well as Governmental Regional Growth Funding has led to the expansion of the DePuy Synthes research and development centre and in the same period the Institute has grown five-fold to over 100 post graduate researchers.

Capacity building for the future of the industry is integral to the partnership. The collaboration has directly supported the work and development of over 50 doctoral researchers, with visiting industry professors and fellows, industry mentors and researchers from the company contributing to education, research, programme oversight, advisory boards and training in the University. More than 25 University of Leeds alumni graduates work for DePuy Synthes worldwide.

### The impact of the partnership reaches well beyond the collaborators themselves.

- During the last 17 years, translation of technology has benefited patients across the globe
- The distinctive collaborative multidisciplinary training environment across ten different University Departments, has benefited over 200 graduate medical engineers, supporting the development of a diverse group of people and disciplines, who have progressed to successful professional and academic careers
- The wider academic community have gained from the publication of over 100 collaborative peer reviewed journal papers which have been cited over 5,000 times
- The global orthopaedic community has benefited from development of enhanced international standards for pre-clinical wear simulation methods.

### Notwithstanding these successes, there are opportunities to fill significant gaps in the ability of the region to deliver innovative, proven treatment solutions which will address the healthcare needs of patients around the world.

#### Two potential examples of this would be:

1. Undertake early stage clinical trials efficiently and quickly to determine the safety and efficacy of new medtech solutions.

**Opportunity:** Establishment of a network of region-wide clinical centres of varying levels of specialisation, with diverse patient population but with a single point of entry to enable rapid enrolment of subjects and a focussed evaluation protocol to answer key safety and efficacy questions in the shortest timescales.

2. Provide the multi-disciplinary digital skills to collect targeted data which will clearly demonstrate improvements in patients' ability to carry out activities of daily living.

**Opportunity:** Exploitation of wearable technologies and remote data collection pathways that will facilitate acquisition of dense datasets from patients to a central data analysis facility. This would involve minimal interruption of their daily routines and without the involvement of a healthcare professional.





Over **25**  
University of Leeds  
alumni graduates work  
at DePuy Synthes

over **100** collaborative  
peer reviewed journal papers  
cited over **5,000** times

## Invibio Biomaterial Solutions: Business Background: Proven history in clinical use of implantable PEEK polymers



From the initial commercial introduction of the high performing PEEK\* polymer as a biomaterial Invibio Biomaterial Solutions (Invibio) has, for more than 15 years pioneered advances in the application of implantable polymers such as, PEEK-OPTIMA™ in a variety of applications including e.g. spine. Today, approximately 9 million implanted devices worldwide use Invibio polymers and Invibio projects by 2025 its solutions will treat a patient every 15-20 seconds.

Corresponding to the company's mission to facilitate medical-device innovation by providing new solutions and support for PEEK-related research, Invibio is sponsoring/supporting a cross-sector forum, the International PEEK MEETING, for sharing and discussing latest advances that are both independent and international in scope.

### Strategy: Accelerate adoption by focusing on targeted programs

Significant opportunities to develop PEEK-OPTIMA™ polymer exist and material sales continue to grow within the growing medical devices market. In addition Invibio has evolved its strategy to also move downstream to develop higher value implantable products in three well defined areas: Dental frames, Trauma plates and Femur component in Knee replacement. In these new medical programmes, our emphasis continues on market adoption through support data (from pre-clinical testing and clinical trials) and engagement with key opinion leaders and market influencers. To deliver this strategy we need improved access to pre-clinical test capability and access to clinical trials centres.

### Business objectives: In-depth expertise in further special disciplines

This strategic decision to complement materials technology alongside high value application led products necessitates a change in business approach and requires a change in skill levels within our business that spans from material knowledge to product function, from material manufacture to product manufacture and has to be/is founded on skills in R&D, manufacture, quality and regulatory and introduction of product related clinical evidence management.

This knowledge base requires in-depth expertise in material technology, in addition to expertise in medical device product applications and manufacturing processes across all technical functions, which takes a significant time to develop in-house or becomes challenging to recruit.

However, this knowledge base is essential to deliver the additional high value from platform technologies. As we have developed this business over the last 4 years, during recruitment, the skills gap has become more evident from the basic science through market application.

Invibio  
will treat a  
patient every  
**15 - 20**  
seconds by 2025.

### Business requirements: Solving identified challenges

Downstream product development requires firstly materials development and testing followed by extensive pre-clinical product testing and often first in-man clinical trials to ensure product safety and to meet regulatory approval. Additionally following safety approval, pre-clinical and clinical studies are required to enable market entry. At Invibio, we conduct the pre-clinical testing and our customers conduct the clinical studies. We find broadly in the UK, pre-clinical testing capability and the ability to develop testing from first principles has been available to us from universities such as Leeds University iMBE.

However the scale currently available to us limits our rate of development. We also experience via our customers that the following stage of clinical trials is largely unavailable to us in the UK because of a lack of clear systems and processes along with corresponding core knowledge and science. The result is that our customers will conduct clinical trials abroad.

In these first technology transformation projects, Invibio has continued to invest in excess of £10m in development, where possible generating external support from small scale government grants which support early stage innovation and a limited amount of pre-clinical testing.

To continue proliferation of projects and to realise the global potential of these projects, we hope to see continued innovation support for proof of concept, pre-clinical testing and improved support for early stage clinical evaluation.

Excess of  
**£10m**  
investment in  
development

\* PolyEtherEtherKetone

## Invibio:

- UK Headquarters
- medical wholly owned subsidiary of Victrex PLC;
- over 70 employees worldwide
- generates £51m in sales with 98% from export
- 9 million implants worldwide use Invibio's PEEK-OPTIMA™
- *Vision:* to deliver new applications that improve patient clinical outcome in Dental, Trauma and Orthopedics.

## Victrex plc:

- UK Headquarters
- an innovative world leader in PEEK (PolyEtherEtherKetone) solutions
- employs more than 700 people worldwide
- listed on the London Stock Exchange; market capitalisation of over £1.5 billion
- annual revenue of £252m (2016, including Invibio), 97% of which is export
- Everyday, millions of people use products and applications, which contain Victrex materials – from smart phones, aeroplanes and cars to oil and gas operations and medical devices.



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