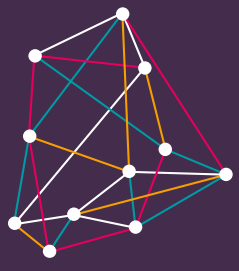
A Northern Life Sciences Supercluster: The Economic Potential of a Systemwide Approach

September 2021

nhsa
Northern Health Science Alliance
A Health Partnership for Northern England

NP11



An NP11 and NHSA report

NP11
The Northern Powerhouse 11 (NP11) is made up of eleven Local Enterprise Partnerships (LEPs) across the North of England.

The Northern Powerhouse Independent Economic Review (SQW, 2016) found that the economy of the North has the potential to grow by 15% by 2050 - creating an extra 850,000 jobs more than the business as usual scenario.

The NP11 has shown that this significant economic potential should be unlocked through greater cooperation between the LEPs in strategic focus areas with pan-Northern benefits, bringing together the unique characteristics, assets, values and cultures of the different cities, towns, and rural communities to create a Northern Powerhouse.

This type of transformational economic development would also help the British economy to overcome other structural issues, achieving growth through increasing exports, boosting productivity and closing the regional economic divide.

NHSA
The Northern Health Science Alliance (NHSA) is a health research partnership between the leading NHS trusts, universities and Academic Health Science Networks in Northern England.

We were established in 2011 with a mandate from our member organisations to act, and add value, across the North on their behalf.

We work together with our members, industry and Government to mobilise the North's assets for the benefit of the people and the economy.

We do this by brokering research and innovation collaborations, building expert networks, attracting investment, and providing a unified voice for the region's health research system.

NP11

nhsa
Northern Health Science Alliance
A Health Partnership for Northern England

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ekosgen, a specialist economic consultancy company, supported by the NHSA, undertook extensive consultations and research to provide the evidence base for this report

Foreword

The 2020s will be a defining decade for the UK as it emerges from the COVID-19 pandemic, establishes its place in the world outside of the EU and sets out to tackle decades-long regional disparities in both economic performance and health outcomes.

Driving prosperity through research and innovation has been placed at the core of the UK Government's long-term recovery strategy. Health and life sciences are a globally recognised UK strength, across all regions and nations of the UK. No other sector provides as big a boost to the economy and no other sector directly impacts the health of its population in the same way. Like all industries, the life sciences are seeing a revolution as technologies converge. The future is multidisciplinary and requires multiple partners to deliver on the potential benefits of the sector.

This includes the globally respected NHS, UK universities, Local Enterprise Partnerships, Catapults and strong industry leadership working together to support the growth of innovative clusters across the UK. The system-wide integration of assets and partnership working will be essential in realising the country's full potential in life sciences.

We note and welcome the recent Life Sciences Vision[1] and its aspirations in terms of levelling up and making the UK the leading global hub for life sciences. The North can play a central role in realising this vision. This report sets out the potential within the North to contribute to the UK remaining a research and innovation powerhouse. It also sets out how the UK can position itself as the high-value, high trust, centre of excellence that the global health system needs. It can do this by building a system and culture that are focussed on real-world evaluation and partnership with innovative global companies. To do otherwise would risk being outpaced by the established competitors, USA, Europe and China, or by rapidly emerging new players across Asia, Latin America, and Africa. Global leadership in life sciences requires every region of the UK to fulfil its potential, and for the NHS in particular to be a full participant.

Finally, new growth must be inclusive and not serve to entrench inequalities across the country. The South East alone makes great contributions to UK life sciences but in combination with the strengths of the North, the collective UK health and life sciences offer to the world becomes significantly more resilient and compelling.

Responding to the opportunities identified here requires an understanding of how to better link research excellence to our strong, established industrial base and a commitment to provide long-term, strategic support towards this goal at regional and local levels.

This report highlights how far we have moved in the North towards system working and partnership. There is valuable learning in this for other regions and other sectors. These ambitions are achievable; but require a new way of working and an investment-driven outlook.

This report sets out how the NP11 and the Northern Health Science Alliance can support the Government in investing in a systems approach to delivering economic growth, powered by deep sectoral expertise and by including a breadth of knowledge and backgrounds not attempted before in the UK.

Our shared ambition is the creation of a Northern Supercluster for health and life sciences to drive forward the health, wealth and resilience of the entire nation, building on existing nationally and internationally recognised strengths.

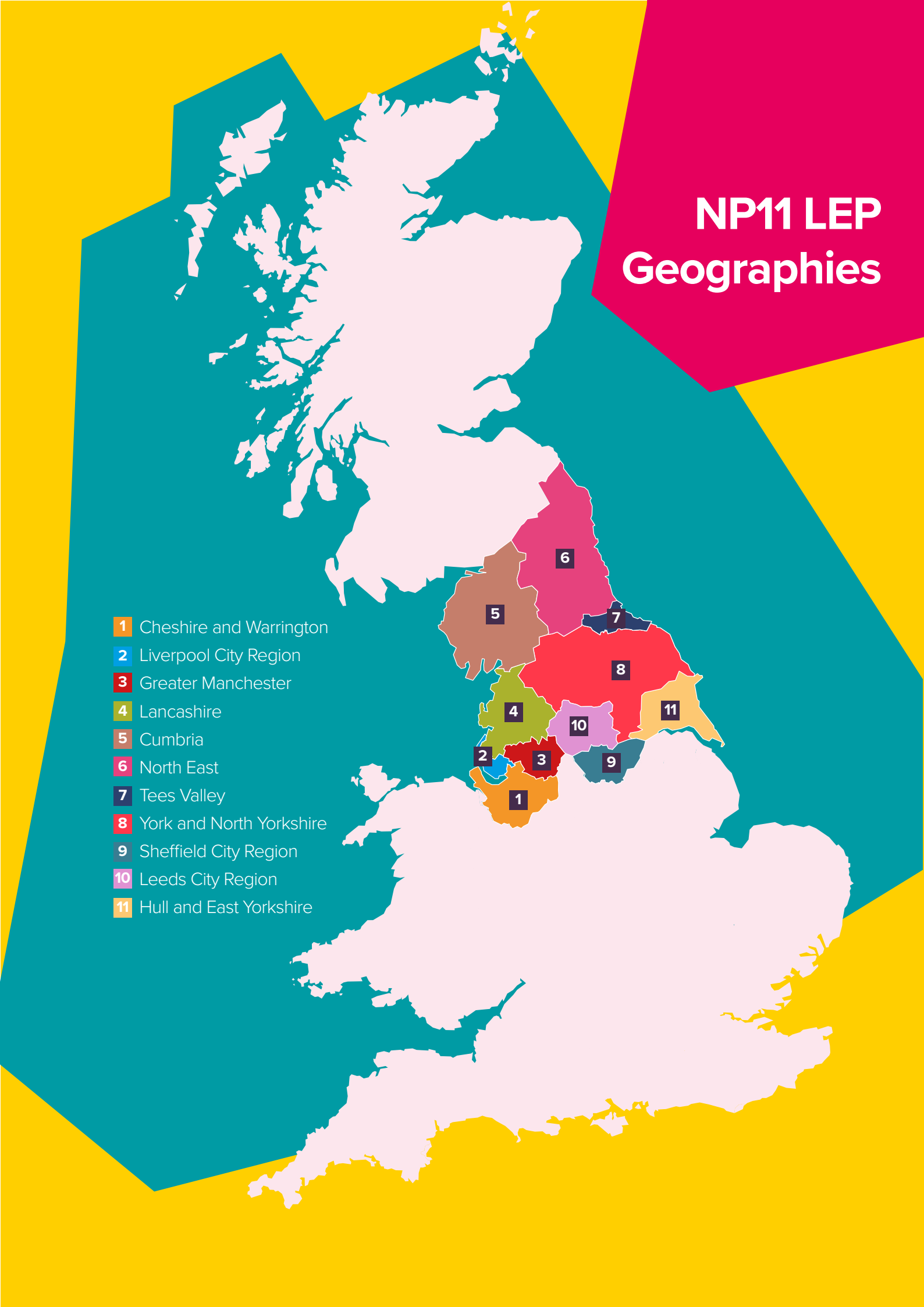
Sir Roger Marsh
NP11 Chair

James Muir
NP11 Innovation Chair, Sheffield City Region Local Enterprise Partnership Chair

Dr Séamus O'Neill
NHSA Chief Executive

Professor David Burn
Pro-Vice Chancellor, Newcastle University and NHSA Chair

NP11 LEP Geographies



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Executive Summary

By 2040, economic growth predictions see jobs in the Northern life sciences sector increase from

54,100

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£5.17bn to **£16.52bn**

A Northern health and life sciences Supercluster would strengthen the UK's global offering in the field, address levelling up based on excellence and opportunity and support a place-based approach to research, skills and innovation.

This report by the NP11 Local Enterprise Partnerships (NP11) and the Northern Health Science Alliance (NHSA), sets out how a second UK life sciences Supercluster complimentary to that in the South East could in the next 20 years double employment and treble Gross Value Added (GVA) in the sector.

Built on the strengths of the North's £13.6bn life sciences economy and home to 21% of the UK's total life sciences workforce, the Supercluster will strengthen the region's Local Enterprise Partnerships (LEPs) and Combined Authorities (CAs), research intensive universities, Catapults, NHS Trusts, Academic Health Science Networks (AHSNs), Academic Health Science Centres (AHSCs), Science Parks and other stakeholders, enhancing the UK's global industry offer.

The Supercluster would build resilience in the UK's health system, enabling it to tackle future pandemics and directly aid tackling health inequalities in the region which cost the UK £13.2bn a year in lost productivity.[2]

Levelling up the economy in life sciences research and innovation should be based on the mantra that "if it can be done in the North then it should be done in the North".

Summary of Findings

The leading LEPs, research intensive universities, NHS hospital trusts and AHSNs across the North have committed to working together to build a life science Supercluster.

The North of England has four globally-important areas of opportunity where its research excellence and innovation capacity is matched by opportunity in the market:

- Advanced Therapies
- Infectious Diseases
- Diagnostics and MedTech
- Data and Artificial Intelligence

The North of England also has two challenge-driven areas of opportunity, where its globally-important expertise meet growing regional, national and international needs arising from specific challenges to the sector:

- Healthy Ageing
- Mental Health and Wellbeing

By supporting these areas of opportunity as a Supercluster through the NHSA and the NP11, the life sciences sector in the North would be doubled over 20 years, creating an additional 64,600 jobs. The GVA added to the national economy from the sector would more than treble from £5.17bn to £16.52bn. A talent pool and world-class infrastructure would be created to attract new companies into the region.

Crucially companies already working in the North would be anchored there and drive innovation-led growth.

The creation of a Northern Supercluster in life sciences would directly benefit patients in the region, build UK resilience through development of assets and excellence in the North and play a role in reducing health inequalities.

The Northern Supercluster

The life sciences sector can make an exceptional contribution to increasing productivity in the region, with growth based on:

- Increased levels of public and private sector investment in Research and Development (R&D) and innovation leveraging world class pan-Northern assets, partnerships and collaboration;
- A business ecosystem which supports new company formation and company growth, as well as anchoring existing business in the UK;
- An incentive system which encourages company investment in life sciences innovation and new development; and
- A skills system which meets the needs of the whole life sciences sector. This would increase productivity through meeting entry-level to higher-level skill needs of all parts of the life sciences sector.

With the development of a Northern health and life sciences Supercluster:

- Jobs in the sector are predicted to increase from 54,100 in 2020 to 118,700 in 2040.
- Productivity measured in GVA is estimated to grow from £5.17bn in 2020 to £16.52bn in 2040. Further, this systems-led approach, applied to other areas of the UK could result in 775,000 jobs by 2030 as shown in the "Economics of Health" by Future Health and WPI.[3]

Market Opportunities

The North of England has four globally-important areas of opportunity where its research excellence and innovative capacity is matched by opportunity in the market. The central premise of this report is the concerted focus on, and investment in, these areas, which will have a dramatic effect on the regional and UK economies.

Advanced Therapies

There is a global opportunity for the North to build on a world-leading competitive edge in advanced therapy development, evaluation and clinical delivery, particularly in high priority areas such as cancer.

This has the potential to drive substantial economic growth in the NP11 geography with the potential for high productivity jobs growth. A Northern Advanced Therapies Accelerator for the development, evaluation, manufacturing capacity and clinical delivery of industry-led innovation, delivered through connecting and scaling existing centres and networks, would provide a lab to bedside development, evaluation, manufacturing and delivery vehicle for cutting-edge treatments.
Doing so would develop high impact treatments, especially in cancer. It would support the growth of the biopharma sector in the North, predicted to generate 17,200 jobs over the next 10 years.

Advanced Therapy employment has the potential to grow 650% by 2032, compared to a projected growth of 490% for the UK as a whole.

This would result in an additional £3.1bn for the UK economy.

Infectious Diseases

There is a valuable opportunity to build on world-class capabilities and expertise in infectious diseases in the North. Successes demonstrated through population/system-wide approaches include COVID-19 testing, vaccine trials, clinical trials and the clinical delivery and validation of novel therapeutics, early clinical characterisation and monitoring disease spread. There are now opportunities to apply the same population/system-wide approach to antimicrobial resistance (AMR) infections and future pandemic preparedness. Working alongside industry, NHS expertise in the North is leading on major pan-European studies.

There is a need to develop a series of specialist research platforms for infectious diseases therapeutics and scale up and extend the infection innovation CONsortium (iiCON) approach of public private partnership to pan-Northern level. iiCON helped lead the AGILE trial which enabled rapid evaluation of potential COVID-19 treatments.
This would enable further partnerships between SMEs, research institutions and large scale industry to drive adoption at scale. In addition, building capacity in Phase 1 vaccine trials will harness the clinical excellence and capabilities in the NHS.

By 2032 it is anticipated that the North will have increased its infection R&D investment by £2bn over 10 years, increasing related annual GVA to £3bn by 2032.

Diagnostics and MedTech

The UK has the opportunity to position itself as the pre-eminent location for co-development of game-changing diagnostics and medical technologies with industry.

The North is well placed to do so as a high-trust, high-evidence test bed that rapidly adopts proven innovation. This offer to work rapidly at scale, and to the highest standards, would be and is globally leading. The UK Government should support a new National Diagnostics Centre, based in the North of England, to provide a UKRI-funded Diagnostics Centre of R&D Excellence and develop, from that, a Diagnostics UK platform to secure the UK's future as a high-trust environment to rapidly develop and adopt new diagnostic technologies.

This Centre would embed and build on the success of the CONDOR evaluation platform. Further, it should create a medtech equivalent platform and provide resource to direct the platform to accelerate evaluation and adoption in areas of high need, including NICE-specified lower volume clinical areas.

The convergence of digital technologies, data analysis including AI and traditional medical technologies requires a platform for development and real-world evaluations to drive adoption at scale.
Formation of intelligence-led integrated care systems across the North provides a platform for deeper, faster medtech validation as shown with rapid antigen testing in pandemic responses. Investment in models of partnership and systemwide working that are being pioneered in the North of England, within existing clusters of strength, shows exceptional growth potential and employment could double over a 15-year-period.

This would result in the Northern medtech sector being worth £7.8bn in 2032.

Data and Artificial Intelligence

The UK National Health Service (NHS) is the single largest integrated health care provider in the world, with population-wide patient records from birth to death.

The NHS and partner local government agencies across the UK, particularly the North, wish to grasp the digital-first, post-pandemic momentum and offer more agile civic health and care systems – joined-up with data, combined intelligence and AI. By establishing a Civic Data Grid as a delivery body, the North will pull-through data, data-science and AIs into ethical, citizen-involved and sustainable innovations.

A Northern grid of Civic Data Co-operatives, feeding sub-regional and pan-regional applications, would boost advanced therapies, diagnostics and medtech research and innovation.

Investing in a jointly accountable network of data/AI teams in key organisations will reduce duplication and focus the timely development and evaluation of data-driven tools. The added pace and scale of data uses will enable the North to offer an NHS AI Sandbox that can partner with regulators to put UK AIs for health at the forefront of trustworthy innovation worldwide.

The value of NHS data alone was estimated at ~£5bn per annum, delivering ~£4.6bn of annual benefit to patients in NHS operational savings, enhanced outcomes and wider economic benefits. The North is ready to realise the UK's potential grid of civic data clusters advancing health & social care and population health management.

Challenge Driven Opportunities

There are two challenge driven opportunities which will support research and innovation in biopharma, diagnostics, data and medtech over at least the next ten years. The response to these challenges is driven by a combination of research strengths, demographic factors and potential positive economic contributions and have been identified to play a role in the future of health and life sciences innovation in the North:

Healthy Ageing

Although life expectancy has been increasing, the associated increase in healthy life expectancy has not kept pace.

Between 2009-2011 and 2016, the proportion of life spent in good health in the UK has decreased from 79.9% to 79.5% for males, and from 77.4% to 76.7% for females.[4]

Significant disparities are also evident across the UK with the difference in healthy life expectancy between the most and least deprived places being 18.9 years for males and 19.4 years for females. [5]

Whilst this has implications for economic contribution and pressures on the health and care system, there are opportunities within this health challenge.

Supporting an ageing population to benefit from a healthier life for longer can contribute to an extended working life, benefits to the economy and cost savings for the NHS. Analysis in 2018 by the NHSA found that improving health would reduce the productivity gap per-person per-hour between the Northern Powerhouse and the rest of England by 30%, generating an additional £13.2 billion in UK GVA.

The prosperity of the North will become increasingly linked to the economic engagement and productivity of its ageing workforce.

Health innovations and skills development have central roles to play in supporting the healthy ageing agenda, with activity to be taken now to support the North to respond to both the challenges and opportunities the changing population profile will present.

Mental Health and Wellbeing

The UK, and the North of England in particular, is facing a crisis in mental health need and support. Before the COVID-19 pandemic, the Kings Fund estimated the 8.65 million people with major mental health problems in the UK will increase by 14% by 2026.[6]

The Centre for Mental Health suggests 500,000 additional people will require support for their mental health in the next two years.[7]

This will have profound personal, social and economic consequences for the country. Mental health problems are of particular concern in the North. Pre-COVID-19, mental health problems were 74% higher in the North of England than the rest of England and in a recent report the NHSA estimated reductions in mental wellbeing in the North could cost the UK economy up to £5bn per year in reduced productivity, measured in GVA output.[8]

There is a need for evidence-based interventions to support both the prevention and management of mental health problems. To make sure the best mental health interventions reach patients quickly, an innovation infrastructure needs to be established and hard-wired into the NHS to help it cope over the coming years.

We recommend setting out a Challenge Fund for industry-led approaches to the development of robust, high trust, high efficacy mental health and wellbeing interventions.

Aligned to this Challenge Fund, we seek to establish a Northern Mental Health Innovation Accelerator, an innovation infrastructure that brings together the mental health assets across the North for the benefit of industry.

The Accelerator would: develop and evaluate digital solutions for mental health service delivery; work across the public and private sector to support the UK workforce and improve productivity; provide data-led intelligent mental health care and treatment using AI; work with Industry to develop and evaluate new products, services and improved care delivery processes by utilising the large scale Northern datasets from the Civic Data Co-operatives.

Recommendations

Recommendation One: Commit to, and invest in, a Northern Supercluster

Action for: Government, NP11, NHSA

To achieve the potential economic and health benefits for the UK through the growth of a Northern Supercluster, we ask that Government, UKRI and NHS England and NHS Improvement (NHS E&I) work with the NP11 and the NHSA (as well as industry partners and trade bodies such as ABPI, ABHI, BIA and BIVDA) to support our cluster approach to economic growth in the North. This should be focused on the four areas of key market opportunities and two opportunity challenge areas identified in this report, in which there is both a critical mass of excellence and a requirement for focused investment to address industry need.

Market opportunities mapping onto critical mass of excellence in the North have been identified in the following areas:

1.1 Advanced Therapies

Create a Northern Advanced Therapies Accelerator to catalyse development, evaluation, manufacturing capacity and clinical delivery of industry-led innovation, delivered connecting and scaling existing centres and networks. This would provide a lab to bedside development, evaluation, manufacturing and delivery vehicle for cutting-edge therapies.

1.2 Infectious Diseases

Develop a series of specialist research platforms for infectious diseases therapeutics and scale up and extend the infection innovation CONsortium (iiCON) approach of public private partnership to pan-Northern level. This would enable further partnerships between SMEs, research institutions and large-scale industry to drive adoption at scale. An added value of a government commitment to invest in a Northern Supercluster would be the ability to leverage the Northern grid of data-intensive health and care systems, to instrument infection dynamics and measure the impacts of interventions system-wide.

Build capacity in Phase 1 vaccine trials to harness the clinical excellence and capabilities in the NHS.

Invest to increase capacity and capability in the Northern Biopharma manufacturing cluster, to deliver the UK vision to be a global centre for the development, manufacture and use of cancer vaccines and immunotherapies.

1.3 Diagnostics and Medtech

Support a new National Diagnostics Centre, based in the North of England, to provide a UKRI-funded Diagnostics Centre of R&D Excellence and develop, from that, a Diagnostics UK platform to secure the UK's future as a high-evidence, high-trust environment that rapidly develops and adopts new diagnostic technologies. This platform would build on the success of the CONDOR evaluation platform.

Further, create a medtech equivalent platform and provide resource to direct the platform to accelerate evaluation and adoption in areas of high need, including The National Institute for Health and Care Excellence (NICE) lower volume clinical areas. The convergence of digital technologies, data analysis including AI and traditional medical technologies requires a platform development and real-world evaluations to drive adoption at scale.

1.4 Data and Artificial Intelligence

Establish a Civic Data Grid as a delivery body for health pulling through data, data-science and AIs into ethical, citizen-involved and sustainable innovations. This Northern grid of Civic Data Co-operatives will feed sub-regional and pan-regional data science and AI, boosting research and innovation in advanced therapies, diagnostics and medtech.

Investing in a jointly accountable network/taskforce of data/AI teams in key organisations will reduce duplication and focus the timely development and evaluation of data-driven tools. This will enable the North to offer an NHS AI Sandbox that can partner with regulators to put UK AIs for health at the forefront of trustworthy innovation worldwide.

Opportunity Challenges have also been identified where there is a need for focussed investment and activity on supporting industry to address key areas of need in:

1.5 Healthy Ageing

Set out a new Challenge Fund in Healthy Ageing and leverage the activity to tackle health inequalities, including:

- Supporting the transition to a life course approach to Healthy Ageing, following the national government priority of prevention over intervention.
- Expanding ageing specialist research centres and providing pump priming funding to support the development of the next generation of therapeutics, medtech, diagnostics and digital health products that support the management of long-term conditions.
- Invest to add supply chain and service resilience in areas found wanting in the pandemic response.

1.6 Mental Health and Wellbeing

Set out a Challenge Fund for industry-led approaches to the development of robust, high trust, high efficacy mental health and wellbeing interventions. Aligned to this Challenge Fund, establish a Northern Mental Health Innovation Accelerator, an innovation infrastructure that brings together the mental health assets across the North for the benefit of industry. The Accelerator will:

- Develop and evaluate digital solutions for mental health service delivery.
- Work across the public and private sector to support the UK workforce and improve productivity.
- Provide data-led intelligent mental health care and treatment using AI.
- Work with industry to develop and evaluate new products, services and improved care delivery processes by utilising the large-scale Northern datasets from the Civic Data Co-operatives.

Recommendation Two: Increase capacity and scale for Pan-Northern Collaboration, Partnerships and Investment

Action for: NP11, NHSA

Realising the opportunity of the Northern life sciences Supercluster is dependent upon working at a scale that goes beyond existing administrative boundaries in the North.

We intend that the 11 LEPs and the NHSA will work together to deliver a pan-Northern, systemwide approach that brings together university and NHS expertise with national and local government, universities, innovators and financial capital to address industry need.

We will work with national government to put in place pan-Northern partnerships and greater connectivity between academic and NHS assets in the life science sector and between the public sector and the North's manufacturing and industry assets, including:

- High quality support for industry within the NHS and academia, with clear metrics for delivery.
- Industry championed cluster development and networking, acting across LEP boundaries, building on the NHSA-run professional networks and NP11 LEP life sciences expertise.
- Fully engaging NHS leadership in creating a new paradigm of partnership with industry to support innovation, real-world evaluation and adoption.
- Maximising Life Science Cluster collaboration across the UK, building on strong North-South axis of partnership with MedCity and rapidly developing collaborations with HIRANI in Northern Ireland, the Scottish Life Science Cluster, the Midlands Cluster and the Health Tech regional clusters (supported by UKRI), amongst others.

Recommendation Three: Address barriers to business innovation and growth in the Northern life sciences Supercluster

Action for: NP11, NHSA, Government

This report identifies some specific barriers to the growth of the life sciences industry in the North, which will need to be overcome for the Supercluster to reach full potential. We will look to work with partners, including Office for Life Sciences, Innovate UK, UKRI, BEIS and DIT to:

- Develop dedicated pan-Northern support for innovative SMEs to flourish and scale.
- Invest in the people, skills and talent needed to grow the life sciences workforce through developing a Life Sciences Skills Action Plan that addresses both national and regional needs.
- Support the NHS and universities to work with businesses within the life science sector to bring innovative products to market more quickly; and crucially, build capacity and skills across the North to do this at scale.
- Improve access to finance for innovation for companies within the North.
- Increase the international visibility of the Northern life sciences Supercluster and drive foreign direct investment (FDI) in the North by better co-ordination of the existing and future innovation pipeline infrastructure.

Recommendation Four: Address wider national requirements for innovation in life sciences sector

Action for: Government

The report notes the wider nationally relevant policy requirements that will be necessary to support a vibrant life science sector. The NP11 and the NHSA will continue to contribute to and inform the development of policy in these areas.

- Commit to investing additional public sector Life Science R&D funding through the 2.4% of GDP target into the North; particularly where businesses are making greater R&D investments.
- Create an innovative regulatory environment so that the UK can lead globally on high-trust, evidence-based development, evaluation and adoption, building on the globally recognised assets of the NHS, NICE, and MHRA.
- Embed the lessons from COVID-19 and prepare for the regulatory challenges of Artificial Intelligence, "Internet of Things" enabled medtech including wearables, digital therapeutics and digital health applications.
- Consult on direct and indirect support to SMEs to determine the extent to which higher levels of state aid subsidy/support would accelerate the commercialisation of research and innovation.
- Review a range of fiscal and other tools available to support high growth companies, and how the tax system enables or incentivises UK-based companies to grow and remain in the UK.

Part 1

A Northern Life Sciences Supercluster

Section 1
Introduction

Report scope

This report is the output of a study of the health and life sciences sector in the North area of the UK.

It was commissioned by the NP11 network of Local Enterprise Partnerships (LEPs) located in the North of England, with the study managed by the Northern Health Science Alliance (NHSA).

The study included:

- A literature and economic review of the life sciences sector, at national and Northern level.
- A LEP-by-LEP review of Local Industrial Strategies and, where available, health and life sciences Strategies, meetings and consultations with sector representatives across the North.
- A sector briefing session that provided an opportunity for a cross-section of industry to respond to and refine the analysis.

The report draws on evidence collected across the stages above to highlight existing strengths across the North and areas of opportunity, as well as the actions needed to secure pan-Northern collaboration and growth in these areas.

Local examples of leading life sciences assets and programmes of activity are cited throughout the report, illustrating both the breadth and depth of excellence that is already evident.

These references are not exhaustive, with many wider examples of expertise also evident across the North's anchor institutions and wider network of organisations with an active role to play within the health and life sciences innovation agenda.

Why life sciences?

The themes identified in the *Life Sciences Industrial Strategy* for the long-term success of the life sciences sector, focus on creating a vibrant and large-scale interface between the NHS, academia, citizens and industry.[9]

Such an arrangement is mutually beneficial and will transform the public's understanding of the role of life sciences companies in their health and wellbeing, highlighting life sciences as an economic sector and a key contributor, through innovation, to important societal benefits linked to the NHS and wellbeing.

Increasing the UK's expenditure on R&D is a national economic priority, a factor which has been historically low compared to other countries.[10] The health and life sciences sector will need to play a major role if the country is to meet the stated ambition of 2.4% of GDP being invested in R&D by 2027.[11]

The North's life sciences economy was worth £13.6bn in 2017 and was home to 21% of the total UK life sciences sector workforce, 19% of the UK biopharmaceutical sector workforce, 22% of the UK medical technology sector workforce and a third of the UK digital health workforce.[12] As such, it provides a range of opportunities for further R&D investment and innovation-led economic growth.

However, the challenge of building on the North's life science strengths is reflected in Nesta's *The Missing 4 Billion* report which estimates that UK regions have missed out on Government R&D spending to the tune of £4bn each year which could have leveraged a further £8bn each year, from the private sector.

Health and life sciences needs to be considered as an important economic sector for the Northern economy, with considerable growth prospects based on its research and business base, including the presence of recognised centres of excellence, international businesses and innovative SMEs.

In addition, there is Government and societal interest in the products, services and innovation the sector offers, making Government both an investor and a customer.

Building the Northern Supercluster

The North has established structures in place to support the creation of a Northern life sciences Supercluster.

Alongside the academic, public health and industrial expertise outlined throughout this report, it has organisations operating across the geography that recognise the strengths of the North, in its own right and as a core component of the national economy, and that seek to further strengthen its contribution.

The North also has a large inter-connected industrial and supply chain base, the presence of public and private sector research institutions and increasing collaboration and innovation supported by an ecosystem provided by specialist agencies and investors.

Research from Savills highlighted a 'Northern Arc' within the life science companies attracting capital during 2020, supported by strong universities.[13]

The mapping suggests that the North provides the second focus for capital transactions in England, behind the Oxford-Cambridge Corridor.

Noting anticipated continued strong interest in the UK's life science sector, the need to establish research facilities across the whole of the UK is highlighted, providing a further opportunity for Government to harness the North-South axis of excellence in life sciences. These two components, aligned and mobilised, constitute a significant majority of the UKs global cluster in life sciences.

The NP11 is the business led voice of the North which brings together the 11 Local Enterprise Partnerships from across the North of England, which has played a leading role in supporting innovation in health and life sciences.

It provides a partnership between the public and private sectors and with Government that aims to drive prosperity and improve lives. It is investment focussed, partnership driven, and business led. The NP11 and its member LEPs are committed to removing boundaries between industries, strengthening innovation ecosystems and establishing networks and places for people to interact and encourage investment.

The NP11 brings together innovation leaders from LEPs, businesses, networks and hubs, academia, and Government to work collaboratively, creating a clear framework for partnership between the North and UK Research and Innovation (UKRI) and other national R&D agencies. This will support not only local and regional innovation strategies, but also national ambitions to drive investment in the North.

The NHSA is the North of England's health partnership, working across a population of 16 million people, bringing together ten universities,

ten research-intensive NHS trusts and four Academic Health Science Networks (AHSNs). It has been instrumental in supporting innovation, collaborative working and linking the NHS and research centres with the life science industry. The NHSA's mission is to unlock the combined potential of the North's health research and innovation assets for the benefit of the people and the economy.

Since its inception, the NHSA has mobilised and connected the North's health and life sciences cluster with a focus on the utilisation and deployment of NHS and university assets, developing collaboration and investment opportunities for member organisations and industry partners.

The partnership with the four Northern AHSNs – and the future innovation functions of Integrated Care Systems – allows industry partnership and introductions to academic and clinical collaboration at scale. This partnership is also important in international visibility and in securing inward investment.

Acting together, the NP11 and the NHSA provide the opportunity for Government and national agencies to work with industry, LEPs, universities and the NHS to develop a Northern health and life sciences Supercluster, building on and amplifying the significant investment already made in Catapults, infrastructure awards, collaborative networks and partnerships which now support innovation and growth in health and life sciences.

This opportunity-driven partnership approach, linked to research excellence, a robust innovation ecosystem and market opportunities, will allow Government agencies to respond positively to the levelling up agenda set out in the R&D Roadmap and allow the North to build on its assets for national advantage.

Furthermore, there is enormous opportunity for regions willing to embrace adoption of a test bed approach for health interventions that is embedded within the organisations that are leading the new Integrated Care Systems across Health and Social Care.

This would provide a further mechanism by which anchor institutions could help to address and ameliorate established social, economic, educational and health inequalities.

Why the UK needs a second Supercluster

While the global forecasts for long term market growth in biopharma and medtech reflect increased expenditure in the wider health economy over the next 20 years, there is fierce international competition facing UK industry, increasing the pressure to convert science and innovation to commercial advantage and economic growth.

The US, European countries such as Germany, France, Italy and Switzerland, and India, China and the Far East all have fast growing sub-sectors and specialisms which now compete directly in the international and UK market.

The UK has benefited considerably from the Golden Triangle - London, Oxford and Cambridge forming three points of an area of southern England - that has become one of the world's foremost knowledge-intensive areas, driven by research and innovation by world-leading universities working with companies in the technology, medicine and life sciences sectors. The Golden Triangle has enjoyed significant growth in employment compared to the North.

While the Golden Triangle will continue to drive growth in health and life sciences, there is evidence that the rising costs of operating businesses and establishing start-ups and the shortage of some critical enabling factors, such as lab space and skilled personnel, could potentially result in missed opportunities and slower growth for the UK economy.

A second Supercluster is required if the UK is to capture and retain its share of a growing national and international market.

The Northern Supercluster will work in partnership with the Golden Triangle to strengthen the whole UK offer in life sciences. Through the NHSA, the North of England has established significant partnership working with MedCity, its sister organisation in the South East. This has been recognised and is being built upon through a joint £4.5m UKRI award. The North-South axis is further complemented by the UKRI jointly operated National Science and Innovation Campus, Harwell in Oxfordshire and Sci-Tech Daresbury in the North West.

This has been recognised and is being built upon through a joint £4.5m UKRI award.

Although already a significant asset, there is recognised potential and imperative for further innovation and growth in the North's life sciences sector. With forecasts suggesting that the sector will grow by 44% by 2030, this is an important opportunity for the North to grasp.[14]

This scale of growth will further the region's role in the national and international marketplace by positioning itself to secure further scale and build on existing assets across the academic, public and commercial sectors.

Greater collaboration and investment in the Northern life sciences sector presents opportunities to:

- Close the productivity gap (with the scale of the current challenge considered further in Section 2).
- Secure inward and new investment.
- Expand involvement in national and international markets.
- Scale up academic/NHS/commercial partner collaboration.
- Secure the scale and multi-faceted skilled workforce needed to support advances.
- Improve workforce productivity and employee health through the application of world-class R&D.

In developing these opportunities, Government and national agencies can work with industry, LEPs, research intensive universities and NHS Trusts to develop a Northern health and life sciences Supercluster.

The Supercluster will build on the significant investment in Catapults, collaborative networks and partnerships which already support innovation and growth in health and life sciences within the North and where there is a recognised opportunity for further growth.

Existing assets and specialisms and an appetite to innovate in health and life sciences are widely highlighted across the Northern LEPs. In recent years, health innovation has become a prominent theme in many LEPs' Local Industrial Strategies, updated Strategic Economic Plans and COVID-19 recovery plans with new health and life sciences focused boards and steering groups also established in parts of the North (e.g., Liverpool City Region, Leeds City Region, North East and Lancashire LEPs) to bring together partners and guide interventions.

Whilst the focus of each LEP and their impetus for health innovation varies (including both economic and social drivers), all recognise the role that they can play in collaboration – whether as a lead or supporting partner. Indeed, the nature of the sector, and the scale and connectivity of the investment required, necessitate a new paradigm of LEP working, one that acts at a pan-Northern level to connect, train, invest, expand and showcase the North's life science sector.

In doing so the LEPs can, with multiple other stakeholders, create the conditions and competitiveness required for a Northern Supercluster that will play its full part in the UK's global offer.

Further information on the economic drivers behind growing the North as a second UK Supercluster can be found in Section 11.

Section 2
The Policy Context

Policy recommendations from Government departments, think-tanks and arms-length bodies have repeatedly called for increased investment in the North of England's innovation system and the need to level up the performance of regions and nations outside of the South East to increase productivity in the rest of the UK.

The UK has some of the largest regional disparities in productivity of the OECD countries. One reason, explored in recent research by the thinktank Onward, for the significant geographic disparities in productivity and income is that innovation, which is the key driver of productivity growth, is concentrated in one part of the country.[15]

The analysis suggests that public spending on R&D may be contributing to the distribution of innovative clusters and the productivity gap.

A third of the productivity gap between the North and the rest of the country is because of worse health in the North at a cost of £13.2bn a year in lost GVA.[16]

The impact of COVID-19 has likely worsened this with an extra £2bn lost from the economy due to the worse mortality rates in the region.[17]

The Government has set out its intention to address regional inequalities, rebalance the economy and level up underperforming and left-behind parts of the UK, including through infrastructure development and investing in education, skills and scientific R&D.

In its 2019-20 report, UKRI highlighted expenditure of £3.28bn in pioneering ideas, through Research Council programmes and funding for research at universities; £1.73bn in research and innovation infrastructure and institutes; and £1.60bn in cutting-edge innovation to improve the business environment and address major industrial and societal challenges through running the Industrial Strategy Challenge Fund (ISCF) and the Strategic Priorities Fund (SPF).

The 2021 Taskforce on Innovation Growth and Regulatory Reform (TIGRR) report highlights the impact clinical research can have on local economic growth and reducing ill health, as well as the need for greater geographical spread of clinical trials stating pharmaceutical clinical trials should be championed as key to levelling up as they are able to generate local income and improve access to innovative treatments at no cost to the NHS.[18] The geographic spread of patient recruitment and trials around the UK must also be widened to further support levelling up.

Innovate UK has the potential to make a major contribution to further supporting the health and life sciences industry in the North of England. There are many organisations involved in health and life sciences in the North, which could assist Innovate UK to support Build Back Better, securing national benefits and developing a Northern health and life sciences Supercluster.

This would build on the significant ecosystem for new starts and scale up companies. In 2019/20 Innovate UK had a budget of £743m for Research and Innovation and £468m for the National Productivity Investment Fund.

The loss of European Regional Development Fund (ERDF) support, now that the UK has left the EU, will reduce the Northern innovation funding pot by several hundred million pounds, with implications for research/innovation centres and business support programmes.
LEPs and city region partnerships have successfully used these funds to support incubation and commercial lab/clinical lab space to support health and life science and digital health SMEs.

While there is Government commitment to fully replace ERDF funding with a Shared Prosperity Fund, it is not clear the extent to which innovation/R&D and SME support will maintain its profile. In order to maintain the momentum in the health and life science industries, and taking account of market demand, Government needs to, as a minimum, match the 2014-2020 European Regional Development Fund (ERDF) and Local/Regional Growth Funds. A full outline of the role of UKRI, Innovate UK and Shared Prosperity funds in supporting life sciences in the North can be found in Section 10.

The Accelerated Access Collaborative (AAC), a dedicated unit within NHS England and NHS Improvement, is a unique partnership between patient groups, government bodies, industry and NHS bodies, all working together to streamline the adoption of new innovations in healthcare.

AAC commissioned or supported programmes of work span the innovation pipeline from idea, through proof of concept, to real-world testing and adoption and spread.

Those with an industry focus include the Artificial Intelligence in Health and Care Award (AI Award); AAC early stage innovations which need support through the regulatory and approvals processes; Small Business Research Initiative (SBRI) for Healthcare competitions; Early Access to Medicines Scheme; NHS Innovation Accelerator; Rapid Uptake Products programme; Pathway Transformation Fund; Innovation and Technology Payment programme and medtech Funding Mandate. AHSNs support the delivery of the AAC's national programmes locally and the adoption and spread of innovation.

The North of England can play a key role in delivering all six of the AAC priorities (innovation service, demand signalling, horizon scanning, world-leading testing infrastructure, adoption and spread and funding strategy), with strategic government investment in the recommendations in this report.

Northern Health Productivity Gap

There is a well-known productivity gap between the North and the rest of England of £4 per person-per- hour. This is due in large part to health gap between the North and the rest of England.

A key reason is that health is worse in the North with average life expectancy 2 years lower than in the South and a higher prevalence of the long-term health conditions lead to economic inactivity.

Spells of ill health increase the risk of job loss and lead to lower wages when people return to work. Improving health in the North would lead to substantial economic gains.

Improving health would reduce the £4 gap in productivity per-person per-hour between the North and the rest of England by 30% or £1.20 per-person per-hour, generating an additional £13.2bn in UK GVA.[19]

Northern Policy

The Northern Powerhouse Independent Economic Review

The 2016 Northern Powerhouse Independent Economic Review (NPIER) sought to understand the North's economic position and drivers underpinning its performance, and identify areas where pan-Northern activity could present opportunities for growth.[20]

The report identified four prime capabilities that were distinctive across the North and where the geography was nationally and internationally competitive.

Health innovation was recognised as one of the prime capabilities, acknowledging "long-established strengths in life sciences, medical technologies and devices, and a growing competence in new and efficient service delivery models brought about by e-health and, crucially, the growing devolution of responsibilities for Health and Social Care".

Two main specialisms within health innovation were identified – life sciences and healthcare technologies (including medical technologies, devices for e-health, health analytics and clinical research).

As well as recognising health innovation, the NPIER acknowledged supporting opportunities that can facilitate further advances in the field. It highlighted that the North is:

- Experiencing rapid technological advances in computing and data analytics that affect public health, drug discovery and development, and the personalisation of medicine.
- Able to draw on digital strengths in computation, big data and simulation/modelling, noting the role this plays in e-health specialisms.
- Exploiting new manufacturing processes, such as 3D printing for prosthetic limbs and organs.

Taken together, these complementary capabilities present a strong opportunity for the North to develop, undertake and showcase world leading health innovation.

The Northern Powerhouse in Health Research: A Science and Innovation Audit

Prepared in 2018, the NHSA-led Science and Innovation Audit (SIA) highlighted the significant academic, science, health and research assets across the North. With a focus on precision medicine and data for better health and wealth, the SIA considered existing capabilities, challenges and opportunities for growth.

The presence of significant 'hard' and 'soft' infrastructure was noted, and stakeholders identified the following research areas as strengths, both in and for the North:

- Health economics and biostatistics
- Clinical trials and real-world evidence
- Digital Health, including digital collaboration
- Companion Diagnostics
- Pharma advanced manufacturing
- Advanced Therapy centres
- Devolution of health and social care in Greater Manchester

Recognition was also given to the North's 28 universities, seven of which are Russell Group and a fifth are in the UK's top 20, and the scale of the academic, industrial and vocational opportunities they generate.

Examples of collaborative working that has already been secured and generated results for the North were recognised, including:

- Bringing partners together – including through the NHSA, the Academic Health Science Centres in Manchester and Newcastle, Bionow, AHSNs UKRI-STFC led regional HealthTec cluster and Tech Nation to provide a voice for the North.
- Connected Health Cities – a partnership using large-scale data to drive public sector reform in health and social care.
- Research collaborations – drawing on clinical, academic and industrial expertise to innovate, including large scale opportunities such as the Salford Lung Studies.

The resulting propositions were intended to support the North to become *"a healthier and more economically productive place in which to live, narrowing the North's health, wealth and productivity gaps compared with the South of England."*

Section 3
The COVID-19 legacy and learning

The COVID-19 pandemic has prompted new partnerships and ways of working in the health and life sciences sectors. The North has delivered world-first, national pilots such as Community Testing. The *Life Sciences Recovery Roadmap* (2020) recommended a series of steps to capitalise on the progress made, recommendations which afford opportunity for the North to benefit, specifically to: [21,22]

- Bring industry, charities and the NHS together to deliver the Long-Term Plan.
- Develop a comprehensive strategy to improve UK manufacturing capability and supply chain resilience in medicines, medical devices and diagnostics.
- Ensure the UK's R&D incentives are globally competitive and continue investing in critical health data infrastructure for research and the 'find and recruit' clinical trial service.
- Transform the UK's clinical research processes, enabling rapid approval, set-up, recruitment and delivery of research across the NHS.
- Review the Medicines and Medical Devices Bill to become more agile and reflect recent innovative regulatory approaches.
- Accelerate the deployment of new and existing treatments and technologies where there are system and patient benefits.

The response of the North's institution and industry partners during the pandemic illustrated the breadth of excellence, the scale of systemwide working and the willingness to push boundary in terms of collaboration, skills, supply chain and partnership working.

There is a commitment across the North to continue this in addressing the health, economic and societal challenges ahead.

Building NHS resilience and delivering efficiency

The NHS has been under escalating pressure for several years.

Although healthcare spending has been protected relative to other public services, there are concerns that increasing demand for services, coupled with rising costs, threaten the stability and sustainability of the NHS and the services it provides.

The long-term strategic opportunity for the UK is to position itself as the pre-eminent location for co-development of game-changing diagnostics and medical technologies with industry and to do so in a high-trust, high-evidence test-bed that rapidly adopts proven innovation. This will require models of partnership and systemwide working that are only just emerging.

The move towards a model of Integrated Care Systems (ICS), linking health and care, is central to a sustainable and affordable NHS in the medium term. Radical innovation is needed to reduce the costs of condition management, reduce hospital admissions and provide care for an ageing population.

The COVID-19 crisis has emphasised the chronic underinvestment and lack of coordinated leadership in diagnostics.
Not only is this crucial in the context of pandemics, but high-quality diagnostic capacity is also central to the future NHS, facilitating risk-stratified integrated care and precise, personalised medicine.[23]

In particular, the shift towards earlier diagnostics and personalised health monitoring rather than the identification of established disease, presents an opportunity for the UK. Development of early, accurate and appropriate diagnosis as a component of population health management is a challenge in which the UK can excel and in which Northern expertise and institutions can play a leading role.

The pandemic has led to a further challenge for the levelling up agenda, and without immediate action the North's towns and cities will see ill health, child poverty and mental health issues exacerbated.

The COVID-19 pandemic has also put the spotlight on the global nature of the health supply chain, and the implications of the reduction in national production capacity for key pharmaceuticals and vaccine production. Manufacturing assets in the North have responded to the challenge of the current

pandemic by increasing the production of key pharmaceuticals and vaccines.

Compounded by Brexit challenges on the timely movement of goods, the UK now needs to look at its capacity to produce critical health products from a strategic and risk viewpoint.

Health inequalities

COVID-19 exposed the deep-rooted and persistent regional health inequalities across England. People in the North were consistently found to be less healthy than those in the South across all social groups and amongst both male and female.

In the 2018 Health for Wealth report, the NHSA found:

- Long-term health conditions lead to economic inactivity, increased risk of job loss and lower wages.
- The North's population has much higher incidences of cancer, cardiovascular and coronary disease, as well as conditions such as asthma.
- The health divide has been widening in recent years. Mortality is now 20% higher amongst young people living in the North.
- Since 1995, for those aged 35-44 years, excess mortality in the North increased to 49%. England's regional health inequalities are now some of the largest in Europe.

In the 2020 COVID-19 in the North the NHSA found:

- An extra 57.7 people per 100,000 died in the North than the rest of England.
- These extra deaths could cost the UK Economy an additional £6.86bn in lost productivity (measured by GVA).
- Reductions in mental wellbeing in the North could cost up to £5bn in lost productivity.

Health inequalities are not restricted to older people, and are evident in children and young people, often linked to multiple deprivation and poverty. Childhood health is a key predictor of later health and economic productivity.

There are substantial, persistent regional inequalities in child health: children living in the North have worse health outcomes than children living in the rest of England. The productivity gap between the North and the rest of the country is likely to worsen for subsequent generations without a COVID-19 recovery strategy that prioritises families with children.

Health challenges

Long term health issues provide both a challenge and opportunity for health and life science companies and Public Health England. The NHS faces major additional costs of addressing issues related to the ageing population and the exponential rise in mental ill-health, as well as conditions such as diabetes and obesity, where the North faces much higher incidences of conditions often linked to lifestyle and behavioural factors. Research and innovation led products and services will be key to assisting the NHS in the UK and health providers globally, to better manage these long-term, often co-morbid, conditions.

The health and life sciences sector has an opportunity to use artificial intelligence and data, diagnostics and medtech to reduce avoidable hospital admissions and support people in employment to manage long-term conditions more effectively.

The North, with its increasingly joined-up approach to innovation and its clinical excellence at scale, has a pivotal role to play in this agenda.

> The significant health inequalities in the North are one of the reasons why the North is particularly suited to the development of a second Supercluster. The North provides the opportunity to generate real world evidence of the effects of reducing health inequalities on the economy of the country by reducing healthcare demand and by improving productivity.

Section 4
The North's Major Life Science Assets

The breadth, depth and connectedness of the life science assets across the North is considerable. They include physical infrastructure, technologies, networks and expertise in the academic, clinical, public and commercial sectors, and they all play a role in supporting leading edge life science research and innovation, skills development, manufacturing and clinical applications.

The Northern life sciences sector also represents a significant national asset as a major employer and contributor to the research and innovation landscape.

Employment

Using the Office of Life Sciences SIC Code definition, across the North, life sciences employ 23,500 people across 800 businesses – 28.5% of national employment in the sector (a higher representation than 27% of employment economy-wide) and 23% of the business base.[24]

Using a wider sector definition applied by the Department for International Trade increases these numbers to over 52,700 jobs and 1,300 businesses.

Data from the Office for Life Sciences shows that, in 2019, the North accounted for a significant proportion of the UK's employment and business base (see fig.1).[25]

In all cases, the North represents the second cluster of life sciences employment in the UK, behind London and the South East.

For example, in contrast the Midlands accounts for only 13% of digital health and 17% of medical technologies employment.

Economic contribution: In 2018 life sciences in the North contributed £9.6bn to the economy, accounting for 33.9% of national sector GVA – a measure of economic output), compared to the 22% Northern contribution across all sectors.[27]

Using the Department for International Trade's wider sector definition suggests the life sciences contribute £17.7bn to the Northern economy.

Trade: HMRC Regional Trade Statistics show that in 2019 the North exported £3.2bn of medicinal and pharmaceutical products, 20% of the national total.

Patents: The North accounts for approximately 22% of UK patent applications in the Medical and Biological fields – a proportion above the North's share of total patent applications.[28]

Specialisms: There are already recognised areas of specialism with the North, reflecting a combination of NHS, commercial and academic expertise and facilities. Areas of specialism and excellence that map onto significant market opportunities are highlighted throughout this report.

Alongside life science specific specialisms, the North is home to distinct wider sector specialisms (including sub-sectors of scale and national or international standing, such as advanced manufacturing) that have roles to play in driving forward health innovation.

Investment and funding performance

Analysis of life sciences research funding awards show that organisations in the North are playing an important role in UK research. Research completed for the Northern Powerhouse in Health Research Science and Innovation Audit showed a considerable volume of research projects (within subject areas of interest to the Science and Innovation Audit) being undertaken in the North, capturing a significant share of the UK funding pot, particularly when in a partner role, although when leading projects both the proportion of projects and funding attracted remains below the North's share of life sciences employment (see fig.2). [29]

Fig 1: Northern Powerhouse Employment Figures (OLS 2019)

Sector	No. sites	% of emp[26]
Digital health	97	25%
Medical technologies	929	24%
Life sciences	N/A	21%
Biopharmaceutical	453	18%

Between 2007 and 2017, the NP11 geography has established a particularly strong reputation in the ageing agenda, supporting organisations in the North to lead 20% of projects, securing 24% of funding for research under this theme.[30] Considering activity across all sectors of the economy, R&D spend in the North totalled £5.4bn in 2018; almost 15% of investment across the UK.[31]

Despite this strong performance, investment in the North East and Yorkshire and Humber ranked the second and fourth lowest, respectively. Regional disparities are emphasised when considering R&D investment levels per head.

While the UK average in 2018 was £558, all three Northern regions performed below average (£293 in the North East, £299 in Yorkshire and Humber and £405 in the North West) while the East of England recorded a figure almost twice the national average (£1,064).

Fig 2: The Northern Powerhouse in Health Research: A Science and Innovation Audit, NHSA, June 2018

	No. projects	% UK projects	% UK funding
In a lead role			
Data for Better Health and Wealth	1,320	18%	17%
Precision Medicine	1,582	17%	14%
In a partner role			
Data for Better Health and Wealth	1,682	23%	30%
Precision Medicine	1,985	21%	25%

Fig 3: The North of England's Life Science assets

The major Northern life science assets are presented across two sections of this document.

Opportunity-specific assets

Later sections of this report provide an overview of the globally significant specialist assets associated with clear Northern opportunity areas: the four market-driven opportunity areas; Advanced Therapies, Infectious Diseases, Diagnostics and MedTech; and Data and AI and also two challenge-driven opportunity areas in Healthy Ageing and in Mental Health. The assets underpinning these are further explored within Part 2 under these headings.

Cross-cutting assets

Second, the report describes the main cross-cutting Northern assets which are of generic relevance. These act supra-regionally and are relevant to several areas of application. The remainder of this section explores these cross-cutting assets:

In terms of broadly relevant infrastructure, key points of note are:

- The research strengths of eight research intensive universities (Durham, Lancaster, Leeds, Liverpool, Manchester, Newcastle, Sheffield and York, with AHSCs in Manchester and Newcastle). The N8 Research Partnership has identified Targets for New Medicines as one of its Emerging Communities and the role of vocationally focused institutions within the North.

- Established relationships and working agreements with industry across all universities in the North, with knowledge generated and applied to the benefit of larger corporates and SMEs.

- Excellence at scale in NHS Trusts both in terms of clinical activity and in engagement with innovators and research, and with the devolution of health and social care funding within the North providing further scope for innovation.

- The presence of nationally recognised accelerators and centres of excellence in components of the life science sector.

- A strong and growing cluster of businesses comprising both multi-nationals and SMEs at the leading edge of the life science sector, including clusters of biopharmaceutical and medical technology manufacturing businesses.

- A strong and ambitious group of city region clusters, each with a strong business base, including multi-nationals and SMEs.

- The increasing presence of national organisations based in the North, such as NICE in Manchester, NHS Digital in Leeds and the NIHR Innovation Observatory in Newcastle.

Details of specific assets are considered in more depth within Part 2 of this report, highlighting assets of national and international significance within the North. Each of these assets is significant individually (including world leading research assets) but it is in bringing them together to acknowledge the North's strengths and identify opportunities for collaboration – both within the sector but also drawing on wider sectoral expertise – that the North can truly prosper.

Steps are already being taken to work collaboratively, including through:

- Securing and investing research funding (including UKRI/Medical Research Council funds) to advance life sciences innovation.

- Collaboration between universities, NHS Trusts and commercial partners, including global companies and innovative SMEs.

- Partners across the North coming together through structures including the NHSA, Bionow, AHSNs and Academic Health Science Centres/ Health Partnerships. Structures supporting complementary sectors will also have a role to play (e.g., Tech Nation and UKRI-STFC led North West HealthTec Cluster).

- The identification of clear economic priorities within Local Industrial Strategies from LEP growth plans to capitalise on assets and strengths. Investment now needs to follow.

Although already a significant national contributor, there is recognised potential and imperative for further innovation and growth in the North's life science sector, with forecasts suggesting that the North's life science sector will grow by 44% by 2030.[32]

Breadth and depth

The North benefits from the breadth and depth of its health and life sciences innovation infrastructure and the increasing connectedness of centres of expertise. Recent designations by national bodies have built on areas of specialism and helped to demonstrate the important contribution that the North makes to the country's innovation ecosystem for the sector. Examples include:

1 The National Institute of Health Research (NIHR), NHS England and NHS Improvement have designated eight Academic Health Science Centres (AHSCs) in England. These partnerships between top universities and NHS organisations are combining excellence in research, health education and patient care, through increased translation of discoveries from early scientific research into benefits to patients.

The North currently has two AHSCs, where innovation functions have been coterminous with large health and care systems covering around 3m population each:

As part of Health Innovation Manchester, the **Manchester Academic Health Science Centre** (MAHSC) brings together world leading academic and NHS partners to drive health research. MAHSC's six research domains focus on addressing the greatest population health challenges – cancer, cardiovascular disease, inflammation and repair, women and children, mental health and neuroscience.

Newcastle Health Innovation Partners (NHIP), with Newcastle University, The Newcastle upon Tyne Hospitals NHS Foundation Trust, Academic Health Science Network for the North East and North Cumbria, Newcastle City Council, and Cumbria, Northumberland, Tyne and Wear NHS Foundation Trust, have a research focus on ageing and multiple long-term conditions, rare diseases, diagnostics and advanced therapeutics.

2 The NIHR Biomedical Research Centres (BRCs) are collaborations between

universities and NHS organisations that bring together academics and clinicians to translate lab-based scientific breakthroughs into potential new treatments, diagnostics and medical technologies.

There are four BRCs in the North, each working closely with local partners such as the NIHR medtech and In-Vitro Diagnostic Co-operatives (MICs), the NIHR Clinical Research Networks (CRN), NIHR Clinical Research Facilities (CRF) and exemplar research institutes. The focus of the four BRCs are:

Leeds – Musculoskeletal – identifying those at risk of rheumatoid arthritis, immunotherapies in rheumatoid arthritis, interventions based on stratified prognosis, drug repurposing and treatment toxicity, longer lasting joint replacements, acellular scaffolds and regenerative devices for treatment of osteoarthritis and non-surgical treatments for osteoarthritis.

Newcastle – Ageing and long-term conditions - ageing syndromes, dementia, liver disease, musculoskeletal disease, neuromuscular disease and skin and oral disease.

Manchester – Translational medicine - biomarker platforms, cancer precision medicine, cancer prevention and early detection, dermatology, hearing health, informatics and data science, musculoskeletal, rapid translational incubator, respiratory and advanced radiotherapy.

Sheffield – Chronic neurological disorders - motor neurone disease, Parkinson's disease, multiple sclerosis, stroke and cerebrovascular disease, dementia, gluten related neurological disorders and ataxia, advanced medical imaging, in silico (predictive) medicine and genomic medicine and bioinformatics.

3 Three of the five NIHR Patient Recruitment Centres (PRCs) established in the NHS are located in the North. These aim to: increase the UK's capacity to deliver late-phase commercial clinical research, make it easier and quicker to deliver commercial clinical research in the NHS and provide a test bed for future innovation in clinical trial delivery.

- PRC: Blackpool - Blackpool Teaching Hospitals NHS Foundation Trust.
- PRC: Bradford - Bradford Teaching Hospitals NHS Foundation Trust.
- PRC: Newcastle - The Newcastle upon Tyne Hospitals NHS Foundation Trust.

With a special focus on common chronic conditions, these research facilities have a number of unique features which offer new ways to conduct late-phase, large-scale commercial research projects. Speed, efficiency, innovation and continuous improvement are key drivers of this new initiative which will help to maintain the UK's position as a global destination for commercial clinical research.

4 The clinical trials infrastructure in the North is world leading, with an ability to deliver trials on time and to target efficiently across a population of 16 million people. This expertise allows Northern institutions to lead the way in innovative trial designs and supports a thriving ecosystem of private clinical research organisations.
It also serves to anchor globally leading companies in the region such as Allergan, AstraZeneca, Bristol Myers Squibb, Eli Lilly, GlaxoSmithKline, MSD, and Roche.

Key networked assets include:

- NIHR Clinical Research Networks covering Greater Manchester, Yorkshire and Humber, North West Coast and the North East and North Cumbria respectively; which manage ~30% of the NIHR's clinical trial portfolio.[33]
- Both the national NIHR Clinical Research Network Co-ordinating Centre and the UK Clinical Research Collaboration Registered Clinical Trials Unit Network hosted in Leeds University.
- Eight registered Clinical Trials Units across the North.
- The Medical Research Council and NIHR Trial Methodology Research Partnership is hosted in Liverpool and involves all Northern universities.
- Innovative trials platforms include North West e-Health, and in-silico/virtual trials developments in Newcastle PRC and Leeds and Liverpool universities. The CIPHA.NHS.UK system rolling out across the North West and other parts of England can also bring routine randomisation into direct care and population health management.

In summary, the cross-cutting Northern assets presented above, together with the opportunity-specific assets detailed in Part 2, provide a robust foundation for the North's life sciences sector to grow and attract further investment.

However, this is dependent on understanding the gaps, market failures and the opportunities for maximising and mobilising these assets at a Northern level going forward.

Northern life science assets in areas with high growth potential

Section 5
Priorities for Northern Growth

Overcoming market failures

While the sector's growth potential is considerable, companies need greater access to networked early-stage co-development facilities, clinical trials space and GMP manufacturing capacity.

There are several market failures relating to the costs of such activities including a lack of investment finance and a lack of awareness of the potential resulting commercial benefits that impact on investment decisions.

Consultation with the health and life sciences industry (including ABPI, ABHI, Catapults, SME-focused membership organisations and a plethora of companies directly) has highlighted serious limitations to its growth, development of products and services. Companies (from SME upwards) have identified:

1 Translation gap – slow translation from invention to implementation, with a lack of capacity and access, at scale and in a structured way to the facilities and expertise to help companies innovate.

2 Innovation efficacy – lack of support in co-developing products and generating a robust evidence base to validate the efficacy of innovation, including patient recruitment for studies.

3 Data gap – lack of predictable, responsive access to well-curated and responsibly managed data of a scale to support diagnostics, medtech, and advanced therapies innovation.

4 Assurance and adoption – limited evaluation methodology expertise and too little support for assurance and adoption.

5 Poor articulation of product specifications from NHS to industry and slow adoption of new diagnostics in the NHS.

6 Access to capital – early-stage initial validation work and for later stage translational work.

These issues vary by sub-sector and location, partly reflecting investment by UKRI, LEPs and the private sector over the past few years.

In spite of increasing levels of collaboration, parts of the scientific and clinical infrastructure are fragmented, and companies are not always provided with an end-to-end product development pathway from access to basic science excellence for discovery, through to clinical expertise for trials and adoption into practice.

Determining areas of opportunity

In determining areas of opportunity where the health and life sciences industry could contribute to national priorities, as well as generating GVA and high productivity jobs in the North, there are several criteria which will guide investment priorities.

These are:

- Evidence of an existing pan-Northern strength or a local/regional strength that could be scaled up across the North with intervention.
- Identification of a national or global market opportunity that the North could help to satisfy.
- Potential to capture new investment through private or public funding routes.
- Opportunity to secure advantage by bringing together the North's research and industrial strengths.
- Recognised scope for business, skilled employment and GVA growth.

New investment would be expected to contribute to several criteria and establish new routes for commercial partner engagement, collaboration with research expertise and the NHS to help develop regional ecosystems.

There is a large pool of health and life science companies with an interest and expertise in innovation, many with international ambitions, and their growth would be accelerated through a more coordinated, collaborative and integrated ecosystem which provided better access to research expertise and more effective links to co-development, trialling and assurance with the NHS.

Underlying the proposals for areas of opportunity is the ambition to further develop the North of England as the UK's second Supercluster, complementing rather than competing with the Golden Triangle and boosting the UK's attractiveness as a leading location for global investment.

Section 6
Opportunities for the Northern Life Sciences Supercluster

These opportunities are outlined in detail in pages 30-45, highlighting the areas where Northern expertise and industry demand come together.

They offer a blueprint to growing the Northern Supercluster through investment in its world-leading assets with a focus on building on the work of Catapults, collaborative networks and partnerships.

They cover opportunities within which the NP11 and the NHSA geography has considerable strengths in terms of research and innovation, commercialisation and a growing company base, able to take advantage of new technologies and growing markets.

These areas involve cutting edge science, established networks of collaboration and the use of data to support innovation to deliver the types of benefits prioritised by Government and an engaged, proactive NHS.

Market opportunities

Page 30
Advanced Therapies
There is a global opportunity for the North to build on a world-leading competitive edge in advanced therapy development, evaluation and clinical delivery, particularly in high priority areas such as cancer. This has the potential to drive substantial economic growth in the NP11 geography with the potential for high productivity jobs growth.

The creation of a Northern Advanced Therapies Accelerator to accelerate development, evaluation, manufacturing capacity and clinical delivery of industry-led innovation, delivered connecting and scaling existing centres and networks would provide an lab to bedside development, evaluation, manufacturing and delivery vehicle for these cutting-edge treatments.

Doing so would develop high impact treatments, especially in cancer. It would support the growth the biopharma sector in the North, predicted to generate 17,200 jobs over the next 10 years. Our modelling has shown that Advanced Therapy employment has the potential to grow 650% by 2032, compared to a projected growth of 490% for the UK as a whole. This would result in an additional £3.1bn for the UK economy.

Page 32
Infectious Diseases
There is a valuable opportunity to build on world-class capabilities and expertise in infectious diseases in the North, including clinical trials and the clinical delivery and validation of therapeutics and technologies for the containment and control of AMR infections. Working alongside industry, NHS expertise in the North is leading on major pan-European studies.

We recommend developing a series of specialist research platforms for infectious diseases therapeutics, and to scale up and extend the Infection Innovation Consortium (iiCON) approach of public private partnership to pan-Northern level. iiCON helped lead the AGILE trial which enabled rapid evaluation of potential COVID-19 treatments.

This would enable further partnerships between SMEs, research institutions and large scale industry to drive adoption at scale. In addition, build capacity in Phase 1 vaccine trials to harness the clinical excellence and capabilities in the NHS.

Lastly, invest to increase capacity and capability in the Northern Biopharma manufacturing cluster, to deliver the UK vision to be a global centre for the development, manufacture and use of cancer vaccines and immunotherapies.

By 2032 it is anticipated that the North will have increased its infection R&D investment by £2bn over ten years, increasing related annual GVA to £3bn by 2032.

Page 36
Diagnostics and MedTech
The UK has the opportunity to position itself as the pre-eminent location for co-development of game-changing diagnostics and medical technologies with industry.

The North is well placed to do so as a high-trust, high-evidence test bed that rapidly adopts proven innovation. This offer to work rapidly at scale, and to the highest standards, would be globally significant.

The UK Government should support a new National Diagnostics Centre, based in the North of England, to provide a UKRI-funded Diagnostics Centre of R&D Excellence and develop, from that, a Diagnostics UK platform to secure the UKs future as a high trust environment to rapidly develop and adopt new diagnostic technologies. This platform would build on the success of the CONDOR evaluation platform.

Further, it should create a medtech equivalent platform and provide resource to direct the platform to accelerate evaluation and adoption in areas of high need, including NICE lower volume clinical areas.

The convergence of digital technologies, data analysis including AI and traditional medical technologies requires a platform for development and real-world evaluations to drive adoption at scale.

Investment in models of partnership and systemwide working that are being pioneered in the North of England, within existing clusters of strength, shows exceptional growth potential and employment could double over a fifteen year period, resulting in the Northern medtech sector being worth £7.8 bn in 2032.

Page 39
Data and Artificial Intelligence:
The UK National Health Service (NHS) is the single largest integrated healthcare provider in the world, with population-wide patient records from birth to death.

The NHS and partner local government agencies across the UK, particularly the North, wish to grasp the digital-first, post-pandemic momentum and offer more agile civic health & care systems – joined-up with data, combined intelligence and AI.

By establishing a Civic Data Grid as a delivery body, the North will pull-through data, data-science and AIs into ethical, citizen-involved and sustainable innovations.

A Northern grid of Civic Data Co-operatives, feeding sub-regional and pan-regional applications, would boost advanced therapies, diagnostics and medtech research and innovation.

Investing in a jointly accountable network of data/AI teams in key organisations will reduce

duplication and focus the timely development and evaluation of data-driven tools. The added pace and scale of data uses will enable the North to offer an NHS AI Sandbox that can partner with regulators to put UK AIs for health at the forefront of trustworthy innovation worldwide.

The value of NHS data alone was estimated at ~£5bn per annum, delivering ~£4.6bn of annual benefit to patients in NHS operational savings, enhanced outcomes and wider economic benefits. The North is ready to realise the UK's potential grid of civic data clusters advancing health and social care and population health management.

Challenge driven opportunities

There are two challenge driven opportunities which will influence research, biopharma, diagnostics, data and medtech over at least the next 10 years.

The response to these challenges is driven by a combination of research strengths, demographic factors and potential positive economic contributions and have been identified to play a role in the future of health and life sciences innovation in the North:

Page 42
Healthy Ageing
Although life expectancy has been increasing, the associated increase in healthy life expectancy has not kept pace. Between 2009-2011 and 2016, the proportion of life spent in good health in the UK has decreased from 79.9% to 79.5% for males, and from 77.4% to 76.7% for females.[34] Significant disparities are also evident across the UK with the difference in healthy life expectancy between the most and least deprived places being 18.9 years for males and 19.4 years for females.[35]

Whilst this has implications for economic contribution and pressures on the health and care system, there are opportunities within this health challenge.

Supporting an ageing population to benefit from a healthier life for longer can contribute to an extended working life, benefits to the economy and cost savings for the NHS.

The prosperity of the North will become increasingly linked to the economic engagement and productivity of its ageing workforce.

Health innovations and skills development have central roles to play in supporting the healthy ageing agenda, with activity to be taken now to support the North to respond to both the challenges and opportunities the changing population profile will present.

Page 45
Mental Health and Wellbeing
The UK, and the North of England in particular, is facing a crisis in mental health need and support. Before the COVID pandemic, the Kings Fund estimated the 8.65 million people with major mental health problems in the UK will increase by 14% by 2026.[36]

The Centre for Mental Health suggests 500,000 additional people will require support for their mental health in the next two years.[37] This will have profound personal, social and economic consequences for the country. Mental health problems are of particular concern in the North.

Pre-COVID-19, mental health problems were 74% higher in the North of England than the rest of England and in a recent report the NHSA estimated reductions in mental wellbeing in the North could cost the UK economy up to £5bn per year in reduced productivity, measured in GVA output.[38]

To make sure the best mental health interventions reach patients quickly, an innovation infrastructure needs to be established and hard-wired into the NHS to help it cope over the coming years.

We recommend setting out a Challenge Fund for industry-led approaches to the development of robust, high trust, high efficacy mental health and wellbeing interventions.

Aligned to this Challenge Fund, establish a Northern Mental Health Innovation Accelerator, an innovation infrastructure that brings together the mental health assets across the North for the benefit of industry.

The Accelerator would:

- Develop and evaluate digital solutions for mental health service delivery and prevention.
- Work across the public and private sector to support the UK workforce and improve productivity.
- Provide data-led intelligent mental health care and treatment using AI, working with industry to develop and evaluate new products, services and improved care delivery processes by utilising the large-scale Northern datasets from the Civic Data Co-operatives.

Section 7
Requirements for growth of the Supercluster

A summary

A combination of agencies and actions are required to underpin industry growth in the North:

Strengthen Systems

1 R&D Investment: where the total UK Government investment is circa £8bn per annum, through various Research Councils under the direction of UKRI, prioritises health and life sciences.

Improve Industry Support

2 Innovate UK: the Government innovation agency, where investment in excess of £1bn per annum supports industry to innovate.

3 Business Infrastructure and Support: where the provision of incubation and innovation centres support SME innovation, with larger mediparks and science parks accommodating new inward and indigenous pharma and medtech investment.

4 Financial and Investment Support: where there is an ongoing review of tax and related incentives to support R&D and innovation.

5 State Aid: where the UK no longer has to apply EU State Aid rules, potentially facilitating a more supportive approach to R&D rules.

Skills And Talent

6 Skills and Talent: where attracting international talent in many high skilled occupations, is accompanied by recruiting a young and highly skilled workforce to take account of an ageing population.

Regulation

7 Regulation: which sets a positive framework for industry led discovery and development.

1 Strengthen systems

Since launching in 2018, UKRI has built on the strengths of the seven Research Councils, Innovate UK and Research England to deliver more ambitious, interdisciplinary research and innovation, enabled by new investment through the Strategic Priorities Fund and the Industrial Strategy Challenge Fund.
As the largest public funder of R&D in the UK, with a statutory role to advise government, UKRI has a central role to play in delivering the economic benefits from science and research in health and life sciences.

In addition to Research England and Innovate UK, four of the most prominent Research Councils in this space are:

(a) Biotechnology and Biological Sciences Research Council (BBSRC); (b) Engineering and Physical Sciences Research Council (EPSRC); (c) Medical Research Council (MRC); and (d) Science and Technology Facilities Council (STFC).
The Government has set out its intention to address regional inequalities, rebalance the economy and level up underperforming and left-behind parts of the UK, including through infrastructure development and investing in

education, skills and scientific R&D. The UK has some of the largest regional disparities in productivity of the OECD countries. One reason, explored in recent research by Onward, for the significant geographic disparities in productivity and income is that innovation, which is the key driver of productivity growth, is concentrated in one part of the country. [39]

The analysis suggests that public spending on R&D may be contributing to the distribution of innovative clusters and the productivity gap. The public and private sector partners involved in health and life sciences are in a position to work closely with UKRI to identify areas where increases in research driven interactions and outcomes in health and life sciences can support Build Back Better and develop a Northern health and life sciences Supercluster, building on the significant investment in Catapults and collaborative networks and partnerships.

Improve industry support

2. Innovate UK

In 2019/20 Innovate UK had a budget of £743m for Research and Innovation and £468m for the National Productivity Investment Fund. Innovate UK has the potential to make a major contribution to further supporting the health and life sciences industry in the North of England. There are a considerable number of organisations involved in health and life sciences in the North, which could assist Innovate UK to support Build Back Better, securing national benefits and develop a Northern health and life sciences Supercluster, building on the significant ecosystem for new starts and scale up companies.

3. Business infrastructure and support

Local Enterprise Partnerships (LEPs) and city region partnerships have successfully used a variety of funds to support incubation and commercial lab/clinical lab space to support health and life science and digital health SMEs. This investment has provided high quality premises in addition to commercial space in UKRI funded facilities and targeted support to assist innovation, in addition to the support provided by Innovate UK.

The principal funds which have been used over the past five years have been the ERDF and Local/Regional Growth Funds. Between 2014 and 2020, ERDF of £511m was available for research and innovation projects and £1,077m for strengthening the competitiveness of SMEs. As ERDF requires matched funding, the total value of investment doubled to £1bn and £2bn in these two priority axis programmes.

The loss of ERDF support, now that the UK has left the EU, will reduce the Northern innovation funding pot by several hundred million pounds, with implications for research/innovation centres and business support programmes.

While there is a Government commitment to fully replace ERDF funding with a Shared Prosperity Fund, it is not clear the extent to which innovation/R&D and SME support will maintain its profile.

In order to maintain the momentum in the health and life science industries, and taking account of market demand, Government needs to, as a minimum, match the 2014-2020 levels of capital and revenue support for innovation, health and life sciences and targeted business support initiatives, strengthening the ecosystem which supports the Northern health and life sciences Supercluster.

There remains an access gap to venture and other forms of capital in the North, particularly in very early-stage investment, where the commercial potential is unclear and smaller companies and start-ups are unable to access funds for trials and prototypes.

For example, 69% of Seed Enterprise Investment Scheme (SEIS) and 65% Enterprise Investment Scheme (EIS) funding goes to companies registered in London and the South East.[40]

Northern companies rely on very early stage support being made available by grants and local investment funds supported by innovation centres. Grant funding in particular can be slow to access and only during time periods where a competition is open, which can disadvantage SME's where time is often their most valuable resource.

Regionally, there are a number of local initiatives working to increase the availability of capital in the North and make it easier for companies to grow, for example: Northern Gritstone, the North by North West consortium, the Northern Accelerator in the North East, and North Invest.

With growing financial services sectors in Leeds, Manchester and Newcastle, and the British Business Bank offices in Sheffield, there is an opportunity to support two growing sectors in the North and provide targeted interventions to increase capital access in the North.

As highlighted by the work of the Northern Accelerator, programmes to increase the entrepreneurial skills of students and staff in academic and clinical sectors are also crucial and investing in a systems approach to 'levelling-up' place based R&D will help. Government should actively look to increase access to capital for Northern companies in life sciences.

4. Financial and investment support

Tax incentives are an important tool in supporting company investment and investment in R&D. They are particularly important to the life sciences industry where the costs are significant. There are several recent proposals, outlined by Onward, to change the current allowances:[41]

1. "Devote the uplift in public R&D investment through the 2.4% of GDP target to projects outside the "Golden Triangle". This would amount to an annual £9bn boost to R&D funding for lagging regions by 2027, and, according to the Government's own modelling, could raise UK productivity by 3-4% by 2027 and 8-12% by 2040 relative to the current distribution.

2. Expand capital allowances for plant and machinery to among the most generous in the G20. This would help manufacturing, which is disproportionately located outside the South East, to innovate. One recent study found that despite having the lowest headline rate, the UK ranks only 10th in the G20 on the effective marginal rate due to limited allowances.

3. Establish a further round of mission-orientated technology institutes to kickstart innovation in industries where the UK has an early advantage. This might include industries such as climate change adaptation, machine learning, food security, and translational genetics, and build on the success of the Catapult network which has underpinned the search for a COVID-19 vaccine.

4. Use R&D tax credits to incentivise follow-on investment from firms. A number of other countries, including South Korea, Japan, and Italy, have successfully raised private R&D spend by directly rewarding firms that increase their innovation spending year-on-year. The UK should do the same.

5. Create expanded University Enterprise Zones to bring together researchers and commercial organisations to translate research innovation into commercial products and services. This would build on the existing network of UEZs and give them additional incentives in the form of additional tax credits or higher capital allowances.

The recently published UK Diagnostics Industrial Strategy has called for Government to examine in depth the range of fiscal and other tools available to support high growth companies, and how the tax system enables or incentivises UK-based companies to grow and remain in the UK.

The UK faces major global competition in attracting FDI investment in life sciences and must carefully position its regulatory and business environment offer to maintain the UK as a gateway to EU markets or it is likely to lead to a reduction in FDI cases.

At the same time, there is likely to be increased demand from European companies to establish a UK presence to service the large British market, with a national priority to strengthen domestic production in light of the pandemic.

There are considerable benefits from FDI investment including jobs, particularly higher paid and more productive jobs, and the impact on local/UK supply chains.

The taxation benefits from employment and business activity, including business rates, benefits the national economy.

Historically, the North has been very successful in attracting manufacturing inward investment,

and a strengthened offer would contribute to the levelling up agenda.

5. State aid

While there are commitments on subsidies arising from the UK's continued membership of the World Trade Organisation (WTO), the move from EU State Aid rules may open up new opportunities for life sciences with regard to support for SME growth in relation to commercial/industrial early-stage R&D.

EU State Aid considerations have impacted on a number of business investment and support activities for many years. Government should consult with those involved in providing direct and indirect support to SMEs the extent to which higher levels of subsidy/support would accelerate the commercialisation of research and innovation.

6. Skills and talent

This growing sector requires a workforce of scale, with the specific skills to meet its aspirations. With strong life sciences employment growth forecasts, evolving job roles and the need to accommodate staff turnover, the challenge lies in how to attract, train and retain the workforce needed to satisfy demand.

Across the UK, it has been estimated that 119,000 people with level 2-8 qualifications will be required by the life sciences sector by 2030, of which around 39,000 (33%) will be required at level 6 (degree level) and 32,000 (27%) at level 7 or above (postgraduate level).[42]

As well as capturing the required scale of workers, there are recognised to be specific skills shortages (for example in immunology and genomics) and sector-wide skills issues to address (including requirements for digital and computational skills, leadership, effective communication and commercialisation skills).

The Parliamentary Office of Science and Technology identifies that by 2024 there will be a four million shortfall in what it terms "highly skilled workers" and, it can be argued that, aside from the shift in demographic and advent of the Fourth Industrial Revolution, future deficits to the skills and employment market will be further compounded by the changes to working patterns created during the pandemic.[43]

Discussions with industry based in, or active within, the North have identified areas for high-level skills development around Advanced Therapies, Diagnostics and Digital/AI in particular.

The pandemic response of the NHS and universities in training large numbers of staff quickly in, for example the Alderley Park Lighthouse Lab and the Integrated COVID Hub in Newcastle, are models for how large numbers of trainees can be provided with high-quality practical and theoretical training that simultaneously builds resilience in the public sector and develops cohorts with the skills required by industry.

The Global Talent Visa, providing a new route for talented individuals to come and work in the UK, allows highly skilled scientists and researchers from across the globe to come to the UK without needing a job offer.

The Life Sciences 2030 Skills Strategy has been developed under the leadership of the Science Industry Partnership (SIP) Futures Group as a key deliverable in the Life Sciences Sector Deal 2, and will play a central role in delivering the skills ambition of the Industrial Strategy.

The Skills Strategy states that the sector has the potential to create approximately 133,000 jobs over the next 10 years, and that digital and computational skills, statistical literacy, leadership and inter-disciplinary working are essential to the success of the UK's Life Science industries.

The Strategy makes the case for sector-based skills investment and investment into high level apprenticeships, alongside flexibilities in use of the Apprenticeship Levy. Across the North there is an opportunity for Northern universities to offer more degree apprenticeships and training in response to the demand from industry and to meet the emerging skills needed in the clinical workforce.

7. Regulation

The UK's regulatory approach and the quality of its regulatory policy rank among the highest internationally.

The UK Government is committed to taking a forward-thinking approach and setting the international agenda on regulation and standards. The intention is to allow SMEs and industry to grow and flourish, attract international R&D investment and talent to the UK.

Government is committed to a streamlined and forward-thinking regulatory system with coordinated working across regulators and competent authorities to offer companies an efficient study approval process.

A single integrated research application system (IRAS) simplifies the process for gaining ethics and trial approvals and companies can engage in early, exploratory discussions through the MHRA Innovation Office, to maximise innovation and speed of approvals, and can use the coordinated scientific advice service from MHRA and NICE.

There are two important commitments needed to further support innovation in health and life sciences:

1. Government and regulators to work closely with researchers and industry to develop regulatory approaches which take account of the new opportunities from investment in science and technology.

2. Consideration of the lessons learnt from the pandemic experience and the extent to which other processes and procedures can be adapted to accelerate new treatments and diagnostics. There is an opportunity to ensure that the UK maintains a regulatory system which attracts new investment from across the globe.

Part 2

High Growth Opportunites For The Northern Life Sciences Supercluster

Opportunity Area 1:
Advanced Therapies

Context

Advanced therapies such as cell and gene therapies offer unprecedented potential for the long-term management and even cure of disease, especially in areas of high unmet medical need.

Advanced therapies are driving an exciting and revolutionary new paradigm in science and healthcare. The North has a well-developed scientific and clinical infrastructure.

It is also well-connected to other UK networks and structures, most notably the Advanced Therapy Treatment Centres (ATTCs), and with plans in place to develop the Sheffield Gene Therapy Innovation and Manufacturing Centre (GTMIC), the North can collectively help keep the UK at the forefront of the global advanced therapy medicinal products (ATMP) market.

Pan-Northern opportunities, supported by R&D investment, have the potential to support the economic contribution of advanced therapies through discovery research, translational research, innovation, commercialisation, and deployment.

A national priority area

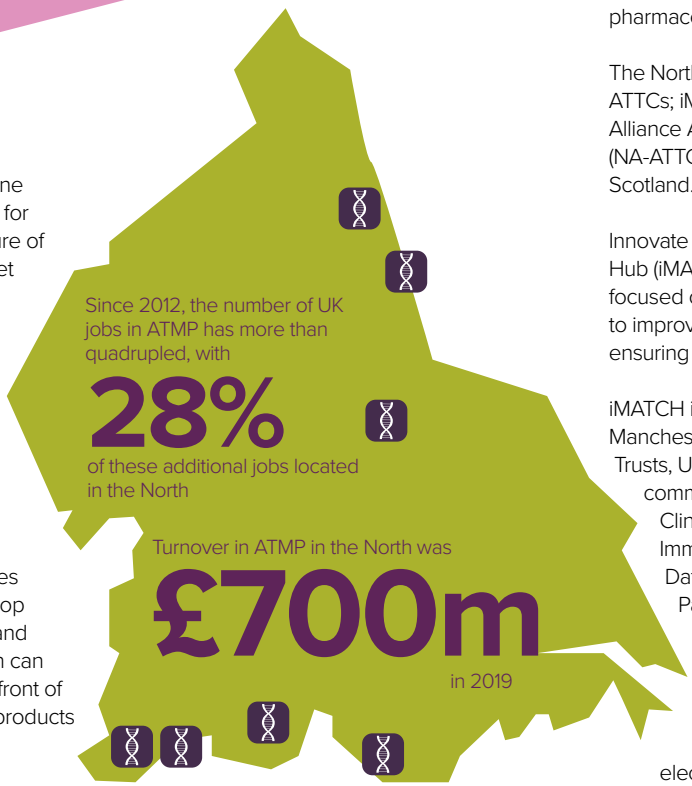
Advanced therapies are highlighted in the 2017 Life Sciences Industrial Strategy as a key growth sector and opportunity for the UK, building on its excellent science base to secure advanced therapies manufacturing.

The Life Science Sector Deal articulates the aim to make the UK a global hub for advanced therapies manufacturing.

The UK is a global leader in advanced therapy development, evaluation and clinical delivery, with the largest advanced therapies cluster outside of the US supported by world-class academics, innovation infrastructure including the Cell and Gene Therapy Catapult, investors, SMEs and pharmaceutical companies.

Where are we now?

Since 2012 the number of jobs has more than quadrupled, with over 3,000 jobs compared to 540 in 2012; the number of ATMP developers in the UK has tripled; and £2.5bn of investment has been received by UK companies.



The UK accounts now for 27% of ATMP companies in Europe, and 12% of global ATMP clinical trials, with 6% of global ATMP clinical trials run through the ATTCs.

In 2020 there was a 20% growth in the number of ATMP clinical trials compared to the previous year.

The field is expected to be worth US$11.96bn globally by 2025, with the vision for the UK of 4,000 additional jobs and £2bn in revenue by 2025, rising to 18,000 additional jobs and £10bn in revenue by 2035.[44]

There is a valuable opportunity to build on existing collaborations and a willingness to continue to work collaboratively.

Biopharmaceuticals are key to the North's life science sector, accounting for 42.6% of jobs. In the North in 2019 core biopharma and biopharma service and supply accounted for 22,480 jobs, 18% of UK's biopharma employment, and turnover of £9.4bn.[45]

Existing clusters and assets

The North of England is heavily involved in advanced therapy development, evaluation and clinical delivery, with world-class academics, innovation infrastructure, investors, SMEs and pharmaceutical companies.

The North is home to two out of the three UK's ATTCs; iMATCH in Manchester and the Northern Alliance Advanced Therapy Treatment Centre (NA-ATTC) which spans the North of England and Scotland.

Innovate Manchester Advanced Therapy Centre Hub (iMATCH) is a Manchester-based consortium focused on scale-up of activity in ATMPs, aiming to improve access to ATMPs for patients, while ensuring their efficient and safe delivery.

iMATCH is made up of The Christie and Manchester University NHS Foundation Trusts, University of Manchester, and nine commercial partners (AgenTus, Aptus Clinical; AstraZeneca (dECMT), Asymptote, Immetacyte, Chaucer Life Sciences, Datatrial, Formedix and Christie Pathology Partnership (CPP)).

The objectives of the iMATCH consortium are to maximise patient access to ATMPs through integration of sample collection; development of electronic sample traceability and tracking systems utilising novel digital implementation. iMATCH aims to increase the knowledge and safety of these complex treatments through innovative systems of clinical data capture, and develop education materials to prepare NHS staff to give the understanding required for working with ground-breaking treatments and sharing best practice across the industry and NHS.

The project was awarded almost £7m of funding from Innovate UK, has been running since March 2018, and is now delivering change and innovation within Manchester and beyond.

The Northern Alliance Advanced Therapy Treatment Centre (NA-ATTC), formally established in March 2018, is a consortium of twenty industry, NHS and academic organisations led by The Newcastle upon Tyne Hospitals NHS Foundation Trust and the Scottish National Blood Transfusion Service (SNBTS). The purpose of the centre is to develop the systems and infrastructure required to support the delivery of cell and gene therapies with the ultimate aim of increasing patient access to advanced therapy medicinal products (ATMPs) on a national level by growing a cost-effective clinical delivery pathway which meets the needs of the providers of advanced therapy products. The centre has a patient reach of circa 15 million spanning the North of England and Scotland and is working across two healthcare systems.

The centre focuses on all elements of the clinical delivery pathway from procurement of starting materials, near patient Good Manufacturing Practice (GMP), distribution and administration through to delivery of clinical trials and adoption and reimbursement. It covers a range of advanced therapies and indications, and requires the participation and collaboration of nurses, medical clinicians, hospital pharmacists, NHS managers, clinical commissioners and companies.

Much of the current Advanced Therapies portfolio of development is cancer related. The NP11 footprint is a leading geography for cancer research and adoption of new treatments, with several important cancer institutions including Clatterbridge Cancer Centre, Rutherford Cancer Centre, Rutherford Diagnostics, Advanced Oncotherapy, Liverpool Experimental Cancer Medicine Centre and the Cheshire & Merseyside Cancer Alliance.

Other therapeutic areas amenable to ATMP approaches are opening up. Sheffield Institute for Translational Neuroscience (SITraN) is an £18m centre at University of Sheffield working in partnership with Sheffield Teaching Hospitals NHS Foundation Trust and is pioneering new treatments for neurodegenerative diseases such as motor neurone disease, spine and muscular atrophy.

The recently announced Sheffield Gene Therapy Innovation and Manufacturing Centre (GTIMC) will be one of three cutting-edge hubs in the UK dedicated to advancing the clinical development of new genetic treatments.

The Sheffield Hub, which is the first in the North of England, is part of an £18m network created by LifeArc and the Medical Research Council (MRC), with support from the Biotechnology and Biological Sciences Research Council (BBSRC) and Co-Lead Institutions including CPI, the Cell & Gene Therapy Catapult and the University of Liverpool. It is anticipated that having this facility in the North is highly significant, bringing the potential for increasing inward investment in future.

The EPSRC National Research Facility for Advance Electron Microscopy (SuperSTEM), on the SciTech Daresbury Campus, is an internationally renowned electron microscopy user facility, which acts as a focal point for driving forward developments in scanning transmission electron microscopy in the Physical Sciences, both in the UK and internationally.

SuperSTEM is involved with leading centres in the latest use of proton therapies and is led by the University of Leeds and joined by the universities of Liverpool, Manchester, York, Glasgow and Oxford. Investment has also been committed to advancing skills and training in the sector as the National Horizons Centre provides the National Training Centre for the Advanced Therapies Skills Training Network (ATSTN).

Recently announced as one of three initial national training centres in the country, the facility will deliver on-site advanced therapies and vaccine manufacturing practical and digital training, providing the workforce the sector needs to innovate and grow.

Fig 4: Advanced Therapy Development, Evaluation and Clinical Delivery

	Employment		Revenue	
	UK	NP11	UK	NP11
2019	3,000	840	£2.5bn	£0.7bn
2025	7,000	2,240	£4.5bn	£1.4bn
2032	14,700	5,460	£8.4bn	£3.1bn

Key constraints and market failures

The scientific and clinical infrastructure can appear fragmented, and there is a recognised need to increase end-to-end product development pathways from access to basic science excellence for discovery of potential treatments, through to clinical expertise for trials and adoption into clinical practice.

In particular, companies need greater access to networked early-stage co-development facilities, clinical trials space and GMP manufacturing capacity. There is insufficient space for commercial clinical trials, and this may be inhibiting the amount of industry funded trials and research. There is some evidence of skills gaps in the wider workforce, in particular on the manufacturing side.

Where could we be in 2032?

To capture a share of growth forecast nationally, there is a strong opportunity to build on a world-leading competitive edge in advanced therapy development, evaluation and clinical delivery, in areas such as cancer, with the potential to transform this into substantial economic growth in pharmaceuticals and medtech. By 2032, the aim is to increase employment and revenues from Advanced Therapy development, evaluation and clinical delivery, with employment more than doubling between 2025 and 2032 as new R&D investment comes in to play (see fig 4)

Increasing the development, evaluation and clinical delivery of advanced therapies will make an important contribution to increasing the pharmaceutical sector in the NP11 geography, where there are already several strong clusters. There is the potential for substantial jobs growth, driven by high productivity employment (see Fig 5).

Growth in pharmaceuticals industries will be assisted by successful inward investment, including new entrants accessing the UK, capacity for clinical trials and the strength of the workforce for pharmaceuticals production.

What is needed to deliver benefits?

The economic benefits for the North will be based on:

- Increasing translational research, clinical trials and new treatments and upscaling activity to accelerate development.
- Accelerating new treatments through to pharmaceuticals and medical technologies.
- Building links to digital and data to identify new approaches to advanced therapy development.
- Developing pharma opportunities for international markets.

A Northern Advanced Therapies Accelerator model is proposed to accelerate the development, evaluation and clinical delivery of industry-led innovation, delivered through existing centres and networks.

This Northern Advanced Therapies Accelerator includes four immediate propositions:

(i) Provide companies with greater access to an early-stage unique environment and skill-mix in the university setting to manufacture and validate multicomponent composite ATMPs including genes / cells / tissues / biomaterials.

(ii) Extend the work of the Innovate Manchester Advanced Therapy Centre Hub (iMATCH), and Northern Alliance Advanced Therapy Treatment Centre (NA-ATTC) to provide companies with greater access to additional networked clinical trials space for commercially funded research.

(iii) Invest in refurbishment of GMP manufacturing facilities with a focus on increasing capacity for cell-based products.

(iv) Support networking across the sector enabling the varied assets across the North to work together to drive further innovation and strengthen the North's profile in the national and international marketplace.

Fig 5: Change to Biopharmaceuticals Sector Growth

	Employment		Revenue	
	UK	NP11	UK	NP11
2019	124,300	22,480	£55.1bn	£9.4bn
2025	134,000	28,140	£59.4bn	£11.9bn
2032	145,000	35,740	£64.4bn	£15.2bn

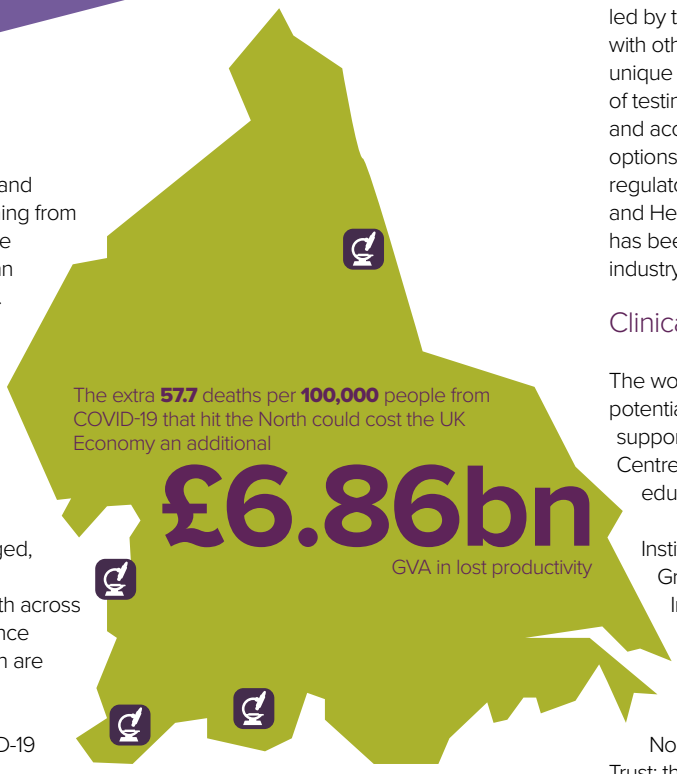
Opportunity Area 2:
Infectious Diseases

Context

The post-COVID-19 economic recovery and Building Back Better, must draw on learning from a number of areas. There are competitive advantages in the UK for industry that can be achieved by building on this learning. For example, the UK can hardwire some of the regulatory and collaborative innovation to the ongoing response to COVID-19 long and building resilience in the local supply chain and manufacturing.

Furthermore the effective partnership working between industry and an engaged, proactive NHS and academia must be sustained to provide a platform for growth across the life sciences sector as well as resilience in our infectious diseases response. Both are crucial to economic prosperity.

The requirements for response to COVID-19 are still very real and there will be other pandemics. We have known for a long time that the worldwide re-emergence of vaccine-preventable diseases, that we need to optimise vaccine provision, and that the growing risk from antibiotic resistant infections is very significant and growing.[46]



Source: NP COVID-19 REPORT 101120 (thenhsa.co.uk)

Vaccine-preventable diseases

There is now a real opportunity to increase UK capacity and capability across the entire anti-infective pipeline from industry, from discovery, through translational research, to clinical validation, evaluation, manufacturing, and production, by building on the recognised scientific and clinical excellence and connecting existing assets across the Northern Supercluster.

The North of England's response to the COVID-19 pandemic is well evidenced in the chronology of scientific and clinical contributions, from viral genome sequencing to the discovery, evaluation and manufacture of diagnostics, therapeutics and vaccines.

Vaccines and therapeutics

The pandemic response, as a collaboration across the public and private sector has, above all else, depended on the strength of the UK science base and it has highlighted the need to sustain that base. The lesson from the pandemic is that this capability should be treasured and nurtured, not only because it has, in this instance, served the country and the world well, but also because of the resilience that it brings in dealing with known and unknown future threats to health and prosperity.

The North can contribute much to the future resilience and capability required around vaccines and therapeutics for infectious diseases. The UK's Centre of Excellence for mRNA vaccines was recently established at CPI in Darlington, supporting the creation of an mRNA 'COVID-19 Vaccine variant library' that will facilitate the rapid development and manufacture of mRNA vaccines to defend against new COVID-19 variants. The mRNA technology being utilised may become the standard for defending against other viruses and diseases in the future, potentially changing the face of vaccines research, development and manufacture.

Partnerships in Liverpool, for example, have played leading roles in the development of new vaccines and therapeutics to address unmet medical needs related to infection and antimicrobial resistance (AMR). Liverpool has significant translational sciences and infrastructure, with close collaborations with regional expertise in antimicrobial drug safety, formulation and regulation.

Initiatives such as the AGILE clinical trial platform, led by the University of Liverpool in partnership with other centres in Liverpool, represent a unique example of collaborative working capable of testing multiple potential treatments in parallel and accelerating new antiviral therapeutic options for patients with COVID-19. AGILE has full regulatory approval from the MHRA (Medicines and Healthcare products Regulatory Agency) and has been a focus of substantial investment from industry.

Clinical trial delivery

The world-renowned RECOVERY trial of various potential therapies for COVID-19 was ably supported by the NIHR Biomedical Research Centres (BRCs) and key NHS and higher education institutions across the North.[47]

Institutions in the RECOVERY Collaborative Group for this study include the Regional Infectious Diseases Unit, North Manchester General Hospital, University of Manchester, and Manchester University NHS Foundation Trust; the Department of Respiratory Medicine, North Tees and Hartlepool NHS Foundation Trust; the Centre for Clinical Infection, James Cook University Hospital, Middlesbrough and the Department of Mathematics and Statistics, Lancaster University.

These organisations and others across the North were crucial to understanding the potential benefits of dexamethasone in the care of seriously ill patients.[48]

Four of the UK sites for the Phase II/III trial of the University of Oxford COVID-19 vaccine clinical trial tap into the clinical excellence of the North of England, with recruitment at Newcastle, Sheffield, Hull and Liverpool. More broadly, Leeds has recruited 1,000 participants into COVID vaccine trials and was the highest recruiter to the NOVAVAX vaccine study.

Clinical excellence

The link between discovery, early-phase testing and excellence in clinical practice is important. The excellence across the North in terms of NHS services is a crucial underpinning of both the trials infrastructure and the rapid influencing required for adoption. Large teaching trusts such as those in the Newcastle, Leeds, Manchester, Sheffield and Liverpool have both specialist and sub-specialist patients under one roof.

This breadth and access to both volume

of patients and rare diseases, allied to the commitment evident to clinical trials in these organisations remain a critical asset in the support for life sciences industry in the UK. The influence of these large teaching hospitals on regional and national adoption of innovation cannot be overstated.

Many infectious diseases lack vaccines and the value of having the capacity and clinical excellence ready to develop such vaccines was well demonstrated in the Phase I clinical trials of the Oxford vaccine for COVID-19.

However, it was notable that none of the clinical recruitment sites for the Oxford vaccine were in the North of England. There is an untapped resource of clinical excellence that could be boosted with investment in capacity for Phase I trials.

For example, Newcastle is one of four recruitment centres for the early phase I and II trials of the Valneva COVID-19 vaccine, alongside Birmingham, Bristol and Southampton. Newcastle has a strong track record of delivering such studies to time and target, frequently as fastest recruitment site, thanks to the willingness of the local population to participate in research.

Manufacturing and production of vaccines

As the UK Government and biotechnology industry responded to the coronavirus pandemic in 2020, the limited UK vaccine manufacturing capacity became apparent.

The UK imported all of its vaccines, with production limited to one plant in Liverpool making seasonal flu jabs and another in Scotland making a niche product, Japanese encephalitis vaccine.

There are now four companies producing, or preparing to produce, COVID-19 vaccines in the UK, using a number of production locations including Stockton-on-Tees and Barnard Castle. In addition, two rapid response centres are under construction and should be ready by the end of 2021 to produce vaccines against coronavirus or any new pathogen that threatens another pandemic.

A new strategic priority of the Government is to increase capacity and capability to produce more vaccines within the UK. While this is in response to the pandemic, the North of England has a strong science base in other infectious diseases and potential vaccines.

Existing strengths and assets include infectious disease and antimicrobial research expertise in universities including Liverpool, Sheffield, Manchester, Leeds, Lancaster, Durham and Newcastle, as well as LSTM.

Liverpool City Region, together with Cheshire and Warrington, delivers £2 billion of research and development activity in the infectious diseases space per annum – representing the largest regional centre for infectious diseases research in the UK.[49]

Viral sequencing

After sequencing the whole genomes of SARSCoV-2 from two local COVID-19 positive patient samples in March 2020, University of Sheffield researchers received a £12.2m funding boost in November 2020 and are now involved in generating and sharing sequence data to map how COVID-19 spreads and evolves, as part of the COVID-19 Genomics UK (COG-UK) Consortium.[50,51]

The COG-UK consortium received total funding of around £20m across 12 partners, of which £1.5m was invested in Liverpool as another key partner. The new funding has allowed the consortium to expand whole genome sequencing of positive SARS-CoV-2 virus samples. Their work has been invaluable in several areas, including documenting new viral variants and investigating transmission within hospital settings.

Diagnostics – clinical evaluation and testing capacity and capability

The *CONDOR diagnostics evaluation platform* for new COVID-19 diagnostic tests, funded by NIHR and UKRI, is co-led by Manchester University NHS Foundation Trust's DiTA (Diagnostics and Technology Accelerator) and the University of Oxford, in partnership with the NIHR medtech and In Vitro Diagnostic Co-operatives in Leeds and Newcastle, and the Academic Health Science Networks (AHSNs) in the North East and North Cumbria, and Yorkshire and the Humber.[52]

The CONDOR platform is divided into three clinical evaluation studies, looking at performance of diagnostics in different real-world clinical settings, and three cross-cutting studies in care pathway analysis, human factors evaluation, and analytical performance, that work across and feed into the clinical studies.

The CONDOR platform has been game-changing in terms of multi-organisational working and that learning, particularly around what can be done to enable large-scale rapid evaluation must be retained post-COVID-19.

In March 2020, the Government announced the launch of a national testing effort to bolster the UK's fight against coronavirus via the establishment of a network of 'mega' testing laboratories, known as 'Lighthouse Labs', designed to be 'high-throughput' facilities to support the National Testing Programme.

The Medicines Discovery Catapult were responsible for the creation of a Lighthouse Lab Network and the North of England is home to two such labs, Alderley Park Lighthouse Lab in Cheshire and the Integrated COVID-19 Hub North East (ICHNE) in Gateshead.

By January 2021, Alderley Park Lighthouse Lab had tested 6 million samples - equivalent to testing 1 in 10 residents of the UK - and is equipped to process 50,000 samples each day, reaching more than 10 million tests undertaken by May 2021.[53]

Baltic Park Lighthouse Lab in Gateshead opened in March 2021 and by July had processed almost 2 million samples. As part of the wider integrated COVID hub, the lab plays a central role in providing a coordinated response to the pandemic. The other two elements of the integrated hub are a coordination and response centre which provides additional regional resource and insight to monitor and respond to the virus, in partnership with local public health teams, and a specialist innovation lab, led by a team of scientists who are accelerating the next stage of COVID diagnostics.

The speed at which the Lighthouse Labs launched, their track-record of delivery at scale, and the collaboration across the system that made it possible, serve as lessons to be learned from COVID-19 in terms of system working. They are also testament to what can happen when the scientific and industry communities harness their collective expertise and apply the brightest minds, best facilities and most innovative ideas to solve a pressing societal challenge.

However, the pandemic continues to be a global disruptor and threat, so the expertise created by, and located within the Lighthouse Labs, should be sustained long-term.

In a recent Insider roundtable marking the 12-month anniversary of their creation and examining "What's Next for Lighthouse Labs", Dame Anna Dominiczak, Director of Laboratories for the COVID-19 testing programme observed that the Lighthouse Laboratories provide "modern, linked-to-industry, high-throughput molecular testing" the importance of retaining this expertise and urged all involved "not to dismantle what has been built".[54]

Similarly, Lord Bethell, Parliamentary Under-Secretary at DHSC (Department of Health and Social Care) outlined that if we are to put the patient at the heart of the prevention agenda, a thread that runs throughout NHS England's Long-Term Plan, we need to step up a level in the scientific advances made in diagnostics over the last 12 months.[55]

Antibiotic resistant infections

As with vaccine preventable diseases, the opportunity to link assets across the North to support industry needs with an infrastructure for microbial research would further increase the economic value of the Northern Supercluster.

The region has extensive track record in the development of new antibiotics in the preclinical and early phase clinical space to meet the challenge of AMR, with active collaborations between the University of Liverpool, LSTM and Infex Therapeutics. Both the University of Liverpool (in partnership with LSTM) and Manchester's BRC received an NIHR Capital Award for AMR Research in 2019.
These centres provide unique infrastructure to develop expertise in the rapid diagnosis of bacterial infections, AMR and sepsis.

To support personalised care, they are identifying

individualised antimicrobial dosing and rapid assessment of antimicrobial response with the aim of reducing emerging AMR.

As evidenced below with the basic science strengths relevant to AMR, in Newcastle, Sheffield and York as well as the examples cited from Manchester and Liverpool, there is a urgent need for research, linked to clinical trials capability and excellence in care to support industry work into both AMR and other emerging infectious disease threats.

Where are we now?

The Northern Supercluster has world-class capabilities and expertise in infectious diseases, including a track record in clinical trials and the clinical delivery and validation of therapeutics and technologies for the containment and control of AMR infections.

Strengths in collaborative working were instrumental to the North of England's significant contribution to the UK's response to the COVID-19 pandemic. Working alongside industry, NHS expertise in the North is leading on major pan-European studies across a number of infectious disease areas.

Biopharma manufacturing strengths across the North are unrivalled in the UK and Europe, ranging from antibodies and vaccine production in the North East and North West to drug discovery and precision medicine in locations including Cheshire, Greater Manchester, Leeds and Newcastle.

Existing clusters and assets

Key Assets within the North include:

The Liverpool School of Tropical Medicine (LSTM), is a world leading centre for infectious disease research and host to the Centre of Excellence in Infectious Diseases Research. It has played a leading role in the national and international response to COVID-19.

Liverpool has extensive infrastructure for the study of (emerging) infectious diseases including CL3 laboratories, NIHR AMR laboratories, Open Innovation Hub for Antimicrobial Surfaces and two Health Protection Research Units (HPRUs).

There are multiple linkages to other regional partners and extensive programs that are both relevant to the NHS and the global community. Liverpool has active programs in antimicrobial medicinal chemistry, formulation science, antimicrobial pharmacodynamics, antimicrobial drug safety, vaccine science, pharmacogenetics and both early and late phase clinical trials.

There are multiple active industrial collaborations from around the world to accelerate the development of new antimicrobial diagnostics, therapeutics and vaccines.

Open Innovation Hub for Antimicrobial Surfaces at the University of Liverpool - a multidisciplinary initiative to develop new processes and technologies to tackle

antimicrobial resistance and infection control, working with a range of businesses including SMEs and multinationals.

Biomanufacturing cluster, one of the largest and longest established clusters of biological and small molecule manufacturing in Europe, with 38% of the output and 43% of the UK pharmaceutical turnover generated in the North West. Several global pharmaceutical companies have manufacturing sites in the North, including: GSK, Fujifilm Diosynth Biotechnologies, Organon, Sterling PSL, Accord, AstraZeneca, Eli Lilly, Medimmune, and Novartis Vaccines, Seqiris, Bristol Myers-Squibb, Allergan Biologics, Elanco, Teva, and Red X Pharma.

High Consequence Infectious Diseases (HCIDs), including viral haemorrhagic fevers (VHFs) are rare in the UK. When cases do occur, they tend to be sporadic and are typically associated with recent travel to an area where the infection is known to be endemic or where an outbreak is occurring. They are classified in contact and airborne groups.[56] Confirmed and highly probable cases are transferred rapidly to a designated HCID Treatment Centre. There are two principal Contact HCID Treatment Centres in England, one of which is in the Newcastle Royal Victoria Infirmary (RVI), where the UK's first COVID-19 patients were treated. Further support for managing confirmed contact HCID cases is provided by the Royal Liverpool Hospital and the Royal Hallamshire Hospital, Sheffield.

There are five interim **Airborne HCID Treatment Centres** in England. Adult and paediatric services are provided by 7 NHS Trusts, including Liverpool University Hospitals NHS Trust, with a paediatric service provided by Alder Hey Children's NHS Foundation Trust, Newcastle upon Tyne Hospitals NHS Foundation Trust (adult and paediatric services) and Sheffield Teaching Hospitals NHS Foundation Trust (adult service only).

In May 2021, the UK's centre for therapeutics innovation, the Medicines Discovery Catapult (MDC), received £5m from the Government's Getting Building Fund programme, to build a Translational Research Facility in Infectious Disease at Alderley Park.
Due for completion in March 2022, the £13m MDC match-funded project is set to enable SMEs and academic innovators to advance the next generation of innovative therapeutics, diagnostics and biomarkers for high risk infectious diseases towards patient use.

Existing strengths and assets in infectious disease and antimicrobial research expertise in Northern universities include:

- **The University of Manchester** – has critical mass in bacteriology and cell wall research, with links to critical care in the NHS. Also host of the Manchester BRC and AMR Centre (NIHR infrastructure).

- **University of Leeds** - Infection and immunity group research encompasses virology, structural biology, immunology, cancer biology and immunotherapy.

- **The University of Sheffield** – a key collaborator in the COVID-19 Genomics UK (COG-UK) Consortium, sequencing COVID-19 variants. The immunity research group is focussed on understanding the mechanisms of physiological and pathological immune responses in a range of organs relevant to human disease.

- **Newcastle University** - Centre for Bacterial Cell Biology is an internationally important asset in the fight against AMR, and the Immunity and Inflammation Group have applied their expertise during the pandemic to produce important evidence on the immune response to COVID-19.

- **Lancaster University** – Materials Science Institute has a focus on providing material-based solutions that enable new approaches to fight the rise of AMR. The CHICAS (Centre for Health Informatics, Computing and Statistics) in Lancaster Medical School has a global reputation for their infectious disease modelling work.

- **Durham University** - Centre for Global Infectious Disease draws upon expertise at

Durham and partner organisations across the biological, chemical and physical sciences to synergise research foci to develop collaborative efforts for the identification and inhibition of novel antimicrobial targets, ultimately leading towards the development of novel therapies and preventative strategies.

- **University of York** - Immunology, haematology and infection (IHI) theme ranges from fundamental insights into disease mechanisms, through to vaccine clinical trials and epidemiology, including microbiology, bacterial pathogenesis and AMR.

CPI, part of the High Value Manufacturing Catapult and based in the North East, has received over £100M of public investment in life sciences.

Collaboration in action

A prime opportunity exists to build on the collaborative networks in infectious diseases that were instrumental to the North of England's contribution to the UK's response to the COVID-19 pandemic.

Collaborative working across the North is already underway via the Infection Innovation Consortium (iiCON). Led by LSTM, with multiple regional partners, iiCON is delivering a £120m major project to tackle infectious diseases, including COVID-19, bringing together six core partners, 64 local businesses, and 120 businesses in a broader network.

iiCON received an £18.6 million grant from the UKRI Strength in Places Fund (SIPF) and £6.6m ERDF, with the remaining income secured through external collaborators and contributions from core partners.

iiCON is creating eight specialist research platforms for infectious diseases therapeutics aiming to fast-track the discovery, development, evaluation and impact assessment of potential new products and treatments.[57]

In Liverpool, a new partnership of three HEIs, local NHS, the city and regional government and the Knowledge Quarter has attracted significant inward investment to create a new Pandemic Institute which will take an end-to-end approach to mitigating the effect of future pandemics in the UK and globally.

Working alongside industry, NHS expertise in the North is leading on major pan-European studies, while the presence of global health leaders in Liverpool means that the Northern Powerhouse extends the opportunity to include international collaborations and trials to patient populations across Africa and Asia.

Key constraints and market failures

- A lack of capacity in NHS facilities to undertake Phase I clinical trials for infectious diseases.

- The commodification of the global infectious diseases market which has weakened the pipeline and deskilled the sector.

- Outdated development methodologies which have led to high rates of later stage failure and dampening appetite to invest, with high-risk product development - costly, long timelines and a high failure rate.

- An under-invested market in need of new solutions and innovations, with innovation coming primarily from research institutes and SMEs.

- Many products at the end of their lifecycle due to the emergence of resistance and now an urgent need to improve efficiency, speed and cost effectiveness of route to market.

- Market reward is poor to incentivise and attrition rates are high.

Where could we be in 2032?

There is a valuable opportunity to build on world-class capabilities and expertise in infectious diseases in the Northern Supercluster, including clinical trials and the clinical delivery and validation of therapeutics and technologies for the containment and control of AMR infections.

Working alongside industry, NHS expertise in the North is leading on major pan-European studies, while the presence of global leaders such as the LSTM mean the North extends the opportunity to include international collaborations and trials to patient populations across Africa and Asia.

By 2032 it is anticipated that the North will have increased its infection R&D by £2bn over ten years, increasing related annual GVA to £3bn by 2032.

The scale of impact will be a result of:

- De-risking product development, facilitating cheaper, quicker and smarter anti-infective product development, supported by open access to technology expertise and commercial support.

- Accelerating new treatments through to pharmaceuticals and medical technologies.

- Building links to digital and data to identify new approaches to advanced therapy development.

- Developing pharma opportunities for international markets.

- The significant knowledge and assets in the North, particularly in Liverpool City Region and Cheshire and Warrington, combined with the significant production facilities in Tees Valley and the North East, mean that the North is already well-positioned to capture a share of growth forecast nationally.

Biopharma manufacturing, especially with the focus on antibodies and vaccines represents an area for growth for the North as the need to be self-sufficient has become increasingly apparent as a result of the pandemic. The North already has key clusters in the North East and North West which complement the drug discovery and precision medicine strengths across locations in Cheshire, Liverpool, Greater Manchester, Leeds and Newcastle.

Dealing with the next big threat

There is a real possibility that by 2032 the world will be facing health and societal problems that dwarf the COVID-19 pandemic.

While this is an unpalatable thought, it is a likely scenario. In the health arena, mental health, obesity, rising inequalities and antimicrobial resistance all have the potential for devastating impact.
In the case of AMR, we can act now to develop the diagnostics, therapeutics and change approaches that will be needed to contain and control these risks. In this arena too, the North is well placed to contribute to the national effort with research and clinical expertise that can be allied to existing and future industry collaborations to meet what will be a global catastrophe if it is not addressed.

While AMR is a different sort of problem to COVID-19, limiting the effects on health and the economy will be just as reliant on having an excellent scientific base and the ability to mobilise the outputs quickly.

However, it will be a much more complex problem and will need a broad underpinning of the research infrastructure and incentives to make rapid progress.

What is needed to deliver benefits?

There are four immediate propositions to fast-track the discovery, development, evaluation and delivery of potential new diagnostics, therapeutics and vaccines for infectious diseases:

a) Develop out the eight full iiCON specialist research platforms for infectious diseases therapeutics and increase staff and commercial support to increase engagement with research centres and companies across the North.

b) Scale up and extend the iiCON approach to a pan-Northern activity enabling further partnerships between SMEs, research institutions and large-scale industry; co-develop and co-risk new infectious disease formulations; validate and position efficacy in market applications; facilitate cheaper, quicker and smarter anti-infectives through open access; and progress to market products from discovery to clinics and elsewhere.

c) Invest in capacity in NHS settings in the Northern Supercluster for Phase I clinical trials in infectious diseases, including AMR.

d) Invest to increase capacity and capability in the Northern Biopharma manufacturing cluster, to deliver the UK vision to be a global centre for the development, manufacture and use of cancer vaccines and immunotherapies.

Opportunity Area 3:
Diagnostics and MedTech

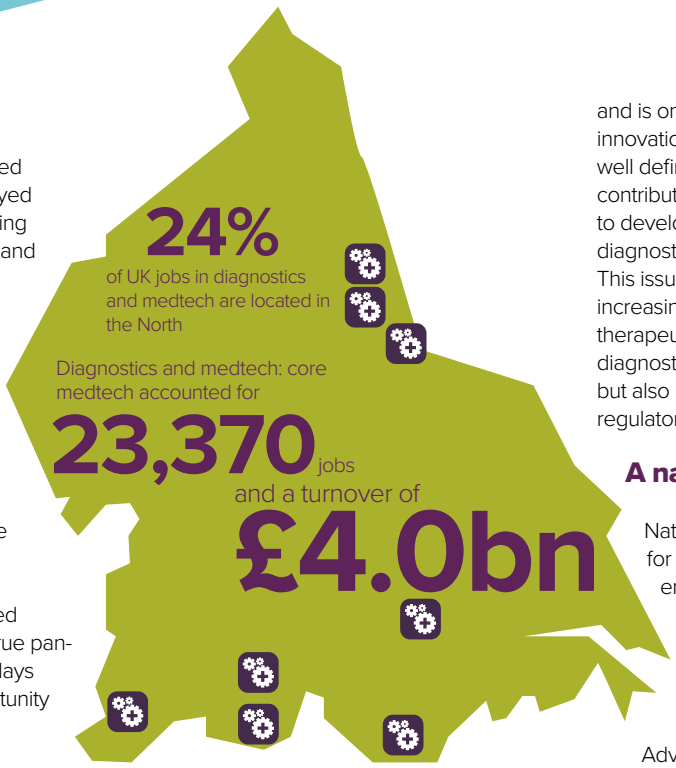
Context

The COVID-19 pandemic has demonstrated the importance of effective, rapidly deployed diagnostics. Meanwhile, innovation is driving convergence between digital, diagnostic and therapeutic technologies, offering great potential benefits.

Diagnostics and medtech are already an established strength within the North. Statistics published in 2020 show that 60% of the core medtech sector's employment is outside London, Eastern England and the South East, with concentrations of employment around the major cities.

Greater collaborative working and targeted interventions present an opportunity for true pan-Northern activity in a geography that displays broad strengths, exploiting a major opportunity outside of the South East.

As well as securing benefits in their own right, advances in diagnostics and medical technologies can also support growth under other areas of opportunity outlined in this document, for example advances in cancer care and digital health, as well as supporting healthy ageing and the wellbeing of the workforce.



What is MedTech?

Medical Technologies, sometimes referred to as Health Technologies, particularly in regions outside of the UK, encompass a broad and diverse set of technologies. The World Health Organisation (WHO) gives the definition:
"An article, instrument, apparatus or machine that is used in the prevention, diagnosis or treatment of illness or disease, or for detecting, measuring, restoring, correcting or modifying the structure or function of the body for some health purpose"

The UK Government categorises the sector into two groups:

1) Core medtech: Businesses who develop and produce products

2) Service and supply medtech: Businesses who provide contract research and manufacturing, specialist legal and regulatory advice, design, analysis, recruitment, IT, logistics or investments

Core medtech business make up approximately 70% of the sector and contribute 80% of the turnover and are generally the focus of this section. Service and Supply are vital to a healthy economy but are attracted to a region based on its core businesses.

In practice, core medtech commonly refers to technology like Orthopaedic devices, In-Vitro Diagnostics, Wound Care, Implants, Single-Use consumables and digital health products.

However, innovation often occurs at the boundary between sectors, and the category medtech also applies to precision medicine with companion diagnostics, the devices used by the biopharma industry to develop, deliver and monitor the outcomes of new treatments, digital devices, engineering advances and even stand-alone software.

The impact of these innovations on the health and care system and the resultant patient benefits and economic growth for successful innovations is the key point regardless of technical categorisation.

Such a broad definition has drawbacks however, and is one factor that has contributed to the innovation pathway for medtech to be less well defined than for pharmaceuticals. This contributes to the difficulties faced by industry to develop, evaluate and implement new diagnostics and medtech.
This issue will only be exacerbated by the increasing convergence of sectors – digital therapeutics, digital devices and companion diagnostics for example all offer great potential but also need a cutting-edge evaluation and regulatory environment.

A national priority area

Nationally, the medtech sector accounts for approximately 51% of life sciences employment.[58] Between 2010 and 2019, core medtech employment increased by 11% across the UK (compared to 9% growth in life sciences overall) to reach 102,100 jobs.[59,60]

Advances in diagnostics and medical technologies are expected to be at the forefront of continued life sciences sector growth.

Activity to identify and commercialise approaches for the prevention, early detection and diagnosis of ill health and the identification of new medical technologies to support subsequent treatment are central to securing both economic and social benefits across the UK.

A focus on diagnostics and medtech is being driven by a series of factors including:

- The COVID-19 pandemic response.
- The NHS Long Term Plan's focus on early diagnosis and prevention.
- Continued technological advancements with both implications and opportunities for healthcare.
- A UK Government commitment to growing the UK diagnostics industry.
- The UK Government's ambition to "create the most advanced genomic healthcare system in the world".
- A requirement to build the UK's biosecurity for future pandemics and antimicrobial resistance.

- The need for an advanced regulatory environment and the post-Brexit opportunity to be more agile.

- Industry challenges such as lack of notified bodies, increased outsourcing, limited advanced manufacturing capacity.

Where are we now?

Scale of activity

Diagnostics and medtech are an important element of the North's life science sector. Core medtech accounted for 22,370 jobs and turnover of £4bn in the North in 2019. This equated to 24% of the UK's medtech employment and regional data shows that, within the North, core medtech accounted for 62% of all life sciences employment in Yorkshire and the Humber (the highest proportion reported in the UK), 34% in the North West and 28% in the North East.[61,62]

Research by Startup Genome ranked Liverpool-Manchester ninth in the world of emerging ecosystems, scoring top marks for performance and talent but with scope for improvement on market reach and funding.[63]

The Leeds City Region has also been recognised for its strengths in medical technologies within a BEIS commissioned Science and Innovation Audit.[64] The Lighthouse Labs at Alderley Park and in the Integrated COVID Hub North East have created foci of activity and industry engagement that can and should be developed in support of both system resilience and economic growth.

Existing clusters and assets

A series of clusters of diagnostics and medtech activity are evident within the North:

- Greater Manchester serving as a test bed for new diagnostic and analytical technologies and home to a Genomics Innovation Campus with Chinese multinational QIAGEN at its core. Including nearby Alderley Park in Cheshire adds nationally significant strengths in medicines discovery and large-scale testing capabilities.

- The Medical devices cluster in Yorkshire centred around the Leeds City Region for both development and manufacturing. Key assets are the medical technologies and innovation centre (IKC), the new Healthtech Catalyst and Grow medtech, a consortium of 6 universities across the Leeds and Sheffield City Regions, providing capacity and capability in medtech. As well as hosting the Global Development and Technology Centre for DePuy Synthes.

- Clusters of orthopaedic and medical device companies in Sheffield City Region with the Advanced Manufacturing Research Centre and Advanced Wellbeing Research Centre providing development, manufacturing and application expertise for medical devices.

- The North East Cluster; Diagnostics North East and the new North East and North Cumbria Innovation Pathway Initiative act as an umbrella to connect nationally significant infrastructure in the region covering research to commercialisation for both diagnostics and medtech. National centres include the NIHR Innovation Observatory in Newcastle while Redcar hosts the Centre for Process Innovation.

- Liverpool City regions Life Science Accelerator which acts as a city sized incubator for Life Science companies, and capitalises on Infectious disease diagnostics and medtech as discussed in Opportunity area 2: Infectious Diseases.

In LEP areas that report a smaller diagnostics and medtech employment base, there are also recognised opportunities to contribute to the sector's success, for example through the commercialisation of medtech spin out activity arising from the University of Central Lancashire and the activities of industry (such as Reckitt – a leading producer of health, hygiene and nutrition products) in the Humber.

Key assets within the North include:

- Five out of 11 NIHR medtech and In-Vitro Diagnostics Co-operatives (MIC), A specialist In-Vitro Diagnostic (IVD) Centre and Surgical MIC in Leeds, Devices for Dignity and Children and Young People MICs in Sheffield, and an In-Vitro Diagnostics MIC in Newcastle.

- DiTA – the Diagnostics and Technology Accelerator that forms part of the The Manchester University NHS Foundation Trust and is generating evidence for commercial in vitro diagnostics and medtech.

- The North's four Biomedical Research Centres and two Health Protection Research Units, bringing together academic and clinical expertise to translate research breakthroughs into new treatments, diagnostics and medical technologies.

- The Integrated COVID Hub North East (ICHNE) a partnership between The Newcastle upon Tyne Hospitals NHS Foundation Trust, Newcastle City Council, public health colleagues, local universities and industry and is distinctive as `it is the first hosted by NHS and a blueprint for wider rollout. ICHNE consists of: a purpose built Lighthouse laboratory at Baltic Park in Gateshead with capacity to perform 80,000 tests per day; a co-ordination and response centre providing additional regional resource to tackle the pandemic, including localised contact tracing and call handling, support for mass testing and unique data analysis and insight; and an Innovation Lab focussed on the next stage of Covid science, based at The Biosphere in Newcastle Helix.

- The University of Liverpool MRC/NERC Centre for Genomic Research has National Research Infrastructure status and has been a key partner in COG-UK.

- CPI's medtech and In Vitro Diagnostics innovation development and scale-up facilities in Sedgefield, County Durham, which works to accelerate the commercialisation of medical technologies and diagnostics under quality management systems including ISO 13485.

- Newcastle hosts a large Cellular Pathology Biobank and extensive Genomics facilities within the largest clinical laboratory in Europe.

- The COVID-19 Lighthouse labs and close partnership with the Medicines Discovery Catapult to drive diagnostic and medtech developments to support medicines discovery at Alderley Park, Cheshire.

- The presence of leading industry partners, including FUJIFILM Diosynth Biotechnologies UK Limited, Thermo Fisher Scientific, Smith and Nephew, B Braun, Canon and Siemens.

- CPI's medtech and In Vitro Diagnostics innovation development and scale-up facilities in Sedgefield, County Durham, which works to accelerate the commercialisation of medical technologies and diagnostics under quality management systems including ISO 13485.

Recognised challenges

Challenges facing the UK's diagnostics and medtech sector, which impact the North, include:

- A poor articulation of product specifications from NHS to industry, resulting in unmet needs and frustration.

- Slow translation from invention to implementation compounded by slow uptake in the NHS. This is in part due to the lack of comparable pathway for diagnostics and medtech to therapeutics.

- Restricted manufacturing capacity to cater for growing demands, especially small scale medtech manufacturing for trials.

- Limited access to capital for innovation outside London and low investment in diagnostics within the NHS – only 1% of the budget is spent on In-vitro Diagnostics, despite 9,700 people working in the area nationally.[65]

- Workforce challenges within parts of the sector, e.g. a shortage of radiologists and pathologists. Technological solutions to the workforce problem (the preferred solution of government) requires multi-disciplinary clinicians trained in skills outside of medicine, for example, computer science, to enable effective innovation development.

- Securing the required scale and representative patient coverage for studies.

- Increasing convergence of complex technologies with ill-defined pathways to adoption

Some of these challenges are set out in more detail in the AHSN Network medtech landscape Review and the proposed UK Diagnostics Industrial Strategy by Becton Dickinson which calls for financial support for manufacturing investment, increased support for inward investment, a manufacturing action plan and a national Catapult.[66,67]

Pan-Northern activity

Opportunities for pan-Northern working will enable existing expertise both within diagnostics and medtech and associated disciplines (e.g. manufacturing) to build the scale of activity needed for the North to establish and maintain competitive advantage and a growing profile in evolving national and international markets.

Examples of collaborative working, within and across LEPs, are already evident that could be built upon including through:

- The CONDOR diagnostics evaluation platform for new COVID-19 diagnostic tests, co-led by DiTA and the University of Oxford with other project partners within the North including the NIHR medtech and In Vitro Diagnostic Co-operatives in Leeds and Newcastle and the North East and North Cumbria, and Yorkshire and Humber AHSNs.

- The NHSA assembled diagnostics and medtech network; a group of over 50 cross sector experts to work to collectively to further Northern impact in the sector.

- The NHSA's health and medtech Memorandum of Understanding established with the UK-Israel Tech Hub to support the attraction of Israeli health and medical technology innovations to the North of England, recognising assets and opportunities across the North.

- The establishment of a Leeds City Region – Israel HealthTech Corridor, mobilising the Leeds medtech cluster to provide a landing pad for innovative Israeli healthtech companies.

- The North East North Cumbria Innovation Pathway initiative and Diagnostics North East both of which bring together expertise within the NHS, academia and the Academic Health Science Network.

- Liverpool city region accelerator that bring together Life Science assets in the city to deliver a system wide support programme to developing companies.

Where could we be in 2032?

The UK has a medium to long term opportunity to position itself as the pre-eminent location for co-development of game-changing diagnostics and medical technologies with industry.

Fig 6: Med Tech (Including Diagnostics) Sector Growth

	UK Employment	NP11 Employment	UK Revenue	NP11 Revenue
2019	102,100	22,370	£20.4bn	£4.0bn
2025	122,000	30,500	£24.4bn	£5.6bn
2032	145,100	41,700	29.0bn	£7.8bn

The development of a UK diagnostics capability has been identified by ABHI as a strategic priority, along with the need to strengthen supply chain resilience and UK manufacturing capability.[68] The UK is well placed to do so in a high-trust, high-evidence test bed that rapidly adopts proven innovation. This offer to work rapidly at scale, and to the highest standards would be and is globally leading.

To achieve this will require investment in models of partnership and systemwide working that are being pioneered in the North of England, within existing clusters of strength.
Linking these clusters together to a Northern Supercluster shows exceptional growth potential and employment could double over a fifteen-year period (see fig 6).

Growth in diagnostic and medtech industries will be assisted by successful inward investment, including new entrants accessing the UK capacity for clinical trials and the strength of the workforce for pharmaceuticals production.

Existing assets mean that the North is already well-positioned to capture a share of growth forecast nationally. There is a strong opportunity to build on a world-leading competitive edge in the evaluation of diagnostic technologies and devices, with the potential to transform this into substantial economic growth, as well as to continue to expand the wider medtech sector.

By 2032, the aim is to establish the North as a global leader in development, evaluation and implementation of diagnostics and medtech for patient benefit, through industry engagement.

What is needed to deliver benefits?

The North has a strong foundation to build on and existing prospects for growth. Priority activities to support the North to secure the scale of growth outlined above are:

- Bringing together expertise across the North to support the accelerated co-development, refinement, testing and evaluation of new diagnostic technologies, whilst also reducing fragmentation and ensuring the alignment and co-ordination of outputs.

- Increasing the availability of targeted innovation funding to pump-prime companies that have potentially transformative diagnostic and medtech products and platforms.

- Improving communication between the NHS, regulators, and industry to ensure new process and device development satisfies requirements.

- Increasing trial capacity to support the accelerated testing of new diagnostic and medtech processes and devices.

- Establishing the critical mass of skilled workers in relevant specialisms within the North to allow advances to be made. Particularly encouraging the crossover between clinical, academic and industry sectors.

There are several immediate propositions which are central to establishing the North of England as a leading centre for diagnostics and medtech industry:

- Support a new National Diagnostics Centre, based in the North of England. An industry-facing UKRI-funded Diagnostics Centre of R&D Excellence, with a focus on early diagnostics could form the basis of a Diagnostics UK initiative on the same principle as Genomics UK. This could leverage CPI-Medicines Discovery Catapult (MDC) joint capabilities in diagnostics innovation and would help to secure the UK's future as a high-trust environment to rapidly develop and adopt transformative diagnostic technologies.

- Embed the CONDOR diagnostics evaluation platform into the diagnostics evaluation landscape permanently: to be able to work with industry to rapidly identify unmet need, co-develop, do validation and evaluation work to bring a product to market as quickly as possible. Expand the platforms remit to include medtech and provide resource to direct the platform to accelerate evaluation and adoption in areas of high need.

- Link and expand capacity within the existing research and evaluation infrastructure, particularly investing in business engagement teams, with access to seed funding. Use this to deliver outputs from national programmes like the Our Future Health, accelerating detection of disease programme.

- Extend and connect the work of Diagnostics North East, Grow MedTech, the Liverpool Life Science Accelerator and other existing programmes, taking a systems approach to Research and Innovation; building on the expertise within the NHS, academia and the Academic Health Science Networks.

- Commit to growing the UK medtech Sector, including diagnostics, by investing preferentially in the North in this key area of strength.

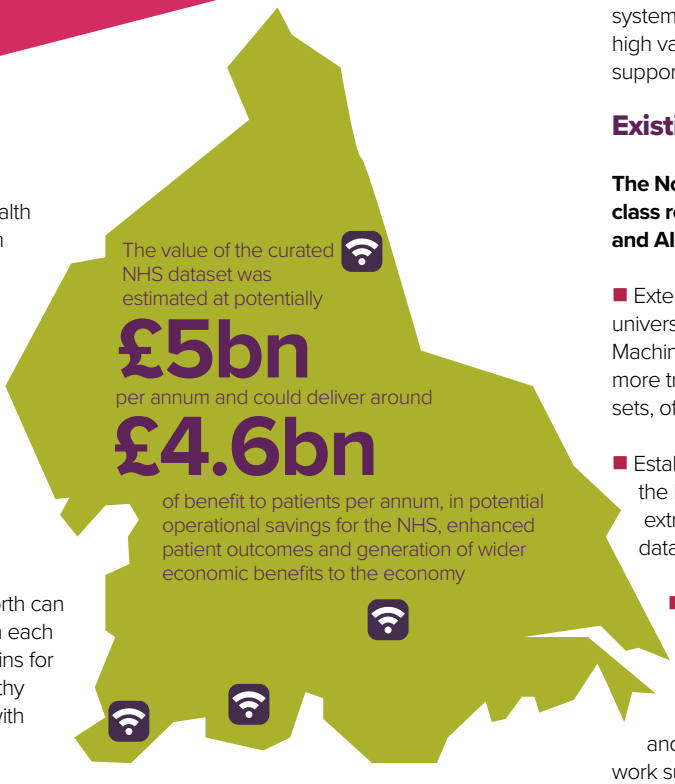
- Invest in batch production capacity to support the production of product samples of the right quality for proof of principle, product feasibility, and clinical study/device trials, in a cost-effective manner to support new advances and acceleration of the translation.

Opportunity Area 4:
Data and AI

Context

Big data, reflecting whole systems of health and care, have the potential to transform life science and health services – when curated well and used in a national/ regional grid of local intelligence and AI innovation. This network of combined data, intelligence and AI development is a competitive advantage for the UK economy.

Turning big data into actionable information for learning health systems is core to integrated care system (ICS) success. Through its variety of big data, digital innovation and ICS assets, the North can show how ICS can borrow strength from each other as a learning network – driving gains for citizens/patients and improving trustworthy data-intensive innovation partnerships with industry.



Decentralised data-intensive innovation has taken a major step forward through the pandemic, including in vaccine development and trials, medtech evaluation and population health management. A major driver of these advances is the digitisation of the research and development processes, with follow on developments in advanced manufacturing techniques, machine learning and automation. Organisations are now able to access, process and analyse huge datasets and simulate outcome scenarios in the digital environment ("in-silico").

A grid of systemwide data and increasingly capable AIs means that discovery, development, manufacturing and quality management processes need no longer be in the same location and that powerful networks of places and facilities can self-organise.
Some research and development approaches can be replaced with faster, cheaper in-silico processes. The data infrastructure needed to seed the simulations can also be used for real-world evaluation and monitoring of products and services, improving safety and driving better patient outcomes.

The potential application and benefits in the NHS and care system are also clear, including:

- Earlier and more precise detection and diagnosis via improvements in modelling of the development progression and consequences of conditions.
- Assisting workforce shortages and productivity through either full or partial automation, or decision support tools
- Better and more robust development, evaluation and monitoring of therapeutics, technologies and services through real-time data analysis.[69]
- More insightful and effective disease prevention, planning and policy development at system level.
- Optimisation and analysis of care pathways, patient flow and surge demand, assisting with identification of staffing requirements.
- Combined intelligence for ICS to respond quicker, be more resilient, and recover more progressively from shocks such as pandemics.

The Academy of Medical Colleges have highlighted the importance of a systems approach to co-design and regulation of AI development and application. This systems approach will involve data providers, clinicians and patients as well as regulators and industry partners so that systems and their application reflect real-world scenarios.
This is the opportunity for the North in support of the national ambition. A network of existing assets is coming together across the North that can, with investment, service the needs of both corporate partners and the health and care system. In doing so it can help anchor existing high value jobs in the UK, bring in FDI and support the growth of UK SMEs.

Existing excellence and assets

The North of England benefits from world class research expertise and facilities in Data and AI, including:

- Extensive research expertise in Northern universities in developing and deploying AI, Machine Learning, and Deep learning. As well as more traditional statistical analysis on large data sets, often referred to as "big data".
- Established partnerships across universities, the NHS and social care in linking and extracting value from large health and care data sets.
- Well established and highly trusted Civic Integrated Care Records in the city-regions around Leeds, Liverpool, Manchester and Newcastle. There is a strong tradition of public involvement and advanced consent, with field-leading work such as from the Connected Health Cities programme. In the pandemic, rapid progress has been made linking public health and local government dataflows to these records in the Combined Intelligence for Population Health Action (CIPHA, www.cipha.nhs.uk) system that is now rolling out across the North West and parts of the South East and Midlands – linking integrate care records with networked analytics that can support multi-ICS research and development.
- Health Data Research UK North: The Northern Better Care Partnership brings together world-class universities, digitally enabled NHS institutions and academic health science systems, in collaboration with the Northern Health Science Alliance and the four Academic Health Science Networks, and subsequently UK-wide.
- National Innovation Centre for Data (NICD) is based at Newcastle University. The NICD aims to address the availability shortage of data skills in the UK; transfer practical data skills into the workforce of private and public sector organisation.
- Leeds Teaching Hospitals and the University of Leeds are part of DATA-CAN, the Health Data Research Hub for Cancer, a UK-wide partnership that aims to unlock the power of health data to improve cancer. The University of Leeds also hosts the Institute for Data Analytics (LIDA) and

the UKRI Centre for Doctoral Training in AI for Medical Diagnosis and Care in cancer.

- The National Pathology Imaging Co-operative is a unique collaboration between NHS, academic and industry partners, deploying digital pathology across hospitals in the North of England, developing artificial intelligence tools to help diagnose cancer and other diseases.

- NHS Digital is responsible for collecting, transporting, storing, analysing and disseminating the country's health and social care data. The Combined Intelligence for Population Health Action (CIPHA) programme (www.CIPHA.nhs.uk) is becoming a national asset led from the North.

- UK Biobank, based in Greater Manchester, is a large-scale biomedical database and research resource holding in-depth genetic and health information from half a million UK participants.

- The Turing Institute is the UK's national institute for data science and artificial intelligence, founded in 2015 and headquartered in London has Leeds, Manchester, Newcastle amongst the 13 partner universities. The Institute aims to innovate and develop world-class research in data science and artificial intelligence that supports next generation theoretical developments and is applied to real-world problems, generating the creation of new businesses, services, and jobs.

- The recent announcement from government of significant funding with IBM (£210 million), developing on several years of industry focussed R&D, for the creation of the National Hartree Centre for Digital Innovation hosted at Sci-Tech Daresbury.
This will bring together innovative AI, quantum computing and the expertise of STFC Hartree Centre and IBM to benefit UK industry and research communities. The health and life science work of this Centre has yet to shaped and could align with the North's Civic Data Grid.

- National Institute for Health Research (NIHR) Innovation Observatory is the national medical horizon scanning facility located at Newcastle University which helps to understand future medicines, devices and diagnostics to help shape policy, regulation, approvals and stimulate research activity.

- The NP11 geography benefits from regional initiatives in digital and tech including specialist accelerator and incubation facilities in Manchester, Liverpool, Hull, Leeds and Newcastle. Importantly, Computer science and AI applications in health and life Sciences benefit from digital strengths in other sectors such a gaming, low-carbon, offshore and others in which the North has established strengths.[70]

Opportunities

Artificial Intelligence (AI) empowering healthcare, and digital diagnosis holds enormous potential for the NHS realising the vision of value-based healthcare providing equitable and sustainable access to health and care provision.[71,72,73]

There is the opportunity to harness this potential, with the support of patients and the public to address economic challenges and support innovation led UK companies through timely and responsible access to the research base, NHS data, unmet need and development priorities. This will be key to positioning the UK globally as a high-trust, high-value partner for research, development and adoption.

Creating a high-trust well-curated data system across the North would also allow a step change in how more traditional research is conducted. In rare diseases for example, system working across an engaged population of 16m, would provide an opportunity for unprecedented scale and a real-world setting for citizen engagement, research and intervention. Realising the potential of this model would be transformative for patients, industry and the care system.

Where are we now?

The market opportunity

A report by Ernst and Young focused on the UK National Health Service as the single largest integrated health care provider in the world with patient records covering the entire population from birth to death.[74]

Using an estimate of 55million patient records produced an indicative market value of several billion pounds. The value of the curated NHS dataset was estimated at potentially £5bn per annum and could deliver around £4.6bn of benefit to patients per annum, in potential operational savings for the NHS, enhanced patient outcomes and generation of wider economic benefits to the economy.

Ernst and Young expect the initial estimate to increase as: the proportion of genomic and other records in the NHS data set increases; the volume of records available to curate and link grows; and additional value is unlocked from patient records by emerging scientific and medical innovations. To unlock further value of its patient records, the NHS would need to create longitudinal patient-level data sets by combining all care settings (e.g., primary, secondary and social care) and available genomic profile data for each patient.

It should be noted, however, that there would be a significant cost associated with this data transformation and that any approach taken needs to done in an ethical and responsible manner that puts citizen trust at its centre. However, to do so would create a modern digitally enabled healthcare system with no global equivalent. An asset the NHS can use to drive patient benefit, boost innovation and deliver economic growth.

The UK regulatory environment

This uniqueness of the UK regulatory system is of particular importance in the rapidly developing world of big data and AI. Through the world-wide reputation of global brands such as the NHS, NICE, MHRA, our universities and others, the UK has global standing and credibility in this space. In combination, these organisations provide globally important markers of quality and reassurance on evidence. This is more important than ever as the world looks for sources of evidence that are reliable.

A multi-agency advisory service on AI and data-driven technologies is in development, funded by NHSX and led by NICE, NHSX, MHRA, CQC and HRA. The co-ordination of the services provided by these organisations as well as their horizon scanning capabilities and international reputation will lead to a cutting-edge regulatory environment. The NHSA will work with the multi-agency advisory service and similar initiatives to utilise the UK health and life science clusters to both inform developments, access unique expertise and act as dissemination and educational networks.

The scale of the ambition in the North

The North seeks to mobilise data with and for its citizens into a world-leading Civic Data Grid, fuelling data-intensive research and innovation. Each constituent health and care system in the grid will have a critical mass of data, infrastructure and expertise for clinical and population health advancement, including AIs. The Grid as a whole will be able quickly to borrow strength across the place-based systems of the North, and potentially across the UK.

Realising this vision will require:

1 Trusted, well-curated data and combined intelligence in civic co-operatives of data management and analyis across NHS, social care, public health, environmental and other local and national data sources – as core business of Integrated Care Systems.

2 A grid of these Civic Data Co-operatives across the North where innovative uses of data can rapidly spread across the health and care systems for 16m population – with facilities for federated and pooled analytics, involving the citizens of each cooperative in how their data are protected and promoted to advance health and care.

3 Creating, and normalising, the appropriate environments for partnership working with industry and regulators to extract value from the data including a unique sandbox environment for developing and evaluating AI interventions and augmentations (of medtech/diagnostics, therapies and population health management).

4 Building a critical mass of capacity and capability in health data science and AIs within each Integrated Care System, and maintaining the momentum of pandemic responses that have delivered integrated data and combined intelligence and unprecedented pace and scale.

Civic Data Grid: Northern Alliance of Civic Data Co-operatives

The North of England leads the UK in data science embedded in health and care systems. Connected Health Cities (CHC) was a £20m

Government-funded pilot programme (2016-2020) that demonstrated the value of curated health data, with appropriate system and citizen engagement, to both drive improvement in the provision of care and to create an economic asset across the North.

Public trust was critical to CHC delivery, and the necessary public involvement operated with a 'diameter of trust' similar to the footprints of nascent Integrated Care Systems. To truly involve the public in these impactful changes in a meaningful way, a 'diameter of trust' was set at a scale of 3 to 5 million citizens, where analysis of personal and sensitive data was accepted by citizens' juries, for the purposes of local population health benefit. Building on CHC, NHSA developed "Connected Health North Economic Case", submitted to the Comprehensive Spending Review in 2020.

The Civic Data Grid will connect the existing, well-established and publicly trusted data systems that are embedded across the large civic centres of the North of England (Manchester, Liverpool, Leeds, Newcastle, Sheffield, Bradford and others).

The COVID-19 pandemic has accelerated dataflows into multi-agency actions, particularly between NHS, local government, public health agencies and universities. Systems such as NHSX www.CIPHA.nhs.uk – stood up for COVID responses – are now being persisted as core business of integrated health and care systems. These combined intelligence systems are now in demand for wider uses, for example in education, housing and transport policies and tactics.

In the Civic Data Grid, each CDC will be able to interrogate and analyse their local system data, to the protocol agreed for each project, such that the results can be aggregated over multiple CDCs, building larger population cohort studies, up to 16 million people across the North, benefiting from the development of shared standardised analysis protocols for different purposes and projects. Automatic federated analytic tools will be available in the grid, and governance will allow for one place to take a lead on a pooled analysis of a data extracts for the whole region.

CDCs will link to each other and with national digital infrastructure. This investment will develop a skilled workforce of health informaticians/analysts/data scientists across the North, with sufficient capacity to service/lead national initiatives. CDCs will work in close partnership with national programmes such as HDR-UK and NHSX.

These civic data approaches have been proven to mobilise data into innovation and impacts. CHC showed that this investment can de-risk the government's major national programmes in health and civic data curation, with greater depth, efficiency, public trust and sustainability. Regional economic growth plans have prioritised this approach, for example the Liverpool City Region CDC, and delivered internationally important impacts such as a national pilot of COVID-19 'mass testing'.

National Pathology Imaging Co-operative (NPIC)

Artificial intelligence is a competitive area, in which success requires a combination of understanding the clinical need and potential market, collaborations with the right industry partners, high levels of technical understanding, and systematic, co-ordinated gathering of high-quality data.

NPIC has proven the North can attract investment and industry collaboration in this new and rapidly evolving area, with over £30m of public funding and £11.4m of matched industry investment from 2019-2022. There is an opportunity for further investment to make a more valuable proposition for the region and the UK. Further investment will place the North in an unrivalled position of data gathering and technology use and operationalize the use of this infrastructure to lead on artificial intelligence evaluation and regulation and use the technology as a platform to diversify innovation and development into areas such as tissue diagnostics.

There is an opportunity for:

Digital pathology deployment across all of the Northern NHS hospital trusts covering a population of 16million, with a National Centre for Digital Pathology AI evaluation driving professionally led evaluation, supporting clinical trials, health economic evaluation, regulation and adoption, and a dedicated commercial development team.

Dedicated clinical evaluation and training programmes in more established centres (Leeds and Newcastle) to build on the expertise of established centres.

Access to digital pathology data from across the North and linked datasets for industry to utilise for the real-world evaluation and AI trials at scale.

Development of an infrastructure to facilitate imaging and tissue correlation for clinical trials in oncological and non-oncological areas across this region.

The National Centre for AI evaluation is sited alongside the Centre for Doctoral Training and established NPIC program at Leeds, with cross cutting themes for regulatory support, clinical trials and health economics, industry engagement and adoption.

This new investment will allow for co-ordinating clinical trials across the whole network, becoming the go-to place for clinical trials in AI in Europe.

Where could we be in 2032?

Exemplar approaches are being developed across the North linked to national systems such as the www.CIPHA.nhs.uk and HDRUK North approaches to Trusted Research Environments (TREs). A Northern Civic Data Grid of TREs will offer a sandbox for developing AIs. The Sandbox would include brokerage of access to federated and pooled AI training and validation sets, including combinations of clinical, genomic and imaging data.

As a function of the Civic Data Grid, it would also have the capacity to provide secure and appropriate access for companies, large and small to come and work and train with practitioners in the North. The development and evaluation of diagnostic and AI tools would also provide an ideal public-private training ground to up-skill the large numbers of practitioners that will be required across the sector in years to come. By 2032, data and artificial intelligence will be a major contributor to innovation in advanced therapies, diagnostics and medtech across the North. This will involve major growth in data analytics and informatics, provided through an estimated 8,000 jobs, developing, maintaining and curating digital information covering the whole population.

These new jobs will be in the NHS, universities, specialist digital and analytics companies in the private sector, and data specialists in pharma, diagnostics, and medtech companies. A significant proportion of the employment and GVA growth in health and life sciences will be underpinned by data and digital, while the NHS will benefit from efficiencies, improved prevention of ill health and improved safety.

What is needed to deliver benefits?

There are four immediate propositions to fast-track the discovery, development, evaluation and impact assessment of potential new products and treatments:

- A Northern Civic Data Grid – a delivery body for trustworthy data uses, including AI research and innovation partnerships with industry, for the benefit of citizens and their local economies, across the 16m population.

- A pan-Northern network of Civic Data Co-operatives, capable of sub regional and pan regional collaboration over data-intensive research and innovation into advanced therapies, diagnostics, medtech and population health management.

- Scale-up investments in data and AI initiatives close to a tipping point of growth, such as in Digital Pathology and AI, building on NHS investment with a National Centre for Digital Pathology AI – accelerating trials, economic evaluations, regulatory compliance and commercial development.

- Northern AI Sandbox on the Civic Data Grid – up-skilling public and private sector workforces to create the most AI-ready workforce in the world, and working proactively with regulators and front-line organisations to adopt AIs with agility, and the capacity for continuous improvement of the technologies.

Challenge Opportunity 1:
Healthy Ageing

Context

Pan-Northern potential

Excellence in ageing research and health innovation is evident across the North and supports the economic opportunities it can generate, with potential for collaborative working to support advances more quickly than public agencies and the private sector working in isolation.

The NP11 geography represents both an asset base and a marketplace with scale that can support the development, testing and commercialisation of healthy ageing innovations that can deliver economic and social benefits.

From an economic perspective, opportunities stem from new market opportunities for products and services, helping to reduce health and care costs, as well as supporting older people to continue working for longer.

With a substantial and growing global challenge and marketplace for new products and services, collaborative working provides an opportunity for the North to build its reputation on the international stage, alongside supporting local ambitions and imperatives.

Advances under the healthy ageing agenda will be further supported by activity under the other opportunity areas, including the early diagnosis of potentially limiting conditions to support effective treatment that can prolong an active lifestyle and continued advances in medical technologies and advanced therapies.

A national imperative

Falling birth rates and longer life expectancy (supported by advancements in healthcare) mean that the structure of the population is changing. The Centre for Ageing Better reports that "nearly one third of the UK workforce are aged 50 or over, more than 10 million workers. But not all employers offer what's needed to retain an older workforce or recognise the benefits of doing so."[75]

Similarly, the shift in demographic has resulted in fewer school leavers, and the new skills-based criteria system introduced in January 2021 results anticipates it will become progressively more difficult to fill vacancies from outside the UK. This is prompting the need to consider how the needs of an ageing population can be accommodated through not only the lens of healthcare provision but also for societal and economic benefit. By improving the provision of training and workforce development in working age and older life we can start to address future workforce skills shortage.

Although life expectancy has been increasing, the associated increase in healthy life expectancy has not kept pace. Between 2009-2011 and in 2016, the proportion of life spent in good health in the UK has decreased from 79.9% to 79.5% for males, and from 77.4% to 76.7% for females.[76]

Significant disparities are also evident across the UK with the difference in healthy life expectancy between the most and least deprived places being 18.9 years for males and 19.4 years for females.[77] Whilst this has implications for economic contribution and pressures on the health and care system, there are opportunities within this health challenge.

The identification of Ageing Society as one of four Grand Challenges within the UK's Industrial Strategy has supported an increased focus on the healthy ageing agenda over the last four years, with innovation recognised to be a central solution. With an ambitious target to support people to enjoy at least five additional healthy, independent years of life by 2035, there is a need to consider the role that health innovation will play in driving both health and economic benefits.

Addressing the trajectory

Innovation in the context of an ageing population presents both economic and societal opportunities, including:

- Easing the pressure on NHS budgets and capacity by recognising and harnessing both health and economic potential of opportunities.
- Using emerging and existing data and AI expertise to build a comprehensive picture of possible solutions.
- Using emerging and existing advances to roll out the devices and advanced therapeutics needed for early detection of disease and proactive prevention of poor health.
- Recognising that learning is life-long and that by championing older people to refresh existing skills and expertise, or learn new skills will assist them to remain independent and live a fulfilled, healthy life, thereby closing the gap between extended life expectancy and healthy life expectancy.
- Challenging historic stereotypes of older age: reinforcing positive societal perceptions of older people and the contribution they can make to the economy and society.

In the 2019 survey of NHS innovation and research needs, older people were identified as one of the top priority patient groups for innovation and research to address the challenges this group faces.[78] Preventing the progression of fragility, including amongst older people, was also identified to be important.

Where are we now?
The current position and the challenge ahead

In 2019, the NP11 geography was home to 6.2

million people aged 50 and over and 0.8 million people aged 80 and over, accounting for 39% and 5% of the population respectively. In each case, the proportion is marginally higher than the England average.

Over the past ten years, the population aged 50 and over has increased by 833,000 (16%) and those aged 80 and over by 133,400 (20%). The North now accounts for 29% of the national population aged both 50 and above and 80 and above, marginally above the 28% share of the total population.

The rate of ageing is accelerating in the North with implications for economic prosperity. Fewer working age residents supporting a growing dependent population could exacerbate the productivity gap already evident between the North and South.

By 2043, the North of England is forecast to be home to 6.9 million people aged 50 and over and 1.3 million aged 80 and over, accounting for 42% and 8% of the population respectively.[79]

Supporting an ageing population to benefit from a healthier life for longer can contribute to an extended working life, benefits to the economy and cost savings for the NHS.

The prosperity of the North will become increasingly linked to the economic engagement and productivity of its ageing workforce.

Health innovations and skills development have central roles to play in supporting the healthy ageing agenda, with activity to be taken now to support the North to respond to both the challenges and opportunities the changing population profile will present.

A nationally significant asset base

Healthy ageing is a recognised area of focus within the North of England reflecting the presence of a series of assets and research successes of national significance, including:

- The UK National Innovation Centre for Ageing (NICA), funded by BEIS and Newcastle University, has a strategy of Ageing Intelligence - working with businesses and citizens to access global evidence needed to inform, co-develop and bring products to market. Newcastle Helix and partners across the city region are working together with NICA to provide a supportive environment and test bed for businesses to flourish.

- University of Manchester's Manchester Institute for Collaborative Research on Ageing (MICRA) delivering cross-disciplinary research and the NIHR Older People and Frailty Policy Research Unit (PRU) dedicated to produce high quality evidence for policy making.

- The Newcastle University Campus for Ageing and Vitality focused on translational biomedical research into age-related disease.

- University of Liverpool's Institute for Life Course and Medical Sciences takes a whole lifecourse approach to the problems of ageing, and has one of the largest groupings of researchers into Musculoskeletal Ageing and disorders in the UK.

It also hosts the Centre for Integrated Research into Musculoskeletal Ageing (CIMA), an MRC-Versus Arthritis Centre of Excellence that also involves the universities of Newcastle and Sheffield. The Leeds BRC also focuses on musculoskeletal disease.

- University of Sheffield's Healthy Lifespan Institute unites more than 100 world-class researchers to examine the global epidemic of multi-morbidity.

- Sheffield Hallam University's Advanced Wellbeing Research Centre is dedicated to improving health and wellbeing through movement at all life stages.

- Durham University's Wolfson Research Institute for Health and Wellbeing Ageing Academy is dedicated to research into ageing healthily across the life-course and through varying domains. Namely gender, brain health, race, culture, work and activity.

- The UCLan Health Ageing Cluster includes Social Work Care and Community Research Centre for Applied Sport Physical Activity and Performance. This addresses the societal challenge of ageing through policy and practice, including supporting healthy workplaces.

- Lancaster University's Health Innovation Campus and Centre for Ageing Research (C4AR) which brings together multiple disciplines and the expertise of the NHS and industry to support translational research.

- University of York's Social Policy Unit, established in the mid-1970s, is dedicated to examining the individual's experience of illness and impairment.

- University of Leeds' Academic Unit of Ageing and Stroke Research is the academic lead for the HDRUK North Health Ageing workstream, the lead for the NIHR ARC Healthy ageing workstream and lead for the development and national implementation of the multi-award winning electronic frailty index (eFI) that has had major national health policy impact.

The North also benefits from:

- The UK Biobank, with a co-ordinating and assessment centre in Greater Manchester, that holds and can track information for over 500,000 volunteers.

- Data assets, including the Great North Care Record, Yorkshire and Humber Care Record and equivalent large civic datasets across the major city regions.

- The freedoms afforded by the devolution of health and care budgets in Greater Manchester that may support greater innovation in support of healthy ageing objectives.

- The award of the UK's first World Health Organisation Age Friendly city-region to Greater Manchester.

- More widely, a life sciences sector of scale across the North that can support advances in products and processes to support healthy ageing.
With 24% of national life sciences research funding into ageing occurring in the North between 2007 and 2017, there is national recognition of the expertise within the North and momentum to build upon.[80]

Pan-Northern activity

There is widespread recognition of the healthy ageing innovation assets of the North and the potential for gains to be secured by working collaboratively.
There is a tangible network of expertise and facilities within the North that together play a significant role in the national healthy ageing agenda. Examples of where collaboration is already occurring within and across the North that can be built upon include:

- A collaboration of researchers and clinicians at the universities of Newcastle, Liverpool and Sheffield to deliver the Centre for Integrated Research into Musculoskeletal Ageing, the MRC-Arthritis Research Centre of Excellence.

- The National Institute for Health Research (NIHR) Newcastle Biomedical Research Centre (BRC) – a partnership between The Newcastle upon Tyne NHS Foundation Trust and Newcastle University and the only BRC in the country to focus on the conversion of lab-based research into ageing and long-term conditions, including a leading role in dementia research.

- The Manchester and Newcastle Academic Health Science Centres that build on research excellence within the North.

Where could we be in 2032?

UK Commission for Employment and Skills (UKES) 2015 report examined the future requirements of the health and social care sector in terms of skills and employability.

Skills for Health working paper 2 (2015) identifies that the sector is lacking a high-quality intermediate workforce due to barriers to progression from support roles to higher skilled 'registered' roles and recommends that developing the support workforce will make a significant contribution to meeting future health care needs.[81]

Skills for Care workforce estimates (2019/20) that 27% of the adult social care sector workforce are over the age of 55.[82] Supporting the skills agenda in this burgeoning sector is both necessary to deliver the care needed in the UK and to enable engagement with the underlying issues and opportunities in the sector.

As well as skilled care staff, innovative products and services will also be central to delivering an affordable and high-quality health and care service for older people, supporting a large

and growing care workforce to increase their productivity and efficiency.

By 2032, ageing products and services will be a major contributor to advanced therapies, diagnostics and medtech companies across the North.

This will involve major growth in targeted products and services, potentially supporting an estimated 5,000 additional jobs. These new jobs will be in the NHS, universities, specialist parts of pharma, diagnostics, and med tech companies.

What is needed to deliver benefits?

The following priorities are identified to support the North to advance the healthy ageing agenda and secure the benefits anticipated as a result.

- Increasing the ageing research and testing capacity of existing centres within the North, including access to and the provision of long-term funding streams.

- Bringing together expertise across the North to support the accelerated co-development, refinement, testing and evaluation of new diagnostic technologies, whilst also reducing fragmentation and ensuring the alignment and co-ordination of outputs.

- Increasing the availability of targeted innovation funding to pump-prime companies that have potentially transformative diagnostic and medtech products and platforms.

- Expanding trial capacity and coverage to better understand the process of ageing.

- Developing more effective treatments and using innovation to increase how conditions are better managed.

- Taking advantage of new technologies, artificial intelligence, data and digital.

- Supporting the move towards improving integrated care.

The North has a strong foundation to build on and existing prospects for growth.

Challenge Opportunity 2:
Mental Health

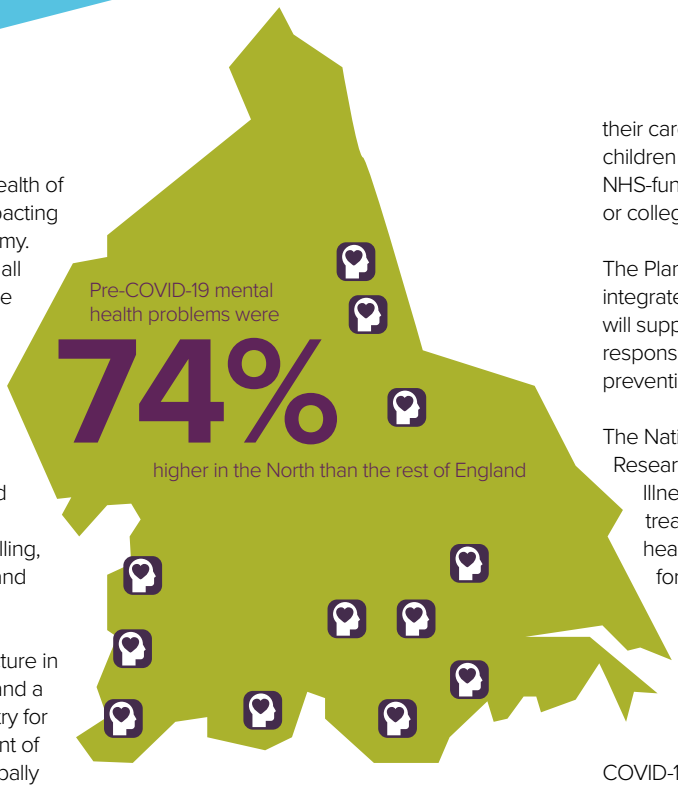
Context

The effects of COVID-19 on the mental health of the population present a serious risk, impacting on the NHS, everyday life and the economy. There is a strong industry interest across all sectors in finding new ways to support the mental health of the workforce, reduce the impact on productivity, and in creating new digital interventions with commercial value.

There is increasing interest in mental health and wellbeing from employers and a growing number of innovators, with an opportunity to increase collaboration, trialling, assurance and deployment of products and services.

There is currently no dedicated infrastructure in the NHS for rapid, real-world evaluation and a partnership between the NHS and industry for the design, development, and deployment of mental health solutions will provide a globally unique platform for evidence generation around mental health and wellness interventions.

The proposed Mental Health Innovation Accelerator will establish an infrastructure for real-time and real-world evaluation across the North of England, drawing on the region's unique and long-standing mental health electronic data assets.



A National Challenge: Workforce Health and Wellbeing

Mental health problems are the largest single cause of disability in the UK and at 23% consume the highest proportion of NHS disease spending. Mental illnesses are more common, long-lasting and impactful than some other health conditions.[83] The economic cost of mental health is significant, costing the UK economy between £74bn and £99bn per year.[84]

Poor mental health costs employers in the UK up to £45bn a year. The cost of poor mental health has increased by 16% (£6bn) since 2016. As such mental health is an increasing priority for NHS, integrated services and employers.

This focus has been accelerated by COVID-19. Within the workplace in 2018/19, stress, depression or anxiety were responsible for 44% of all cases of work-related ill health and 54% of all working days lost due to health issues in Great Britain.[85]

NICE estimate 19% of long-term sickness from work is attributed to mental health problems. Those with a long-term mental health condition lose their jobs at around double the rate of those without a mental health condition, equal to around 300,000 people a year.[86] Problems of absenteeism and presenteeism are particular challenges, with direct impact on productivity. Evidence suggests that interventions to address wellbeing at work can increase productivity by up to 12%.[87]

NHS Response

The NHS Long Term Plan committed to improving and broadening access to care for children and adults needing mental health support, increasing funding at a faster rate than the overall NHS budget, and by at least £2.3bn a year by 2023/24.

By 2023/24 the NHS Mental Health Implementation Plan for 2019/20 to 2023/24 commits to giving 370,000 adults with severe mental illnesses greater choice and control over their care and providing an additional 345,000 children and young people with support through NHS-funded mental health services and school- or college-based mental health support teams.

The Plan reiterates how the "shift towards more integrated, population-level health systems will support more localised and personalised responses to health inequalities across the prevention and treatment spectrum".[88]

The National Survey of Local Innovation and Research Needs of the NHS identifies Mental Illness as a top priority as a medical treatment area, and people with mental health issues as a top priority patient group for innovation and research.

Where are we now?

Impact of COVID-19 on Mental Health

COVID-19 has exacerbated levels of psychological distress and mental ill health due to the impact on the population and the economy.

Research by the Centre for Mental Health suggests that the COVID-19 pandemic is likely to lead to an additional 500,000 people requiring support for their mental health in the next two years. Research shows the impact of the pandemic on children and young people's mental health is greater in areas and communities hardest hit by the virus and by lockdowns.[89]

The implications for future mental health are also stark, with a recent review finding that young people experiencing loneliness during lockdown may be up to three times as likely to develop depression in adulthood.[90]

Healthcare services and employers have been negatively impacted by the pandemic, requiring new approaches for supporting mental health and delivering care. As demand increases, the ability of the services to respond, and for workforces to maintain productivity, is limited.

The NHS Confederation has called for increased funding to support the expansion of digital approaches in mental health. However, there is a gap in terms of systems for ensuring that digital solutions are developed and tested appropriately

and rapidly, particularly under the current pandemic.

In March 2021, the Government published a COVID-19 mental health and wellbeing recovery action plan to support the general population to look after their mental wellbeing.

The aim was to prevent the onset of mental health difficulties, by:

- Addressing factors that shape mental health and wellbeing in adults and in children;

- Supporting services to continue to expand and transform to meet the needs of people who require specialist care.

The plan also included a commitment to transforming the public health system in response to the lessons learnt from COVID-19, with reforms placing prevention of physical and mental ill health at the heart of government and embedding health improvement expertise, capacity and accountability more widely and deeply across local and national government and the NHS.

Position in the North

There are higher incidences of poor mental health in the North of England. The North of England has some of the highest mental health needs, the highest rates of suicide, substance mis-use and depression. The North of England has very recently been identified as a priority area for mental health research in the NIHR.[91]

Pre-COVID-19 mental health problems were 74% higher in the North than the rest of England. COVID-19 has further highlighted the need to invest in maintaining good mental health.

Evidence suggests that the NP11 geography has been hardest hit by the COVID-19 pandemic. Higher incidences of COVID-19 in the North and Midlands has meant tighter restrictions in some areas for longer periods of time. Together this suggests a worsening mental health impact in the North of England following COVID-19. The productivity and the GVA of the North will fall further behind the rest of the country unless action is taken.[92]

The NHSA Health for Wealth Report found reductions in mental wellbeing in the North as a result of the pandemic could cost the UK economy up to £5bn.

While clearly the broader social and economic determinants of mental and physical health have a key role to play, there is an immediate and urgent need for the development of evidence-based products and interventions to better prevent and manage mental health problems across the North.

Existing clusters and assets

There is a range of clinical, academic and research expertise within the North including:

- Strong, innovative mental health trusts that are joining forces under the auspices of the NHSA (led by NHSA member organisations; Rotherham, Doncaster and South Humber NHS FT and Tees, Esk and Wear Valleys NHS FT) to make the accelerator a reality. The Trusts are committed to the required collaborative working and ultimately

to the evaluation and adoption of transformative innovation.

- Specialist research expertise at a number of Northern universities, such as Sheffield, Sheffield Hallam, Leeds, Lancaster, Newcastle, Liverpool, UCLAN, Durham, York, Northumbria and Manchester universities.

- The Institute of Work Psychology at the University of Sheffield.

- The Spectrum Centre for Mental Health Research at Lancaster University.

- International Centre for Mental Health Social Research at York University.

- The UCLan Centre for Mental Health and Well Being is channelling a wide range of research, development, and consultancy programmes for patients, vulnerable people and organisations that helps promote the development of a resilient and productive workforce and harmonious employment relations.

- Child Oriented Mental Health Intervention Centre which is a collaboration between Leeds & York Partnership Foundation Trust and the Mental Health and Addictions Research Group at the University of York.

- Centre for Collaborative Innovation in Dementia at Liverpool John Moores University.

- NIHR Applied Research Collaborations (ARCs) support applied health and care research that responds to, and meets, the needs of local populations and local health and care systems. All four of the Northern ARCs undertake research in mental health.

Pan-Northern Potential

The effects of COVID-19 on the mental health of the population presents a serious risk for employers. There is a strong industry interest in the North to support the mental health of the workforce and an increasing interest in mental health from a growing number of innovators, increasing demand for collaboration, trialling, assurance and deployment.

The focus on addressing workforce mental health and wellbeing has attracted interest from major corporates such as BAE Systems and national organisations such as the Defence Medical Services.

The following priorities are identified to support the North to advance the mental health agenda and secure the benefits anticipated as a result.

- Increasing the mental health research and testing capacity of existing centres within the North, bringing together expertise across the North to support the accelerated co-development, refinement, testing and evaluation of new approaches and technologies.

- Increasing the availability of targeted innovation funding to pump-prime innovators and companies that have potentially transformative new approaches and technologies.

- Expanding trial capacity and assurance processes.

- Developing more effective treatments and using innovation to increase how conditions are better managed.

- Taking advantage of new technologies, artificial intelligence, data and digital.

Where could we be in 2032?

The recent reported increases in mental health challenges in the workforce, along with the effects of the COVID-19 lockdowns is likely to lead to an increase in key metrics for mental health in the UK and the North.

The main targets for making measurable progress are: (a) reducing the numbers of economically inactive and unemployed people with mental health related issues; and (b) reducing the numbers of those in employment with mental health related issues. This will involve a marked increase in employer engagement.

The North needs to review its key metrics with regard to mental health, and set new targets based on moving key indicators towards the national average and reducing the economic costs of poor mental health.

What is needed to deliver benefits?

There is an opportunity for a Northern Mental Health Innovation Accelerator; one that is an asset for the region, with health, societal and economic benefits accruing.

As it becomes established it will look beyond the North to secure national and international collaboration and investment. Creating an innovation infrastructure that brings together the mental health assets across the North for the benefit of industry could be progressed through the establishment of a Northern accelerator, or living lab, for mental health which will:

- Support workforce wellbeing in the public and private sector to improve workplace productivity. Collaboration with large corporate employers as well as SMEs and NHS organisations to develop, evaluate and implement interventions within the workforce to support mental health of employees.

- Provide data-led intelligent mental health care and treatment using AI, working with industry to develop and evaluate new products, services and improved care delivery processes by utilising the large-scale Northern datasets from the Civic Data Co-operatives. This will provide an architecture and framework for prediction and proactive, personalised management of care.

- Develop and evaluate digital solutions for mental health service delivery. The vision is to reduce the prevalence of common mental disorders through targeted prevention and intervention across the life span through employing innovative digital solutions.

Companies developing digital products for mental health struggle to get access to the design, development, and deployment of mental health solutions at scale. There is no dedicated infrastructure in the NHS for rapid, real-world evaluation.

A Northern Mental Health Innovation Accelerator will:

- Establish an infrastructure for real-time and real-world evaluation across the North of England, drawing on the region's unique and long-standing mental health electronic data assets. These can be federated to provide a safe, secure and consistent approach to data management for evaluation and deployment.

- Focus on testing and deploying interventions to support large corporates and SMEs based in the North as they seek to maintain healthy and productive workforces amidst the fall-out of the COVID-19 pandemic.

- Provide a Northern platform for economic growth that could be scaled up at a national level; provide a potential 'employee wellbeing' offer that could be scaled and exported internationally and provide opportunities for business to identify unmet needs and gaps in the market directly from the NHS end users.

- Position and promote digital mental health capability nationally and internationally, serve as an incubator for commercial innovation and research, and provide a co-creation process for assisting businesses to better address customer need.

Part 3

Drivers And Context

Section 8
Economic Drivers

Research & innovation

Research, technology and innovation are delivering new products and services which transform health and care globally, providing new opportunities for investment and jobs.

As an example, the UK is a global leader in data driven health and care. While recent data research and digital innovation investments have been concentrated in disease specific and hospital centred precision medicine, new approaches are driving innovation with regard to parts of the health system, such as multimorbidity, antimicrobial resistance, dementia, obesity and mental health.

The early detection agenda has also been growing in significance with national initiatives such as the UKRI funded Our Future Health programme collecting information from volunteers across the UK to support the development of new ways to detect, prevent and treat diseases.

The North benefits from world leading research centres, many already connected internationally, a growing number of accelerators and centres of excellence, strong connections to global companies and an increasing number of smaller companies with plans to scale-up innovation.

Innovation continues at a pace in advanced therapies, diagnostics and medtech, directed by academic and commercial research and a very strong commercial sector, incorporating global companies and SMEs.

The breadth and depth of expertise, research and innovation track record, and acceleration plans in the North provides Government with an opportunity to boost the health and life science sector through innovation and contribute to the levelling up agenda.

Productivity and prime capabilities

The Northern Powerhouse Independent Economic Review (NPIER) found that – at the time of reporting in 2016 – the North's GVA per capita, over the previous thirty years, had consistently been about 25% below the average for the rest of England, and 10-15% below the England average excluding London. The NPIER looked at data on specialisms and productivity performance, combined with local evidence on sectoral strengths, expertise and knowledge assets and wider likely market and technological change. The analysis identified four Prime Capabilities; where the North is home to international-class assets, expertise, research and businesses that are highly productive and can compete at national and international scales.

The four pan-Northern 'Prime Capabilities', as identified within the NPIER, included Health Innovation, with long-established strengths in life sciences, medical technologies and devices, and a growing competence in new and efficient service delivery models brought about by e-health and, crucially, the growing devolution of responsibilities for health and social care.

A related Prime Capability is Digital, focusing on high performance computing, cognitive computation, data analytics, simulation/modelling, and machine learning, which will play an important role in health and life sciences.

The combination of international class assets and a growing and global market for health and life sciences will be an important driver of growth for the national and Northern economy.

The NPIER sets out how greater collaboration and investment in the Northern life sciences sector presents opportunities to support an increase in the health and life sciences' GVA contribution to £43bn and an additional 72,000 jobs by 2050, under what the NPIER terms a 'transformational scenario', which is underpinned by substantial improvements in the skills base, innovation performance, and transport connectivity.[93]

Healthier workforce

The effects on population health of sustained under investment and a sluggish economy are significant. The NHSA's landmark 2018 report Health for Wealth demonstrated that a third of the productivity gap between the North and the rest of England is due to ill health.

A significant proportion of the Northern workforce are managing long standing health conditions and there is increasing employer interest in support to help staff manage conditions, benefiting the individual and reducing health

impacts on performance and attendance. The NHSA found that improving health in the North would reduce the regional gap in productivity by 30% or £1.20 per-person per-hour, generating an additional £13.2bn in UK GDP.

New research demonstrates a likely further £6.86bn loss already due to mortality from the COVID-19 pandemic and a potential £5bn loss from the strain on mental health.[94]

This loss has the potential to escalate if mitigating factors are not put in place. This report identifies mental health innovation as a priority area for attention due to the economic and societal imperatives and also because of the opportunity observed for impact.

Global markets

In 2019/20, the Department of Health and Social Care spent over £137bn on core departments and agencies, the vast majority of which went on hospital-based treatment services.[95]

While this represents a major domestic market, the global marketplace presents a significant opportunity for the North to export products and services. As an example, the EU spent some £900bn in 2019, some 7% of GDP, with France and Germany spending over 11% of GDP.

While the US and Canada present a major North American market with high levels of health expenditure, Asia and China have seen rapid increases in economic growth and an increasing demand for health services.

The global forecasts predict increased wealth in all continents, combined with increasing pressure to care for an ageing population, to support a much larger global health economy, with increasing demand for more effective and less costly health solutions.

While the North needs to continue to develop domestic production capacity to produce new products and technologies, generating wealth and jobs in regional economies in high productivity sub-sector, global demand provides growing opportunities to further increase exports (including through the North's established ports and aviation infrastructure) and capture an increasing share of a global market.

The North, and the UK as a whole, needs to consider how it achieves and protects its reputation through an effective balance of evidence collection, use of data, product development, testing, commercialisation and subsequent adoption.

Foreign direct investment

The UK has a strong track record in attracting foreign direct investment from around the globe and investment in life sciences accounts for a significant proportion of new UK investment each year. In 2019, the UK secured 82 life science foreign direct investment (FDI) projects worth £510m, up from 42 in 2018, ranking second for the number of life science projects with FDI amongst comparator countries, surpassing China to rank behind the United States of America, which has ranked first since 2015.[96]

The growth in global markets is likely to see reinvestment by foreign owned companies already established in the UK and new entrants keen to access the UK's science, technology and production capacity.

The North now offers a range of locations for new investment with several established clusters and specialist science, technology and mediparks across the wider region that can accommodate growth.

Section 9
The National Context for Intervention

National policy objectives

Raising Productivity

Raising productivity has long been recognised as a priority for the UK economy and one where the life science sector can play a role. It has been a central theme in Government policy since the publication of the UK Industrial Strategy in 2017, which aimed to boost productivity by backing businesses to create good jobs and increase the earning power of people throughout the UK, through a focus on the five foundations of productivity as shown below.[97]

The five foundations of productivity

1. **Ideas:** the world's most innovative economy.
2. **People:** good jobs and greater earning power for all.
3. **Infrastructure:** a major upgrade to the UK's infrastructure.
4. **Business environment:** the best place to start and grow a business.
5. **Places:** prosperous communities across the UK.

The Strategy identified several strategic sectors, which were supported to bring forward Sector Deals to accelerate growth, including the life science sector.

Ageing Society was identified as one of four Grand Challenges, which represent areas in which the UK can play a leading global role.

The ambition is to ensure that people can enjoy at least five additional healthy, independent years of life by 2035, while narrowing the gap between the experience of the richest and poorest.

Setting a new imperative for R&D

The Government has committed to increasing public and private R&D investment to 2.4% of GDP by 2027, and 3% over the longer term. This compares to a base position in 2018 of 1.7%, causing the UK to under-perform relative to its competitors – e.g., the EU28 average is 2.0%, the OECD average is 2.4% and the USA reports 2.8%.[98]

As the North currently secures a below proportionate share of Government R&D spend, as outlined in Nesta's *The Missing 4 Billion* report, ensuring that the North is both effectively positioned for and in receipt of growing R&D budgets is a priority.[99] Allocations should recognise and expand the North's research strengths to support national economic recovery and growth by maximising the North's contribution.

The drive to increase investment in R&D has a role to play in boosting productivity, employment and competitiveness in global markets, as well as generating societal benefits as innovations are commercialised.

The Government's *Research and Development Roadmap* seeks to further strengthen science, research and innovation across the UK. The scope of this document and its implications for life science propositions in the North is considered below.[100]

The COVID-19 pandemic has prompted early gains in life sciences R&D expenditure. In the public sector, gains include an announcement in the Spending Review 2020 that almost £15bn would be made available in 2021-22 including support for clinical research to support the delivery of new drugs, treatments and vaccines. A commitment was also made to provide multi-year settlements for the National Academies (including the Academy of Medical Sciences) and UKRI's core research budgets, growing by an average of over £400 million per year for the next three years, supporting the government to invest £1.4bn more per year in core funding in the research base by 2023-24.

In the private sector, OECD data suggest that across all sectors of the economy industry spent 6% more on R&D in 2020 than in 2019, with vaccine and drug manufacturers increasing expenditure by up to 20%.[101]

Research and development roadmap

Government's 2020 'Research and Development Roadmap' strategy sets out the influence of the UK's response to the pandemic and the importance of innovation to economic recovery:[102]

> *"In light of the COVID-19 crisis, the importance of being able to find ingenious, practical and timely solutions to the most challenging problems is even clearer. Research and development will be critical to economic and social recovery from the impacts of COVID-19, enabling us to build a greener, healthier and more resilient UK."*

The commitment to increasing UK investment in R&D to 2.4% of GDP by 2027 will increase public funding for R&D to £22bn per year by 2024/25, linked to raising domestic and international business investment into UK R&D, increasing economic productivity and prosperity through new products, services and jobs and helping to transform our public services.

There are four Government commitments which are particularly relevant to the health and life science industries in the North. These are:

- Increase investment in research, unlocking new discoveries and applying research to solving our most pressing problems in government, industry and across society.
- Strengthen the interactions between discovery research, applied research, innovation, commercialisation and deployment.
- Support entrepreneurs and start-ups and increase the flow of capital into firms carrying out R&D enabling them to scale up. Exploit competitive and comparative advantage where the UK can lead the world in key industries, technologies and ideas.
- Take greater account of place-based outcomes in how we make decisions on R&D in the UK, ensuring that R&D systems make their fullest contribution to the levelling up agenda.

With place now featuring in the Treasury Green Book, Government is expected to publish a new UK R&D Place Strategy in 2021 to unlock local growth and societal benefit from R&D across the UK - fostering greater collaboration and networks

between funders, researchers, practitioners and civic leaders to embed a system that delivers stronger local economic benefit and improved quality of life outcomes from R&D.[103]

There are several other Government commitments set out in the Research and Development Roadmap, which are of interest to the health and life science industries, including to:

- Ensure the UK has the best regulatory system to support research and development.

- Attract, retain and develop the talented, diverse people and teams that are essential to delivering the vision, through a new R&D People and Culture Strategy. Increase the attractiveness and sustainability of careers throughout the R&D workforce for researchers, technicians, innovators, entrepreneurs and practitioners.

- Set up an Office for Talent taking a new and proactive approach to attracting and retaining the most promising global science, research and innovation talent to the UK.

- Provide long-term flexible investment into infrastructure and institutions, building on the UK's system of universities, public sector research establishments and other publicly funded laboratories, developing the large-scale infrastructure, facilities, resources and services to make them world leading.

- Be a partner of choice for other world-leading research and innovation nations, whilst also strengthening R&D partnerships with emerging and developing countries.

Develop a new funding offer for collaboration to ensure the UK can further benefit from the opportunities of international scientific partnerships.

The commitment by Government to ensuring that the UK's science and innovation community, people, institutions, and infrastructure are outward-facing and attract collaboration and investment from across the globe, is already reflected within many of the international collaborations involving NP11 institutions.

Building Back Better

The COVID-19 pandemic has had an unprecedented impact on the UK's business and economic environment.
In the 2021 Budget, Government announced that while creating and supporting jobs remains the Government's central economic focus, in the current context, helping to drive growth in existing, new and emerging industries is also a priority.

In support of transitioning from the Industrial Strategy into a plan for growth, *Build Back Better: our plan for growth,* sets out the Government's plans to support economic growth through significant investment in infrastructure, skills and innovation, recognising innovation as a key driver of economic growth, with an Innovation Strategy to be published in Summer 2021.[104]

The Plan clearly sets out the importance of innovation, stating:

> *"Innovation drives economic growth and creates jobs. The UK has a world-leading research base, which will be boosted by the government's significant uplift in R&D investment and the creation of the Advanced Research & Invention Agency to fund high-risk, high-reward research.*
> *However, too few businesses are able to access the tools they need to translate new ideas into new products and services and to challenge established businesses.*
> *We will make the UK the best ecosystem in the world for starting and growing a business. That means having the best access to capital, skills and ideas, as well as a smart and stable regulatory framework".*[105]

As part of the plan for innovation, the Government has committed to:

- £14.6bn investment in R&D in 2021-22.

- £800m of funding for the Advanced Research & Invention Agency (ARIA).

- A new £375m UK wide Future Fund: Breakthrough scheme to address the scale up gap for innovative businesses.

The UK's global leadership in life sciences and international reputation, including strengths in pharmaceuticals and emerging industries such as AI is highlighted in the plan.

The plan notes that investment is regionally concentrated in London and the South East and highlights its UK-wide R&D Places Strategy, expected to be published in summer 2021 and will focus on how R&D can contribute to the Government's levelling up agenda.[106]

Levelling Up Performance across the UK

The Government has set out its intention – including through the Spending Review 2020 and Budget 2021 – to address regional inequalities, rebalance the economy and 'level up' underperforming and left-behind parts of the UK including through infrastructure development and investing in education, skills and scientific R&D.

The UK has some of the largest regional disparities in productivity of the OECD countries. One reason, explored in recent research by Onward, for the significant geographic disparities in productivity and income is that innovation, the key driver of productivity growth, is concentrated in one part of the country.[107]

The analysis suggests that public spending on R&D may be contributing to the distribution of innovative clusters and the productivity gap, for instance:

- London and the South East received almost half (49%) of all Government and UKRI's R&D spending in 2018.

- Since 2009, 60% of total grant funding dispensed by the Small Business Research Initiative was given to organisations in London, the South East and East of England.

- Between 2015 and 2018, start-ups in London received four times more per head of population than elsewhere through the Government's two main innovation investment reliefs, Enterprise Investment Scheme (EIS) and Seed Enterprise Investment Scheme (SEIS). Together London and the South East made up over 60% of SEIS and EIS investments during the period, compared to 10% for the North of England.

- Between 2015 and 2020, venture capital investments rose fourfold in London compared to a third in Manchester. London's share of venture capital increased from 69% of total UK investment in 2015 to 77% in 2020.

These figures further emphasise the challenge outlined in Nesta's *The Missing 4 Billion* report.

A recent Council for Science and Technology (CST) letter to Government explored how science and technology can contribute to addressing regional disparities and promoting equality of opportunity.[108]

The letter recommended that a strategy to maximise the contribution of R&D for levelling up should include:

- Leveraging R&D funding for regional growth by scaling up collaborative funding opportunities to foster and enhance partnerships, within and between regions, where there are research and innovation synergies with the potential to contribute to local growth.

- Further incentivising the contribution of research, innovation and technology centres to regional growth in funding agreements and in organisational strategies.

- Enhancing the availability of information on local innovation strengths and needs, for local and national decision makers to inform effective investment strategies and to evaluate outcomes.

- Supporting wider measures needed for R&D investment to act as a driver for local growth, including measures to support skills and to support local leadership and decision-making.

These recommendations, allied to the connectivity across industry and the public sector within the North provide a sound basis to support and invest in the North as the UK's second supercluster.

The strategic importance of the life sciences sector

The *Life Sciences Industrial Strategy*, produced by industry and charity partners, led by Professor Sir John Bell, set out the direction for growth in life sciences over the next two decades.[109]

The 2017 strategy highlighted the UK's competitive advantages including:

- A powerful life sciences research base supported by world leading universities.
- Leading position in clinical and translational medicine.
- Longitudinal datasets within a national healthcare system.
- The third largest biotech cluster after Silicon Valley and Boston.
- A high productivity and skilled workforce.
- Emerging strengths in digital health and AI.

The opportunity for the UK to capitalise on advanced therapies as a key growth sector was also highlighted, by leveraging its excellent science base to secure advanced therapies manufacturing. Over the past five years, the UK advanced therapies industry has tripled, and now represents the largest advanced therapies cluster in Europe and a leading global cluster.[110]

An update to this report, published in 2020 highlights the need to reinforce the UK science offer, including clinical research, data and genomics as well as capitalising on the opportunities of advanced therapies, including developing advanced therapies manufacturing capabilities.

Recognising the sector's potential, the Industrial Strategy Life Sciences Sector Deal included almost £500m of government support for major research programmes and over £1bn of new industry investment. Building on this the second *Life Sciences Sector Deal* included additional measures and innovative programmes to secure a global lead in the areas of greatest opportunity for the UK.[111]

The document references the significant and growing cluster of activity in the North, recognising its 21% contribution to the UK's life sciences employment base and presence of significant investments. This includes a £5.7m investment by Fujifilm Diosynth in Tees Valley to support medicines manufacture, the development of a world-leading genomics campus in Manchester and hosting two Proton Partners International Rutherford Cancer Centres in the North.

This second Life Sciences Sector Deal deepens the partnership with industry, universities and charities and demonstrates how the NHS is pivotal as a delivery partner. It included:

- Investment in digital pathology and radiology programmes to support early and improved diagnosis across the UK and to deliver more efficient NHS services.
- Funds to support a network of regional Digital Innovation Hubs, providing expert clinical research data services, data analysis and sharing capabilities and a wider programme delivering on the Government's tech vision to reform the architecture of technology in the NHS and make it work better for patients, clinicians and researchers.

Health and life sciences in the UK

Scale and characteristics of the sector

Key strengths: The UK benefits from a unique ecosystem for life sciences and health innovation, with five core strengths:[112]

- **A world-class science base**
- **A dynamic and global life sciences hub**
- **Government and industry working in partnership**
- **The NHS – an anchor institution employing 1.4 million people and managing an annual budget of £114bn in 2018/19**[113]
- **A competitive business environment**

Employment and economic contribution: Using the Office of Life Sciences (OLS) SIC Code definition,[114] the sector directly employs almost

100,000

people across almost **4,000** businesses, generating

£33.4bn

of economic output.

The **OLS 2020 Life Sciences Competitiveness** report indicated that in 2019, using a wider definition, the sector employed over a quarter of a million people and generated turnover worth

£81bn

in the UK[115]

Whilst multi-national businesses have a high profile within the sector,

80%

of life sciences businesses are SMEs, employing **23%** of the workforce[116]

R&D spend: The Government's commitment to increasing R&D spending is evidenced by UK government spend on health research and development which totalled in 2017, the second highest level of

US$3bn

Government spending on health R&D, behind only the US.[117] Since 2017, an additional

£4bn

has been invested in R&D, helping to support the goals of the Life Sciences Industrial Strategy.[118]

In 2018, the UK's pharmaceutical industry's spend on R&D totalled

£4.5bn

one-fifth of total industrial R&D spend in the UK.[119] The UK's top two companies performing R&D during 2018 were Pharmaceuticals & Biotechnology companies – **GlaxoSmithKline** and **AstraZeneca**[120]

- Significant action to address the Industrial Strategy Grand Challenges and transform the prevention, diagnosis and treatment of chronic diseases by 2030.

Providing the skills for growth

This growing sector requires a workforce of scale, with the specific skills to meet its aspirations. With strong life sciences employment growth forecasts and the need to accommodate staff turnover, the challenge lies in how to attract, train and retain the workforce needed to satisfy demand.

Across the UK, it has been estimated that 119,000 people with level 2-8 qualifications will be required by the life sciences sector by 2030, of which around 39,000 (33%) will be required at level 6 (degree level) and 32,000 (27%) at level 7 or above (postgraduate level).[126] As well as capturing the required scale of workers, there are recognised to be specific skills shortages (for example in immunology and genomics) and sector-wide skills issues to address (including requirements for digital and computational skills, leadership, effective communication and commercialisation skills).

Within its manifesto for the 2019 General Election, The Government committed £3bn over five years (from 2021) via a National Skills Fund. This fund is set to address skills gaps and build capability within the workforce, notably including the digital skills market.

Since that pledge was made, COVID-19 has had a significant impact on employment markets. The Parliamentary Office of Science and Technology identifies that by 2024 there will be a four million shortfall in what it terms "highly skilled workers" and, it can be argued that, aside from the shift in demographic and advent of the Fourth Industrial Revolution future deficits to the skills and employment market will be further compounded by the changes to working patterns created during the pandemic.[127]

Mobilising and coordinating skills development in business-critical areas for the UK is being built into plans for growth and competitiveness across the North. Discussions with industry based in or active within the North have identified areas for development around Advanced Therapies, Diagnostics and Digital/AI in particular.

The pandemic response of the NHS and universities in training large numbers of staff quickly in for example the Alderley Park Lighthouse Lab and the Integrated COVID Hub in Newcastle are models for how large numbers of trainees can be provided with high-quality practical and theoretical training that simultaneously builds resilience in the public sector and develops cohorts with the skills required by industry.

Health policy priorities

Among the key priorities cited in the Public Health England (PHE) Strategy 2020-25 is utilising technology to develop targeted advice and interventions and support personalised public health and care at scale and improving data capability and strengthening the approach to disease surveillance.

Together, these priorities can contribute to the Government's ambition to use data, AI and innovation to transform the prevention, early diagnosis and treatment of chronic diseases by 2030.

Reversing trends in life expectancy and poor health, in other words supporting healthy ageing, and tackling infectious diseases are two of the key challenges noted.

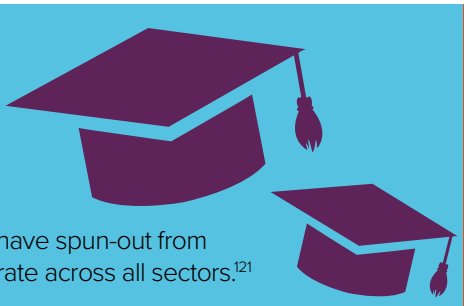
The NHS Long Term Plan articulates its commitment to:

- Ensure a strong start in life for children and young people.
- Deliver world class healthcare for major health conditions which include cancer, cardiovascular disease, stroke, diabetes, respiratory disease and mental health.
- Support healthy ageing.

Both PHE and the NHS have prioritised the use of data and artificial intelligence as central to improving health outcomes over the next ten years.

Spin outs: Research suggests that

42%



of life sciences businesses in the UK have spun-out from academic institutions – ten times the rate across all sectors.[121]

FDI: In 2019/20 there were **159** FDI projects in life sciences and biotechnology and pharmaceuticals in the UK, creating over

3,000

new jobs.[124]

Trade: The UK exported

US$31bn

of pharmaceutical products and

US$4.4bn

of medical technology products in 2018.[122]

In 2019 the UK exported

£22.6bn

of medicinal and pharmaceutical products[123]

In summary, the UK is home to one of the most productive health and life sciences sectors in the world and continues to invest in human capital across life sciences to support the success of the sector.[125]

Section 10
Enabling Factors

As considered in section 9, the national policy context for health and life science innovation is complex and fluid. This section considers the role that needs to be played by some of the key agencies and the areas in which actions are required to achieve the potential identified in this report.

R&D investment:

UKRI

Since launching in 2018, UKRI has built on the strengths of the seven Research Councils, Innovate UK and Research England to deliver more ambitious, interdisciplinary research and innovation, enabled by new investment through the Strategic Priorities Fund and the Industrial Strategy Challenge Fund.

As the largest public funder of R&D in the UK, with a statutory role to advise government, UKRI has a central role to play in delivering the economic benefits from science and research in health and life sciences.

In addition to Research England and Innovate UK, four of the most prominent Research Councils in this space are: (a) Biotechnology and Biological Sciences Research Council (BBSRC); (b) Engineering and Physical Sciences Research Council (EPSRC); (c) Medical Research Council (MRC); and (d) Science and Technology Facilities Council (STFC).

In its 2019-20 report, UKRI highlighted expenditure of £3.28bn in pioneering ideas, through Research Council programmes and funding for research at universities; £1.73bn in research and innovation infrastructure and institutes; and £1.60bn in cutting-edge innovation to improve the business environment and address major industrial and societal challenges through running the Industrial Strategy Challenge Fund (ISCF) and the Strategic Priorities Fund (SPF).

The Government has set out its intention to address regional inequalities, rebalance the economy and level up underperforming and left-behind parts of the UK, including through infrastructure development and investing in education, skills and scientific R&D.

The UK has some of the largest regional disparities in productivity of the OECD countries. One reason, explored in recent research by Onward, for the significant geographic disparities in productivity and income is that innovation, which is the key driver of productivity growth, is concentrated in one part of the country.[128] The analysis suggests that public spending on R&D may be contributing to the distribution of innovative clusters and the productivity gap.

Onward,'s Levelling Up Innovation report proposes a straightforward solution to how public funded R&D can fully contribute to the levelling up agenda:

> *Devote the uplift in public R&D investment through the 2.4% of GDP target to projects outside the "Golden Triangle". This would amount to an annual £9bn boost to R&D funding for lagging regions by 2027, and, according to the Government's own modelling, could raise UK productivity by 3-4% by 2027 and 8-12% by 2040 relative to the current distribution.*

The public and private sector partners involved in health and life sciences are in a position to work closely with UKRI to identify areas where increases in research driven interactions and outcomes in health and life sciences can support Build Back Better and develop a Northern health and life sciences Supercluster, building on the significant investment in Catapults and collaborative networks and partnerships.

Innovate UK

Innovate UK is an agency of UKRI which drives productivity and economic growth by supporting businesses to develop and realise the potential of new ideas, including those from the UK's world class research base.

UKRI works with partners to drive sustainable growth by investing in high-potential entrepreneurs and businesses across the UK that have the ambition and potential to contribute to economic growth and society through innovation.

This includes working with spin-outs and start-ups through to large businesses at the top of complex supply chains that can provide routes to market for the companies supporting them.

Innovate UK works to: support and invest in innovative businesses and entrepreneurs with the potential and ambition to grow; maximise the commercial impact of world-class knowledge developed in the UK's industries and its research base; and identify, support and grow transforming and emerging industries through innovation. In 2019/20 Innovate UK had a budget of £743m for Research and Innovation and £468m for the National Productivity Investment Fund.

Innovate UK has the potential to make a major contribution to further supporting the health and life sciences industry in the North of England. There are a considerable number of organisations involved in health and life sciences in the North, which could assist Innovate UK to support Build Back Better, securing national benefits and develop a Northern health and life sciences Supercluster, building on the significant ecosystem for new starts and scale up companies.

Business and innovation infrastructure:

Commercial Space and Targeted Support
Local Enterprise Partnerships (LEPs) and city region partnerships have successfully used a variety of funds to support incubation and commercial lab/clinical lab space to support health and life science and digital health SMEs. This investment has provided high quality premises in addition to commercial space in UKRI funded facilities and targeted support to assist innovation, in addition to the support provided by Innovate UK.

A number of Local Authorities and LEPs have also used external funds to provide more affordable grow on space for high growth smaller companies in the early stages of scale up.

The principal funds which have been used over the past five years have been the European Regional Development Fund (ERDF) and Local/ Regional Growth Funds. EU ERDF programmes in the 2014-2020 period typically had both an innovation priority and a focus on SMEs, which allowed targeted facilities to be delivered, often accompanied by specialist business support programmes.

These funds have also supported the establishment of technology, advanced manufacturing and business parks and these

locations have been crucial in modernising production space for high priority sectors such as advanced manufacturing and life sciences.

Between 2014 and 2020, ERDF of £511m was available for research and innovation projects and £1,077m for strengthening the competitiveness of SMEs. As ERDF requires matched funding, the total value of investment doubled to £1bn and £2bn in these two priority axis programmes.

The loss of ERDF support, now that the UK has left the EU, will reduce the Northern innovation funding pot by several hundred million pounds, with implications for research/innovation centres and business support programmes.

While there is a Government commitment to fully replace ERDF funding with a Shared Prosperity Fund, it is not clear the extent to which innovation/R&D and SME support will maintain its profile.

The R&D roadmap highlights the importance of sub regional interventions – "we will also ask what more we can do to support impact-focused activities such as SME outreach, business incubation, technology diffusion and talent development.

We will rigorously assess how local economic impact could be factored into future infrastructure investment decisions by government at all levels. We will ask how we can achieve effective join-up between local and devolved growth funding and R&D funding, to improve coherence and achieve stronger outcomes across the UK."

In order to maintain the momentum in the health and life science industries, and taking account of market demand, Government needs to, as a minimum, match the 2014-2020 levels of capital and revenue support for innovation, health and life sciences and targeted business support initiatives, strengthening the ecosystem which supports the Northern health and life sciences supercluster.

Business and innovation Tax incentives

Tax incentives are an important tool in supporting company investment and investment in R&D. They are particularly important to the life science industry where the costs are significant.

There are several recent proposals, outlined by Onward, to change the current allowances:[129]

> *"Expand capital allowances for plant and machinery to among the most generous in the G20. This would help manufacturing businesses, which are disproportionately located outside the South East, to innovate. Use R&D tax credits to incentivise follow-on investment from firms. A number of other countries, including South Korea, Japan, and Italy, have successfully raised private R&D spend by directly rewarding firms that increase their innovation spending year-on-year. The UK should do the same.*
> *Create expanded University Enterprise Zones to bring together researchers and commercial organisations to translate research innovation into commercial products and services. This would build on the existing network of UEZs, and give them additional incentives in the form of additional tax credits or higher capital allowances."*

The recently published UK Diagnostics Industrial Strategy has called for Government to examine in depth the range of fiscal and other tools available to support high growth companies, and how the tax system enables or incentivises UK-based companies to grow and remain in the UK.

State aid

The EU State aid rules, which were developed and adopted to support the EU 'Single Market', no longer apply. Under the EU approach, the General Block Exemption Regulation allowed (and limited) a number of categories of aid relevant to life sciences, including: (a) Regional aid; (b) SME Investment and employment; (f) Aid in the form of Risk Capital; (g) Aid for Research, Development and Innovation; and (h) Training Aid.

The UK-EU Trade and Cooperation Agreement (TCA) signed on 24 December 2020 contains a chapter on subsidies. Under the Agreement, each Party will have its own independent system of subsidy control that would prevent authorities giving businesses subsidies that distort trade.

The UK and EU have agreed broad common principles under which subsidies could be granted.

For example, a subsidy has to contribute to a well-defined objective of public interest or remedy a market failure. It has to be proportionate and limited to what is necessary to achieve its objective.

The UK-EU TCA includes a separate joint declaration on subsidy control policies relating to subsidies for the development of disadvantaged areas (regional aid), transport (airports, roads and ports), and research and development.

The UK-EU TCA and joint declaration on subsidy control policies includes a commitment to avoid divergence where possible, although the GBER restrictions and de minimis rules for business support have not been transferred into the new arrangements. There is, therefore, scope for the UK to review its approach to industry and R&D aid.

While there are commitments on subsidies arising from the UK's continued membership of the World Trade Organisation (WTO), the move from EU State Aid rules may open up new opportunities for life sciences with regard to support for SME growth in relation to commercial/industrial early-stage R&D.

EU State Aid considerations have impacted on a number of business investment and support activities for many years. Government should consult with those involved in providing direct and indirect support to SMEs the extent to which higher levels of subsidy/support would accelerate the commercialisation of research and innovation.

Investment and venture finance

Government is committed to improving access to finance, in particular for small and start-up companies, particularly high impact, innovative and disruptive companies.

For innovative SMEs, a £750 million package of support including targeted grants and loans is delivered by Innovate UK, while a new UAE-UK Sovereign Investment Partnership (SIP) will serve as a coordinated investment framework (including an initial £800m commitment to invest in UK life sciences over five years) and the sum will be deployed alongside the UK's £200m Life Sciences Investment Programme, announced last year.

There remains an access gap, however, to venture and other forms of capital in the North, particularly in very early-stage investment, where the commercial potential is unclear and smaller companies and start-ups are unable to access funds for trials and prototypes. For example, 69% of Seed Enterprise Investment Scheme (SEIS) and 65% Enterprise Investment Scheme (EIS) funding goes to companies registered in London and the South East.[130]

Northern companies rely on very early-stage support being made available by grants and local investment funds supported by innovation centres. Grant funding in particular can be slow to access and only during time periods where a competition is open, which can disadvantage SME's where time is often their most valuable resource.

This is an issue as it results in a skills and IP drain from the North to the South and overseas (often the USA) in search of capital. This in turn reduces the number of investors with experience of working with life science companies in the region and further drains the availability and quality of the capital.

Until recently this was an acknowledged issue for the UK, and Europe, as a whole, with loss to the USA frequently cited.[131] Recent efforts to increase access to capital for life science companies have been successful; the BIA reports UK biotech financing increasing from £261 Million in 2012 to £2.8bn in 2020. Venture capital in particular has doubled since 2016 to £1.3bn; but this success has been concentrated into London and the South East.[132]

Regionally, there are a number of local initiatives working to increase the availability of capital in the North and make it easier for companies to grow, for example: Northern Gritstone, the North by North West consortium, the Northern Accelerator in the North East, and North Invest.

Northern Gritstone is a collaboration between the universities of Leeds, Manchester and Sheffield to create an investment company based in the North of England with the ambition to be one of the largest investors in academic spin-outs in fast-growing sectors such as advanced materials, energy, health technology and cognitive computation and to ensure that IP generated in the North benefits the region.

North Invest is a non-profit organisation working to connect angel investors in the region, while the Northern Accelerator has a focus on increasing the skill levels of, and finding, skilled executives to lead start-ups and spin-outs.

With growing financial services sectors in Leeds, Manchester and Newcastle, and the British Business Bank offices in Sheffield, there is an opportunity to support two growing sectors in the North and provide targeted interventions to increase capital access in the North.

The Government can look internationally for examples of successful interventions, such as Israel, where public private partnerships and government programmes have been used to create a thriving investment ecosystem that is accessible across multiple regions of country.

As highlighted by the work of the Northern Accelerator, programmes to increase the entrepreneurial skills of students and staff in academic and clinical sectors are also crucial and investing in a systems approach to 'levelling-up' place-based R&D will help.

Government should actively look to increase access to capital for Northern companies in life sciences.

Inward investment

The UK has a strong track record in attracting foreign direct investment from around the globe and investment in life sciences accounts for a significant proportion of new UK investment each year. In 2019/20, there were 159 FDI projects in life sciences and biotechnology and pharmaceuticals in the UK, creating over 3,000 new jobs.

The growth in global markets is likely to see reinvestment by foreign owned companies already established in the UK and new entrants keen to access the UK's science, technology and production capacity.

The UK faces major global competition in attracting FDI investment in life sciences and post-Brexit, active programmes to enable the UK to remain as a gateway to EU markets are needed or it is likely to lead to a reduction in FDI cases. At the same time, there is likely to be increased demand from European companies to establish a UK presence to service the large British market, with a national priority to strengthen domestic production in light of the pandemic.

There are considerable benefits from FDI investment including jobs, particularly higher paid and more productive jobs, and the impact on local/UK supply chains. The taxation benefits from employment and business activity, including business rates, benefits the national economy.

FDI that attracts innovative SMEs provides the additional benefit for attracting high growth potential companies, and skilled innovative individuals into a region.

The adoption of the best and most effective health technologies the world has to offer will play a keep role is keeping the NHS a modern and innovative healthcare system.

There are a number of barriers to foreign companies working with the NHS. The NHS typically requires a UK proof of concept and understanding of real-world data.

NHS Procurement is fragmented, considerably more so than it appears to overseas companies. The route for a company to procurement is complex and requires navigation.

A recent report by Lord O'Shaughnessy and the all-party Britain-Israel Parliamentary group sets out an ambition for a HealthTech landing pad to smooth the introduction and pathway to procurement for Israeli companies, a region with strong FDI links to the UK.[133]

This work also builds upon HealthTech Connect the Accelerated Access Collaborative and other initiatives championed by Lord Prior.

Historically, the North has been very successful in attracting inward investment, particularly in manufacturing.

The Leeds-Israel Health Tech Corridor Initiative is an example of the assets of a city region working in a concerted manner to attract and assist with inward investment, as recommended by the Israel & UK HealthTech innovation report. Investment in scaling up these programmes and a strengthened offer would contribute to the levelling up agenda.

Skills and talent

Government has committed to developing a new offer linking research and innovation talent to the ambitions on levelling up, building on the work UKRI is doing through its network of institutes and centres to deliver high-level skills for technicians, working with their sectors and skills providers to identify future skills needs and develop the relevant training modules.

This will focus on working with and through institutions including universities, PSREs and UKRI research institutes to strengthen their role in skills and talent development in their local context.

The R&D roadmap states:

> *"We will consider how levelling up can be more embedded into our approach to R&D talent, looking closely at building regional capacity to make decisions on talent schemes – including doctoral training, and vocational and further education provision. We will assess how research culture might differ across places, and where differences help or hamper levelling up outcomes."*

These plans now need to be made available to other stakeholders in order to ensure complementarity with other life sciences workforce priorities. Given the ageing of the UK workforce and the need for new skills in many areas of life sciences, the UK life sciences industry will need to recruit internationally to ensure the skilled workforce is available to support new opportunities and company growth plans.

The UK has put in place a new points-based immigration system which should allow the UK to attract talented people from around the world. The unknown factor is the extent to which the UK is a less attractive place to live and work, given the change from the EU free movement of labour market.

The Global Talent Visa, providing a new route for talented individuals to come and work in the UK, allows highly skilled scientists and researchers from across the globe to come to the UK without needing a job offer.

In addition, international students who complete a PhD from summer 2021 can stay in the UK for three years after study to live and work. And, as announced previously, students who have successfully completed undergraduate and masters degrees will be able to stay for a further two years after study.

The Life Sciences 2030 Skills Strategy has been developed under the leadership of the Science Industry Partnership (SIP) Futures Group as a key

deliverable in the Life Sciences Sector Deal 2, and will play a central role in delivering the skills ambition of the Industrial Strategy. The Skills Strategy states that the sector has the potential to create approximately 133,000 jobs over the next 10 years, and that digital and computational skills, statistical literacy, leadership and inter-disciplinary working are essential to the success of the UK's life science industries.

The Strategy makes the case for sector-based skills investment and investment into high level apprenticeships, alongside flexibilities in use of the Apprenticeship Levy. Across the North there is an opportunity for Northern universities to offer more degree apprenticeships in response to the demand from industry. The life sciences sector involves biomedical science, engineering, computer science, data analytics, chemistry, physics and mathematics working in close partnership with clinical research and high-value manufacturing expertise.

The case for investment in skills is based on the importance of the sector with:

- An average Gross Value Added (GVA) per worker of £104,000 a year, more than twice the UK average.
- Direct employment of over 220,000 people, with over 160,000 within core operations and a further 60,000 within service and supply.
- 5,870 companies; 20% of which are large companies and 80% are SMEs.

The potential to create around 133,000 jobs includes both anticipated replacement demand and job growth over the next 10 years. In some specialisms, a large proportion of the skilled workforce are expected to retire over the next 10 years, and there is an urgency about providing a skilled workforce to support business growth.

The modelling undertaken to support the Skills Strategy indicated that:

- The Biopharma sub-sector has the potential to generate almost 43,000 jobs over the next 10 years. Sixty percent of these jobs – 25,500 – are required to replace those retiring from the labour market.
- The medtech sub-sector has the potential to generate 90,000 jobs by 2030, of which almost a third – 29,600 – are required to replace retirees. As well as capturing the required scale of workers, there are recognised to be specific skills shortages (for example in immunology and genomics) and sector-wide skills issues to address (including requirements for digital and computational skills, leadership, effective communication and commercialisation skills).

The intention is to develop and fund a sector-based skills policy that joins up the skills and business agendas through a Life Sciences Skills Action Plan.

There is a strong case for three or four regional action plans to bring together skills and industry partnerships. Recognising trends that are already evident and expected to grow, the jobs forecast for the Northern health and life sciences sector will provide a major challenge for the skills and talent needed to support a Northern Supercluster

Regulation

The UK's regulatory approach and the quality of its regulatory policy rank among the highest internationally. The UK Government is committed to taking a forward-thinking approach and setting the international agenda on regulation and standards. The intention is to allow SMEs and industry to grow and flourish, attract international R&D investment and talent to the UK.

Regulation is particularly important to health and life sciences companies, where there is a need to protect the public interest, while allowing new products and treatments to be safely developed and approved for use. New responsibility now applies to data and the use of personal information to assist with the identification and treatment of illnesses and conditions.

The R&D roadmap includes a commitment to working with key industry and regulatory stakeholders, to review the current regulatory system around controlled substances for scientific research to ensure it does not inhibit the development of new therapies and the full potential of the innovative life sciences industry. This focus highlights the need for the regulatory framework to adapt as science introduces new health and safety and security concerns.

A current example is a response to a Government consultation, where the BioIndustry Association (BIA) has made a case for Government to adopt a science-based and innovation-friendly regulatory framework for gene editing and genetically modified organisms (GMOs), to ensure the UK remains a globally competitive location for clinical development and allow rapid patient access to these potentially curative medicines.

In a 21 March 2021 press release, the BioIndustry Association (BIA) have put forward the view that significant experience with gene delivery systems in the manufacture of medicines provides demonstrable evidence of the lack of increased risk of harm to human health or the environment posed by organisms produced by gene editing.

The BIA make the case that by adopting a science-based regulatory system which regulates the product instead of the process and has the confidence of the public, the UK would enable more start-ups to be created from our excellent science base, attract global investment, help deliver on the Government's levelling up agenda and ambition to make the UK a global life sciences cluster.

Similarly, the Association of British HealthTech Industries (ABHI), in a 2020 position paper, call for real regulatory innovation in digital health, along with the opportunity for the MHRA to take a global leadership role in medtech through membership of the International Medical Device Regulators Forum (IMDRF) in its own right, and by joining initiatives such as the Medical Device Single Audit Program (MDSAP). The UK is ranked 8th among 190 economies for the ease of doing business, with the quality of our regulatory practices given the highest overall country score by the Organisation for Economic Co-operation and Development (OECD).

Government is committed to a streamlined and forward-thinking regulatory system with coordinated working across regulators and competent authorities to offer companies an efficient study approval process.[134]

A single integrated research application system (IRAS) simplifies the process for gaining ethics and trial approvals and companies can engage in early, exploratory discussions through the MHRA Innovation Office, to maximise innovation and speed of approvals, and can use the coordinated scientific advice service from MHRA and NICE.

The development of the Oxford AstraZeneca vaccine has shown how science and regulators can adapt processes to accelerate new development, without compromising safety. There is an opportunity to ensure that the UK maintains a regulatory system which attracts new investment from across the globe.

There are two important commitments needed to further support innovation in health and life sciences:

- Government and regulators to work closely with researchers and industry to develop regulatory approaches which take account of the new opportunities from investment in science and technology.
- Consideration of the lessons learnt from the pandemic experience and the extent to which other processes and procedures can be adapted to accelerate new treatments and diagnostics.

The importance of continuing to adapt the regulatory framework is set out in the proposed UK Diagnostics Industrial Strategy:

> *The UK has a rich heritage of regulatory excellence, but there are profound structural changes and new innovations coming through that our regulatory system will have to change and adapt to if we are to realise their potential. Regulators need to reform their own internal processes to enable greater diagnostic innovation, but also seek to work with and through international regulatory co-operative structures post Brexit, to broaden and harmonise regulatory processes.*

The UK also benefits from a single payer healthcare system with research delivery arms coordinated across the UK. Increasing early company engagement with clinical research expertise and commercial studies benefiting from streamlined study-wide approvals will enable companies to begin studies quickly and accelerate development and adoption.

Part 4

Forward View and Conclusions

Section 11
Forward View

There is an opportunity for the life science sector to make an exceptional contribution to increasing productivity in the North.

The health and life science industry can further build on the economic momentum from its research and industrial base, to deliver an innovation led booster which could lead to an additional 38,600 jobs and £5.8bn of GVA by 2032, compared to 2020, while having significant benefits on the health needs across the UK, and in particular in the North.

This accelerated growth is based on:

- Increased levels of public and private sector investment in R&D and innovation based on world class pan-Northern assets, partnerships and collaboration;
- A business ecosystem which supports new company formation and company growth;
- An incentive system which encourages company investment in life sciences innovation and new development; and
- A skills system which increases productivity through higher level skills in new technologies

The 2032 forecasts highlight the progress which the North can make to establishing a Northern Supercluster, on a par with the Golden Triangle, allowing the UK to capture its full share of global growth.

Accelerated growth building on momentum established in the 2020s will support the North's GVA contribution to the national economy to more than treble by 2040, with an additional 64,600 jobs, and a turnover growth of £20.4bn compared to 2020.

The intention is clearly set out in the R&D Roadmap:

... research and innovation activity and funding is highly concentrated in certain parts of the UK. This makes the businesses in these areas more adaptable and innovative and provides more opportunities for high-skill employment and training, directly benefitting communities through improved productivity and resilience. To unlock these benefits in more areas of the UK, we should do more to build on a wider range of R&D strengths...and... to enable places all over the UK to thrive and to fulfil their potential in R&D.
Ensuring we are making the most of all our strengths across the UK will allow us to capitalise on longer-term economic opportunities and tackle longstanding regional inequalities.

The Northern Powerhouse Independent Economic Review (NPIER), 2016, highlighted four prime capabilities that were distinctive across the North and where the geography was nationally and internationally competitive, with the potential to close the gap between the North and London and the South East.

Health innovation was recognised as one of the prime capabilities, acknowledging "long-established strengths in life sciences, medical technologies and devices, and a growing competence in new and efficient service delivery models brought about by e-health and, crucially, the growing devolution of responsibilities for Health and Social Care".

Since the publication of the IER, there has been significant investment in new research facilities, innovation centres and tailored support for SMEs in the health and life science industries.

In particular the North has taken a leading role in gene therapies, intelligent drug discovery and development, and telemedicine, with ambitious proposals to accelerate the use of data and artificial intelligence

Life science growth forecasts

The Life Sciences 2030 Skills Strategy developed under the Leadership of the Science Industry Partnership (SIP) Futures Group, included workforce modelling which indicated that the Biopharma sub-sector has the potential to generate almost 17,200 jobs over the next 10 years and the medtech sub-sector has the potential to generate 60,000 jobs by 2030.[135]

The Skills Strategy was published in January 2020, essentially pre-COVID-19, and stems from a recommendation of the Life Sciences Industrial Strategy (LSIS), and its subsequent sector deals, for the development of an industry-led skills strategy, based on a skills gap analysis of the sector. [136]

Growth in the North 2020-2032

While nationally employment splits evenly between biopharma and medtech, in the North of England, medtech is much larger, accounting for around 60% of employment in life sciences. The national and global growth forecasts for biopharma in health and life sciences are very positive, and the momentum built around current assets will see both employment and productivity grow in the North. Although biopharma accounts for lower employment numbers, its economic contribution to GVA is exceptional.

The strong growth forecasts reflect the "momentum" provided by some of the factors set out in this report, including new science, new approaches to shortening the development timetable and the use of data and AI.

This momentum growth reflects the current scale of R&D investment and networks already in place and the strength of the private sector.

For biopharma, the momentum growth, using the Life Science Skills Strategy employment forecasts for the UK and OLS and ONS Regional Accounts data, and assuming the north maintains its share of the national industry indicates a significant

Fig 7: Health and Life Sciences Growth Predictions: **Biopharma**

Life Science Skills Strategy, OLS and ONS Regional Accounts

Fig 8: Health and Life Sciences Growth Predictions: **MedTech**

Life Science Skills Strategy, OLS and ONS Regional Accounts

increase in GVA between 2020 and 2032, and a smaller although important rise in employment. medtech has always been a very strong manufacturing sub sector for the North of England with many of the leading companies represented in a number of sub regions. The growth forecast nationally and globally for medtech are very positive, reflecting the combination of opportunity and demand.

The momentum growth, using the Life Science Skills Strategy employment forecasts for the UK and OLS and ONS data, and assuming the North maintain its share of the national industry indicates a significant increase in employment, an additional 16,600 jobs and a doubling of GVA by 2032.

The Skills Strategy forecasts, produced for a pre-COVID-19 scenario, suggest that the health and life science industry will see a marked increase in employment and, using OLS and ONS data, this translates into a significant uplift in turnover and GVA by 2032. This momentum from the North's research and industrial base, makes an important contribution to the ambition set out in the Northern Powerhouse Independent Economic Review and the need to boost productivity and employment.

Innovation led booster

The potential to unlock the full potential of the sector in the context of a Northern Supercluster has a foundation in the Government commitment to innovation and R&D, which can provide the impetus to delivering exceptional economic growth over the next ten years.

The intention is clearly set out in the R&D Roadmap:[137]

> *We know, however, that research and innovation activity and funding is highly concentrated in certain parts of the UK. This makes the businesses in these areas more adaptable and innovative and provides more opportunities for high-skill employment and training, directly benefitting communities through improved productivity and resilience. To unlock these benefits in more areas of the UK, we should do more to build on a wider range of R&D strengths. We should also do more to enable places all over the UK to thrive and to fulfil their potential in R&D.*
>
> *Our commitment to R&D effectively supporting the wider levelling up agenda runs through this Roadmap. Ensuring we are making the most of all our strengths across the UK will allow us to capitalise on longer-term economic opportunities and tackle longstanding regional inequalities.*

There is an opportunity for Government to provide a booster effect to the already very positive prospects for health and life sciences in the North, sharing the North's ambition to support a second UK health and life science Supercluster.

This assumes that building on research excellence, economic potential and industry strengths will be supported by UKRI and Innovate UK, along with the full replacement of

the discretionary funds which have supported innovation and measures to strengthen the business and investment environment.

This will allow health and life sciences in the North to make a major contribution to *Build Back Better: our plan for growth* which sets out Government's plans to support economic growth through significant investment in infrastructure, skills and innovation, recognising innovation as a key driver of economic growth, with an Innovation Strategy to be published in Summer 2021.[138]

There are a number of factors which will unlock the full potential of the health and life sciences:

1. The acceleration of advanced therapies and diagnostics and medtech through a networked eco-system which supports the commercial sector.
2. The full adoption of data, digital and artificial intelligence through a networked curated data network covering 16m people.
3. Increased levels of support from UKRI, to reflect Northern assets and potential.
4. Increased support from Innovate UK, along with the full replacement of innovation related ERDF/LGF resources to support SMEs.
5. Changes to the business support and state aid system.

While health and life sciences companies will deliver significant business growth, reflecting the current asset base and global market growth, there is an opportunity to provide a further boost to employment and GVA growth over the next ten years, supported by further investment in skills and targeted business support.

Innovation booster led growth

The planned increase in the national R&D budget and the commitment to levelling up provides the opportunity for a Government commitment to a Northern Supercluster which would result in R&D driven innovation, benefiting both advanced therapies and diagnostics, supported by data and artificial intelligence, generating an "innovation booster" effect.

In biopharma, an innovation booster in the North could lead to an additional three quarters of a billion pound economic boost to the UK economy by 2032, and an additional 3,400 jobs, adding to the momentum impact, with an anticipated GVA annual growth rate of 4.3%, and an employment rate of 2.2%.

As with biopharma, the forecast growth rate for medtech employment increases markedly if the Government commitment to the Northern Supercluster results in a significant increase in R&D driven innovation, new inward investment and re-investment to serve both a domestic and international market.

In medtech, an innovation booster could lead to an additional 15,100 jobs and £1.44bn of GVA boost to the UK economy by 2032.

Fig 9: Health and Life Sciences: **Biopharma and MedTech**

Life Science Skills Strategy, OLS and ONS Regional Accounts

In order to realise the scale of benefits from an innovation led booster there would also be a need to invest in the economic infrastructure for advanced manufacturing facilities in high demand locations across the North.

The innovation booster forecast for employment and turnover reflects health and life sciences as a prime capability, with world leading science, supported by a large industrial base.

While the health and life science industry will see a marked increase in employment and GVA by 2032, an innovation booster could lead to an exceptional level of growth with an additional 38,600 jobs and £5.8bn of GVA, compared to 2020, and a significant proportion of the additional growth would be linked to increased investment in R&D (dependent on how historic imbalances in R&D are addressed through the levelling up agenda).

While the innovation booster scenario could add an additional 38,600 direct jobs to the Northern economy by 2032, there would be an accompanying significant increase in scientific, research and technical jobs, estimated at 12,000 in total, and an additional 50,000 jobs in the associated supply chain.

The booster effect has been estimated at adding circa 40%-70% to current jobs, turnover and GVA growth at the industry level, with turnover growth closer to the Deloitte global growth numbers, although this is dependent upon the scale of additional investment in R&D, the life science

Fig 10: Health and Life Sciences: **Biopharma and MedTech 2020-2040**

ecosystem, inward investment and support for business growth.[139]

Market led growth

The 2020 Deloitte Global Life Sciences Outlook makes the case that the sector is at an inflection point, with new opportunities opening up for biopharma and medtech organisations, with the integration of artificial intelligence (AI) and machine learning approaches within life sciences making drug discovery and development more innovative, time-effective, and cost-effective.[140]

The report suggest that worldwide prescription drug sales are projected to have a positive CAGR of 6.9% between 2019-24, while the global medical devices market valued at US$425.5bn in 2018 is expected to reach US$612.7bn by 2025.

Life Sciences: Trends & Outlook 2020 published by Savills was also very positive with regard to the industry,[141]

> *Regardless of the final version of Brexit, the strength and importance of life sciences in the UK will not diminish. It will continue to grow and requires the delivery of all types of commercial floorspace to accommodate growth and meet future demand. Despite the break away from Europe, it will still remain a key trading partner and collaborator for life science and discovery*

The Savills report highlighted the need for more lab space to support industry growth and also identified a Northern arc where life sciences were clustered.

These very positive forecasts for growth reflect the plans of the Local Enterprise Partnerships in the North of England e.g. The North East Health, Life Sciences and Medicines Manufacturing Strategy,

> *Our vision is to position the North East as a leader in the development, testing, manufacturing and adoption of people-centred treatments, therapeutics and medicines at a time of demographic change.[142] By 2030 we want to see the number of jobs in the sector doubled from 12,000 to 24,000 by 2030 and to double the number of businesses active in the North East health and life science sciences community from 150 to 300.*

A Northern Supercluster forward view 2040

The 2032, booster led forecasts highlights the progress which the North can make to establishing a Northern Supercluster, on a par with the Golden Triangle, allowing the UK to capture its full share of global growth.

The momentum established in the 2020s will allow for accelerated growth through to 2040, more than trebling the North's GVA contribution to the national economy, with a larger and more productive workforce in a key industry.

By 2040, there is the potential for the north to benefit from an additional 64,600 jobs, and a turnover and GVA growth of £20.4bn and £11.35bn compared to 2020.

The scale of growth would need to be supported by further investment in science and industrial parks, as well as a marked increase in lab and technical space needed to support further innovation.

There would be a major challenge in providing the skilled workforce needed to support growth in life sciences, as well as in the research and science base.

Section 6 sets out some of the enabling factors which will allow government and national institutions to support the accelerated growth of the Northern Supercluster, based on a collaborative approach to R&D investment which anticipates and builds on the current strengths of the North and which will allow the pace of innovation and adoption to increase and contribute to the strategic objectives of Government and key agencies.

Section 12
Conclusions

The health and life sciences sector is a hugely important and growing part of the Northern economy. It is also vital to the UK's ambitions in terms of being a global R&D Superpower, with the potential to contribute to raising productivity and delivering high skilled new jobs across the geography.

The sector is an already-recognised exemplar of systems working and prime capability, supported by a world-class research and clinical base. There is a critical mass of excellence and corporate engagement surrounding innovation, notably in advanced therapies; diagnostics and medtech; infection and immunity; and Digital and AI.

The recommendations of this report provide a sound basis to support the North to position its system-led strengths, develop pan-Northern networked propositions and accelerate the growth of biopharma, diagnostics and medtech.

A commitment from Government to the 'Build Back Better' agenda is central to unlocking the full potential of the sector, particularly on innovation and R&D. This commitment needs to be reciprocated by many other actors in the sector to ensure that innovation-led recovery can provide the impetus for exceptional economic growth over the next ten years.

The NP11 and the NHSA make the following recommendations to government, public sector and private sector stakeholders in support of the North's health and life sciences sector. The shared commitment of all those involved in this work is to see that sector continue to innovate and grow. Our vision and aspiration is to play a full part in the UK's global offer and its economic future.

Systems-led acceleration of innovation and growth

The ambition to establish the UK as a global leader in R&D will be supported by the North, as a recognised systems-led Supercluster for health and life sciences, providing an opportunity to scale up industry across the North, increase the company base and provide an ecosystem to support innovation and new industry investment.

An "innovation booster scenario", where the UK invests more in R&D over the period and the Levelling Up focus set out in the UK R&D Roadmap, produces a revised set of forecasts, with additional 38,600 jobs (4.6% per annum growth), and a turnover and GVA growth of £11.0bn and £5.85bn, a growth rate of 4.7% and 6.5%, with growth characterised by higher rates of productivity. The Northern Supercluster would help the UK to match and outperform its competitor nations and at the same time take more advantage of all of the UK's research and innovation and production assets.

An opportunity-driven partnership approach

The NP11 and the NHSA now provides the opportunity for Government and national agencies to work with industry, LEPs, universities and the NHS to develop a Northern health and life sciences Supercluster, building on the significant investment in Catapults, collaborative networks and partnerships which now support innovation and growth in health and life sciences.

This approach, linked to research excellence and a robust innovation ecosystem, will contribute to reaching the UK's 2.4% of GDP R&D target, whilst also building back better and levelling up across the country.

The NP11 and the NHSA are in a unique position to bring partners together to continue to develop the detail of proposals outlined in the document and all LEP areas/partners are committed to working in partnership to take the next steps in advancing priorities.
This includes developing existing and establishing new thematic networks that bring together academic, clinical and commercial expertise so that the North acts in concert on these programmes.

Work is well under way, with the aim of developing a short and medium-term pipeline of activity in support of pan-Northern ambitions, and we require Government support to realise the full potential.

The first step in accelerating growth is an in-principal commitment by Government and UKRI to support the further development of a Northern Supercluster in health and life sciences as a national economic priority, complementing and working with the Golden Triangle to maintain the UK's global competitiveness and develop a new portfolio of international collaboration.

In parallel, a commitment from Government to invest in capacity, skills and network infrastructure to support the approach and ambition outlined in this report, building on the 11 LEPs and the NHSA working together to deliver complementary, joined-up infrastructure across the North, providing scale, resilience and connectivity for business support, co-development, evaluation, adoption and training.

Recommendations

1 Commit to, and invest in, a Northern Supercluster

Action for: Government, NP11, NHSA

To achieve the potential economic and health benefits for the UK through the growth of a Northern Supercluster, we ask that Government, UKRI and NHS E&I work with the NP11 and the NHSA (as well as industry partners and trade bodies such as ABPI, ABHI, BIA and BIVDA) to support our cluster approach to economic growth in the North.

This should be focused on the four areas of key market opportunities and two opportunity challenge areas identified in this report, in which there is both a critical mass of excellence and a requirement for focussed investment to address industry need.

Market opportunities mapping onto critical mass of excellence in the North have been identified in the following areas:

1.1 Advanced Therapies

Create a Northern Advanced Therapies Accelerator to catalyse development, evaluation, manufacturing capacity and clinical delivery of industry-led innovation, delivered connecting and scaling existing centres and networks. This would provide a lab to bedside development, evaluation, manufacturing and delivery vehicle for cutting-edge therapies.

1.2 Infectious Diseases

Develop a series of specialist research platforms for infectious diseases therapeutics and scale up and extend the infection innovation CONsortium (iiCON) approach of public private partnership to pan-Northern level. This would enable further partnerships between SMEs, research institutions and large-scale industry to drive adoption at scale.

Build capacity in Phase 1 vaccine trials to harness the clinical excellence and capabilities in the NHS.

Invest to increase capacity and capability in the Northern Biopharma manufacturing cluster, to

deliver the UK vision to be a global centre for the development, manufacture and use of cancer vaccines and immunotherapies.

1.3 Diagnostics and Medtech

Support a new National Diagnostics Centre, based in the North of England, to provide a UKRI-funded Diagnostics Centre of R&D Excellence and develop, from that, a Diagnostics UK platform to secure the UK's future as a high-evidence, high-trust environment that rapidly develops and adopts new diagnostic technologies.

This platform would build on the success of the CONDOR evaluation platform.

Further, create a medtech equivalent platform and provide resource to direct the platform to accelerate evaluation and adoption in areas of high need, including NICE lower volume clinical areas. The convergence of digital technologies, data analysis including AI and traditional medical technologies requires a platform development and real-world evaluations to drive adoption at scale.

1.4 Data and Artificial Intelligence

Establish a Northern Civic Data Grid responsible for delivering benefits from application of data science and AI. Build a Northern network of Civic Data Co-operatives, capable of sub-regional and pan-regional applications, boosting advanced therapies, diagnostics and medtech R&D. Invest in Data and AI Innovation teams in NHS Trusts and at CCG/ICS level to develop and evaluate new data driven tools.

Create an NHS AI Sandbox at Northern level for the rapid development and evaluation of AI tools, that can proactively work with regulators to keep the NHS at the forefront of AI development while maintaining the trust and engagement of the population.

Opportunity Challenges have also been identified where there is a need for focussed investment and activity on supporting industry to address key areas of need in:

1.5 Healthy Ageing

Set out a new Challenge Fund in Healthy Ageing and leverage the activity to tackle health inequalities, including:

- Supporting the transition to a life course approach to healthy ageing, following the national government priority of prevention over intervention.
- Expanding ageing specialist research centres and providing pump priming funding to support the development of the next generation of therapeutics, medtech, diagnostics and digital health products that support the management of long-term conditions.
- Invest to add supply chain and service resilience in areas found wanting in the pandemic response.

1.6 Mental Health and Wellbeing

Set out a Challenge Fund for industry-led approaches to the development of robust, high trust, high efficacy mental health and wellbeing interventions. Aligned to this Challenge Fund, establish a Northern Mental Health Innovation Accelerator, an innovation infrastructure that brings together the mental health assets across the North for the benefit of industry.

The Accelerator will:

- Develop and evaluate digital solutions for mental health service delivery.
- Work across the public and private sector to support the UK workforce and improve productivity.
- Provide data-led intelligent mental health care and treatment using AI.
- Work with industry to develop and evaluate new products, services and improved care delivery processes by utilising the large-scale Northern datasets from the Civic Data Co-operatives.

2 Increase capacity and scale for pan-Northern collaboration, partnerships and investment

Action for: NP11, NHSA

Realising the opportunity of the Northern life sciences Supercluster is dependent upon working at a scale that goes beyond existing administrative boundaries in the North.

We intend that the 11 LEPs and the NHSA will work together to deliver a pan-Northern, systemwide approach that brings together university and NHS expertise with national and local government, universities, innovators and financial capital to address industry need.

We will work with national government to put in place pan-Northern partnerships and greater connectivity between academic and NHS assets in the life science sector and between the public sector and the North's manufacturing and industry assets, including:

- High quality support for industry within the NHS and academia, with clear metrics for delivery.
- Industry championed cluster development and networking, acting across LEP boundaries, building on the NHSA run professional networks and NP11 LEP life sciences expertise.
- Fully engaging NHS leadership in creating a new paradigm of partnership with industry to support innovation, real-world evaluation and adoption.
- Maximising life science cluster collaboration across the UK, building on strong North-South axis of partnership with MedCity and rapidly developing collaborations with HIRANI in Northern Ireland, the Scottish Life Science Cluster and the Midlands Cluster amongst others.

3 Address barriers to business innovation and growth in the Northern Life Sciences Supercluster

Action for: NP11, NHSA, Government

This report identifies some specific barriers to the growth of the life sciences industry in the North, which will need to be overcome for the Supercluster to reach full potential. We will look to work with partners, including Office for Life Sciences, Innovate UK, UKRI, BEIS and DIT to:

- Develop dedicated pan-Northern support for innovative SMEs to flourish and scale.
- Invest in the people, skills and talent need to grow the life sciences workforce through developing a Life Sciences Skills Action Plan that addresses both national and regional needs.
- Activate the NHS and universities in assisting businesses within the life science sector to bring innovative products to market more quickly.
- Improve access to finance for innovation for companies within the North.
- Increase the international visibility of the Northern Life Sciences Supercluster and drive foreign direct investment (FDI) in the North by better co-ordination of the existing and future innovation pipeline infrastructure.

4 Address wider national requirements for innovation in life sciences sector

Action for: Government

The report notes the wider nationally relevant policy requirements that will be necessary to support a vibrant life science sector. The NP11 and the NHSA will continue to contribute to and inform the development of policy in these areas.

- Commit to investing additional public sector Life Science R&D funding through the 2.4% of GDP target into the North; particularly where businesses are making greater R&D investments.
- Create an innovative regulatory environment so that the UK can lead globally on high-trust, evidence-based development, evaluation and adoption, building on the globally recognised assets of the NHS, NICE, and MHRA.
- Embed the lessons from COVID-19 and prepare for the regulatory challenges of Artificial Intelligence, "Internet of Things" enabled medtech including wearables, digital therapeutics and digital health applications.
- Consult on direct and indirect support to SMEs to determine the extent to which higher levels of state aid subsidy/support would accelerate the commercialisation of research and innovation.
- Review a range of fiscal and other tools available to support high growth companies, and how the tax system enables or incentivises UK-based companies to grow and remain in the UK.

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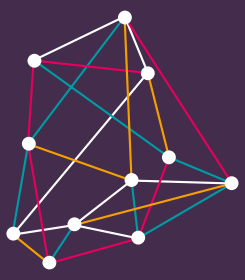

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