Edinburgh and South-East Scotland City Region Deal Joint Committee

2 pm, Tuesday 3 September 2019

Usher Institute Project Business Case

Item number

Executive Summary

This report seeks approval to secure funding for, and enact, the Usher Institute project (as set out in the Usher Institute Final Business Case). The preparation of this Business Case has been led by The University of Edinburgh (UoE) on behalf of the Edinburgh and South East Scotland City Region Deal consortium partners and has been prepared in accordance with the HM Treasury 5 Cases model.

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City Region Deal Checklist

Criteria	Details/Link to Document
Contribution to City Region Deal commitments and Inclusive Growth Framework	The Usher Institute project supports the inclusive growth ambitions of the partnership including: • **Accelerating inclusive growth** through unlocking new talent pools for business, third and public sector partners, promoting fair work, and equipping disadvantaged citizens with the skills they need to succeed; • **Removing the barriers to growth** through interventions to unlock current physical barriers to growth, including enabling infrastructure and innovative health facilities; • **Community benefits through procurement** by integrating our approach to employer engagement and procurement to increase the value achieved from our collective investments; • **Targeted skills interventions** through integrated and targeted employability and skills interventions; and, • **Social benefit through innovation** to drive challenge-based health and social care benefits across the city region, over the medium- and long-term. The UoE has committed (in its Procurement Strategy) to add value to local and regional communities by identifying and achieving robust, relevant and proportionate Community Benefits (CBs) from the: • University's Procurement Strategy: *"For every procurement over £4million, the delegated authority of the University will consider how the acquisition can improve the economic, social or environmental wellbeing of our area through inclusion of community benefit clauses, to assist with our strategic objective of Community Engagement."* • Procurement Category Strategies: *"Contributing locally [by] applying community benefits to major contracts, engagement in local collaborations in the city and with Scottish peer groups, including shared services and collaborative framework agreements."* Consequently, within the Usher Institute project, robust, relevant and proportionate CBs will be incorporated in future procurements of £4 million and above and will be considered in regulated procurements below £4 million at strategy stage (i.e. at £50,000 and above). Where CB requirements are included in a DDI contract, the contracting authority must include in the award notice a statement of the benefits it considers will be derived from those requirements. The project sponsors, procurement manager and any other participating University entity must agree who will be responsible post-contract award for the initiation of engagement with the supplier to achieve the CB commitments, as well as who will be responsible for delivering, monitoring and reporting the achieved CB. At the discretion of the University, CBs offered as part of the tender response may be enforceable as part of the final contract (or where submitted after contract award, pursuant to a legally compliant contract variation process). On high risk projects, written commitments may be required from suppliers that obligate them to follow through with offered CBs, which include means to penalise suppliers who are non-compliant.

Criteria	Details/Link to Document
	In addition, projects will also specifically address – once fully defined by Scottish Government – agreed inclusive growth objectives. Based on the University's existing inclusive growth-related policies and programmes, activity in scope includes: • DDI skills development for health and social care staff; • Developing DDI-related products that reach and benefit the most vulnerable in society; • Data-related initiatives to inform national policy and practice development relevant to the Scottish Government Health and Social Care Delivery Plan such as, for example, drug and alcohol programmes and child health activities
Alignment, integration with, or dependence on, other City Region Deal activities	The other City Region Deal activities with the potential for alignment with investment in the Usher Institute include:

CRD Theme	Scope of Potential Collaboration
Skills	• Establish DDI Skills Gateway extending from school-age to life-long learning, including a focus on those working in health and social care roles
Housing	• Establish DDI housing 'living lab' which can explore the relationship between housing and health outcomes
Food & Drink Hub	• Establish "health and diet" DDI living lab
Business Innovation Parks	• Establish parks as DDI start-up and scale-up company locations within targeted areas

Criteria	Details/Link to Document
Scale and regional distribution of expected outcomes, benefits, and leverage, from activity	As illustrated, in the table overleaf, a range of ("net additional") outcomes have been identified for the Usher Institute over the period of CRD funding, namely: • **Talent:** engaging and training 20,000 students and health & social care professionals in the application of data, of whom 9,000 will attain certification; • **Research:** hosting with world-leading applied researchers and DDI projects worth £138 million, including £51 million leveraged private R&D funds, through public sector and industry awards; • **Adoption:** engaging 280 public, private and third sector organisations, including early stage and scale-up companies; • **Data:** developing a comprehensive health & social care data resource, initially for the ESES region, and leveraging partnerships with health and social care providers to curate and make accessible around 270 new data assets; and • **Entrepreneurship:** establishing 49 new DDI health & social care companies in the ESES region over the life of the programme. Based on the distribution of current activities across the areas of talent, research, adoption, data and entrepreneurship the anticipated direct net economic benefits of the Usher Institute is projected to be in the region of £412 million for the whole of the UK of which a minimum of £118 million to accrue to the City Region. These benefits exclude – by definition – the wider eco-system effects of the Programme on the current DDI cluster within the Region. While no explicit quantitative analysis of these wider impacts has been undertaken, they are likely to be significant if the Programme achieves one of its longer term objectives of the City Region becoming a world-leading centre of excellence for applied data science.

Criteria	Details/Link to Document			
	Outcome or benefits	**Baseline (without DDI)**	**Target Uplift (with DDI)**	**Date**
	Total learners engaging with DDI Programme	2,160	19,329	Programme lifetime
	DDI research funding	110.7m	86.3	
	DDI collaborative adoption assignments	0	280	
	DDI data sets acquired	0	270	
	New spin out, scale-up and spin in companies	0	49	

Criteria	Details/Link to Document
Compliance with financial requirements and agreed expenditure profile	The vision of the City Region Deal partners is for Edinburgh to become the "Data Capital of Europe". To realise this vision, UoE is proposing a combined capital of £68 million. This business case is specifically seeking £49.2 million in Government funding towards the £68 million capital investment in the Usher Institute.
Equalities Impact	This Programme of work sits within the Equalities Framework laid out by the City Region Deal, through its Inclusive Growth Framework, which has five key themes aimed at accelerating inclusive growth and social benefit through innovation, with specific regard to minorities and disadvantaged population. The UoE also has an Equality and Diversity Strategy, Outcomes and Action Plan, which outlines the University's continuing commitment to equality and diversity for both students and staff. These frameworks highlight the central concepts of fair and equitable treatment regardless of race, disability, ethnicity, gender (including transgender), age, sexual orientation or beliefs. These will be key principles governing the development and delivery of programme activities outlined in this document. For all projects carried out within the Programme of work, equalities screening will be carried out to ensure that these issues are raised and addressed from project inception through to delivery and evaluation.
Alignment and fit with City Region Deal governance arrangement	The City Region Deal Programme has the following tiers of governance: • Joint Committee that is responsible for delivering increased value for money from the City Region Deal and wider regional collaboration; and, • DDI Delivery Board that is responsible for the overall direction and management of all DDI programme activities. The DDI Delivery Board is responsible for assuring commissioning of the Usher Institute investment including establishing the Health & Social Care DDI Programme Board and defining the key resources, financial and Key Performance Indicators (KPIs) delivery parameters within which the Usher Institute will operate. The Health & Social Care DDI Programme Board is responsible for the overall direction and management of the Usher Institute activities described in this document. As such, it is ultimately accountable for success of the Usher Institute project and providing unified direction to the project.

Criteria	Details/Link to Document
PMO compliance check	All evidence provided.
Government approval	Scottish and UK Governments have confirmed their agreement to this Business Case progressing in this form for formal approval.
Partner sign-off	The UoE agreed on 21 August 2019 that this Business Case can progress for formal approval.
Advisory Board sign off	This Business Case was approved by the DDI Delivery Board on 19 August 2019.
Executive Board sign off	This Business Case was approved by the City Region Deal Executive Board on 22 August 2019.

Report

Usher Institute Project Business Case

1.   Recommendations

1.1   To approve the Usher Institute final business case and implementation of its activities and organisational structure.

1.2   To note that the individual activities to be undertaken as part of Usher will be approved separately and reported to the Joint Committee.

2.   Background

2.1   As evidenced in various Scottish and UK Government policy documents, and publications by the OECD and global consultancies, Data-Driven Innovation has become a key pillar of 21st century growth with the potential to significantly enhance social wellbeing; productivity; resource efficiency; and, economic competitiveness. Data and technology can be applied to the health and social care sector to reduce costs while improving public health, with one estimate from McKinsey putting potential savings in the range 7 to 11.5% of healthcare expenditure.

2.2   The [Edinburgh and South East Scotland Science and Innovation Audit](#) (SIA), published in 2016, identified that:

- The city region is already a powerhouse in Data-Driven Innovation;
- Growth in DDI is at a tipping point and requires further investment to meet demand and deliver its potential;
- There are a number of industry sectors that are key to the local economy and which align to national areas of focus; and,
- Realising DDI opportunities are most likely to generate sustainable socio-economic benefits and support inclusive growth.

2.3   The DDI Programme vision is establish the region as the Data Capital of Europe. It will do this by playing to the City Region Deal partner strengths in education and research and significantly boosting activities with public, private and third sectors. In the health and social care sector UoE will work with regional partners to create the Usher Institute - a world-leading innovation hub, where key organisations from the public, private and third sectors collaborate and access data in a trusted, secure environment, to enable data-driven advances in the delivery of care and create innovative commercial solutions.

2.4   The Usher Institute will have a population of circa 950 people, bringing together world-leading researchers from UoE and other Higher Education institutions, public and third sector organisations, to offer unprecedented opportunities to transform approaches to the prevention, diagnosis and treatment of disease, and to drive innovation in delivery of efficient and effective health and social care.

2.5   Through this business case UoE seeks approval for capital investment of £68 million (of which Government is asked to fund £49.2 million) for the construction of the Usher Institute and associated enabling infrastructure, by the UK and Scottish Governments.

2.6   This Business Case has been endorsed by UK and Scottish Governments and is now presented to the City Region Deal Executive Committee, and Joint Committee for approval.

3.   Main report

3.1   The City Region has a long history of excellence and leadership in informatics and data science including one of the largest computing school in Europe (the University of Edinburgh's School of Informatics) and the UK's principal super-computing facility (Edinburgh Parallel Computing Centre) and the largest concentration of internationally-significant and world-leading informatics research in the UK.

3.2   Moreover, in the last four years, local DDI capability has grown significantly as multiple new initiatives within the data science, robotics and computer systems areas have been secured. The city region hosts Scotland-wide initiatives like the Data Lab, the Centre of Excellence for Cyber Security Research, and Administrative Data Research Centre, as well as hosting four doctoral training programmes in Robotics and Autonomous Systems, Natural Language Processing, Biomedical AI, Cyber Security and Data Science and AI.

3.3   As a part of the University's College of Medicine and Veterinary Medicine (the College), the Usher Institute brings together inter-disciplinary research with expertise in epidemiology, public health, statistics and modelling, informatics, computer science, clinical sciences, clinical trials, sociology, social policy, governance, ethics, politics, medical law psychology, economics, health promotion and medicine. The Usher Institute operates virtually across the UoE campus and comprises around 300 staff. The City Region Deal investment will enable the number of staff to increase significantly and work in close physical proximity with a range of partner organisations.

3.4   As with the Data Driven Innovation programme as a whole, the Usher Institute is designed around five key areas of intervention (or "TRADE" themes):

- **Talent**: Develop a flow of talent in data driven entrepreneurship and the application of DDI;

- **Research**: Develop, in conjunction with industry, a world-leading research capability in data science;

- **Adoption**: Undertake a range of industry engagements focused on building collaborative partnerships to enable new research and innovation activity;

- **Data**: Support initiatives such as IoT and City Data Exchanges to encourage and enable the creation of new forms of data asset; and,

- **Entrepreneurship**: Generate a pipeline of new high-growth start-ups and scale-ups, and support equity investment.

3.5   By demonstrably improving innovation and incrementally enhancing the City Region DDI ecosystem the Usher Institute will, over the next 15 years, deliver:

- **Talent:** Create a vibrant learning environment the enables circa 20,000 students and health and social care professionals with the skills needed to realise the value of data;

- **Research:** Facilitate cross-disciplinary collaborations to deliver data-driven research that impacts on patient care that secures £138 million in additional research funding from public bodies, research charities and industry partners. Areas of research will include population health and registries, blood and imaging biomarker discovery, artificial intelligence and data-enabled clinical trials;

- **Adoption:** Dive innovation through interactions with 280 companies in the public, private and third sectors that address the major challenges facing the health and social care sector;

- **Data**: Through the utilisation of 270 new datasets, harness Scotland's comprehensive healthcare data and expertise in data science to evaluate health & social care outcomes in the City Region and beyond; and,

- **Entrepreneurship**: Initiate and accelerate the growth of 49 new health & social care businesses and improve the delivery of care to our citizens.

Intervention 1: Talent

3.6   Circa 20,000 students and health & social care professionals with the skills needed to realise the value of data. This will be delivered through a blended approach of teaching methods:

- Embedding data science in the MBChB Medicine six-year degree programme will lead to a transformational change in the data capability of the next generation of clinicians. Over the lifetime of the Programme 4,300 courses in data science will be taken by students. This will be further enhanced with an annual data-driven innovation prize for research projects;

- Further investment and growth of online distance learning postgraduate programmes remains a significant opportunity for innovation, resulting in circa 2,000 online courses being delivered;

- Build on the success of the Zhejiang University - University of Edinburgh Institute (ZJE), an established partnership with a leading C9 Chinese university, which has seen the development of a Biomedical Informatics undergraduate programme. This will be mirrored at the University with additional data science modules for Biomedical Sciences students;

- A need to develop and embed data skills in the Modern Apprenticeship (MA) frameworks, has been highlighted by employers, including the NHS. Employers require specific data skills to be developed alongside the main MA role focus in a blended way. The ambition of the pilot project being sponsored by Skills Development Scotland (SDS) and the University is to develop data skills enhancement that can be co-delivered as part of the training programme within MA frameworks. This will provide apprentices with relevant data science skills and knowledge contextualised for their business sector and role, including health & social care; and,

- Delivery of an extensive programme of events for health & social care professionals from across the City Region, both during construction and following the opening of the new Usher Institute building. This will include Continuing Professional Development (CPD) accredited events, delivered as part of the wider CPD programme. This will encompass a wide range of events, including lectures highlighting data-driven research and exemplar projects in the practical application of data in health & social care. The co-location with NHS Lothian, the relocated Edinburgh Medical School (opening in 2025) and other health & social care delivery partners will create a vibrant community of engaged and interested professionals.

3.7   Intervention 2: Research

3.8   Realising the potential of digital health is dependent on a highly collaborative approach involving experts from a range of disciplines, including medicine, social sciences, informatics and mathematics. The Usher Institute has been successful in creating a critical mass of world-leading expertise from across all of these areas, who are collectively focused on the development of data-enabled health systems. This expertise is recognised internationally – for example, six of the Institute's researchers are listed in 'The Most Influential Scientific Minds' by HighlyCited.com.

3.9   From this foundation, there will be significant further investment in research, focussing on data-driven research that delivers improvements aligned to the national ambition of 'better health, better care, better value'. Six DDI Chancellor's Fellows are being recruited to develop new programmes of research and innovation, working closely with the private, public and third sectors in a data-enabled theme, with a focus on delivering high impact results.

3.10   There is also an established record of conducting data-enabled clinical trials to improve outcomes for patients. Heart disease provides a useful case study. Using the existing system of permissions, multiple routinely collected electronic data assets have been linked through a network of NHS Safe Havens to

evaluate the impact of new approaches for diagnosis and risk assessment of patients attending Emergency Departments in the ESES region with chest pain.

Intervention 3: Adoption

3.11 A focus on commercialisation will be achieved through:

- The Usher Institute industry engagement teams, which will actively identify industry partners and opportunities to interact and work with Scotland's burgeoning start-up and scale-up company network;

- Working with the Bayes Centre to co-create new innovative start-up and spin-out companies, bringing transformative data technologies to the health and social care sector;

- A specialist team from Edinburgh Innovations, which will embed collaborative partnership and business development expertise in the new Usher Institute to maximise opportunities;

- The Health & Social Care DDI Delivery Team consulting service combining academic input and clinical expertise from a network of specialists across various disciplines with programming code and functions that have been developed in the DataLoch; and,

- The development and delivery of modular Continuing Professional Development (CPD) training to engage with health & social care professionals. The Usher Institute has growing experience in this area and, working with colleagues across the University, will build on exemplar activities (such as the NHS Digital Academy) to deliver CPD certified courses and events. This will include delivery of Massive Open Online Courses (MOOCs) and piloting other Distance Learning at Scale (DLAS) activities, such as nanodegrees or MicroMasters co-created with industry to ensure continuing skills development across the sector.

3.12 Intervention 4: Datasets

3.13 Scotland has a single healthcare provider and world-leading linked healthcare data assets from birth to death through the use of the person-specific Community Health Index (CHI). However, the current approach to data access and linkage is fragmented, slow and inefficient, is limited to specific projects, and is a barrier to research and innovation at scale in the region.

3.14 We will create a comprehensive and integrated health & social care data ecosystem in partnership with NHS Lothian, Borders and Fife, allied to partners across the social care spectrum. The data repository (DataLoch) will link multiple data assets from primary, secondary and social care, providing same day access to accurate, rich and current data on all aspects of health and care for the population, for any condition, clinical pathway, or service across the region.

3.15 This data repository is being developed in partnership with the NHS Boards in the City Region, and will facilitate a data-driven approach to prevention, treatment, health and care service provision in our region, and will enable the

development of a world-leading learning healthcare system. A consultancy and governance team (the DDI Prism team) will manage users and approvals for access and disclosure checks of reports exported from the DataLoch, using the existing governance framework set out in the Charter for Safe Havens in Scotland.

Intervention 4: Entrepreneurship

A strong focus for the University will be mentoring to support start-up growth and creating a robust pipeline to attract corporate capital and other forms of inward investment. Many of the corporate partners involved in research and innovation are also interested in engaging with early-stage high-growth ventures that may be acquisition targets or who offer increased competitive advantage.

3.16   A core objective of the entrepreneurship activity will be to help build the next generation of 'data entrepreneurs' in the health & social care sector and data-driven companies of scale. The focus will be on building a sustainable pipeline of high-growth start-up and spin-out data-driven innovation companies operating from the broader ecosystem the Usher Institute will support, that help the City Region to maintain and strengthen its entrepreneurial ecosystem.

3.17   An accelerator programme offered to high-growth potential start-ups in the area of data-driven health & care will be created and the Usher Institute will support the delivery of the programme in partnership with Edinburgh Innovations and other key delivery partners building on the knowledge of successful similar accelerator programmes.

3.18   The Usher Institute Accelerator programme will be designed to discover high-growth opportunities within the digital health & social care sector, providing researchers with the skills, knowledge and connections they need to go from concept to a real working prototype, ready to be productionised and commercialised.

3.19   The programme will also facilitate access to capital and other vital resources, and support on all aspects of entrepreneurship, health sector knowledge, data science and investment strategies.

4.   Financial impact

4.1   Through this business case UoE seeks approval for capital investment of £68 million (of which Government is asked to fund £49.2 million) for the Usher Institute build.

4.2   In addition to underwriting up to £18.8 million of the total capital requirement, UoE will:

- Fund on-going operating costs; and,

- Fully fund the continued operation of the Usher Institute facility beyond the duration of the DDI Programe.

4.3 The actual spend profile will vary across the funding period and will be regularly updated in response to learning and changing circumstances to ensure maximum impact against its programme and wider inclusive growth goals.

4.4 Overall the initial due diligence undertaken by the University indicates that this project and associated risk profile is affordable and capable of being self-sustaining over the longer term if the capital grant is approved at the currently requested level and phasing.

5. Equalities impact

5.1 City Region Deal partners are committed to ensuring that Inclusive Growth ambitions are embedded across the deal, reflecting the challenges being faced across the region. An Inclusive Growth framework has been developed which provides an evidence base and proposed approach to help address these issues. A number of themes are included in the framework, namely: 1) Accelerating Inclusive Growth; 2) Removing the physical barriers to growth; 3) A significant programme of construction; 4) Targeted skills interventions; and 5) Social benefit through innovation.

5.2 The link between inequality of income and poor health is well documented. Health inequality remains a challenge across the city region Health Board areas. For example, across the NHS Lothian area the most deprived communities have:

- 76% more patients hospitalised with asthma than the overall average;

- 114% more patients hospitalised with Chronic Obstructive Pulmonary Disease (COPD); and,

- 26% more premature births.

5.3 This inequality gap is equivalent to 4,796 deaths each year. Within the City of Edinburgh Council area there are 76% more preventable emergency hospital admissions for a chronic condition in the most deprived areas than the overall average. Similar inequality gaps can also be seen across Fife and Borders Health Board areas.

5.4 The opportunity presented by the City Region Deal for co-operative working across partners has potential benefits to the health and social care sector. As referenced by the OECD health data can be used to explore the impact of poor health on life chances and help evaluate the impact of public health interventions on health promotion and prevention.

6. Background reading/external references

6.1 Edinburgh and South-East Scotland City Region Deal Document, August 2018

6.2 *Enabling a World-Leading Regional Digital Economy through Data Driven Innovation*, Edinburgh & South East Scotland City Region Science and Innovation Audit, November 2016

7. Appendices

7.1   Usher Institute Project Summary

1. Project Summary

1.1. Aligned and Material Opportunity Realised through the Vision

Opportunity

We are now entering an era when the generation, collection, and analysis of large volumes of data underpins the digital economy. The value of data comes from its use in real time, or aggregation over long periods, to understand and predict behaviours. While data have become ubiquitous, the challenge is to use these data effectively to shape, develop and deliver innovative digital products and services to consumers and citizens. This is what we call data-driven innovation (DDI) – the focus of this Business Case.

DDI has the potential to be a key pillar of 21st century growth by significantly enhancing productivity, resource efficiency, economic competitiveness and social wellbeing. Data and technology can be used to reduce costs in the delivery of health & social care and improve public health, with one estimate from McKinsey putting potential savings in the range of 7 to 11.5 percent of healthcare expenditure.[1]

In harnessing such opportunities, the Edinburgh and South East Scotland Science and Innovation Audit[2] (SIA) identified that:

- The City Region is already a DDI **powerhouse;**

- Growth in DDI is at a **tipping point** and requires further investment to meet demand and deliver its potential;

- There are a number of **industry sectors** that are key to the local economy and which align to national areas of focus; and,

- Realising DDI opportunities are most likely to generate sustainable socio-economic benefits and support **inclusive growth.**

Vision

The DDI Programme vision is to establish the City Region as the "Data Capital of Europe". This will be achieved by playing to the City Region Deal partners' strengths in education and research, and significantly boosting commercial activity. In the health & social care sectors, the University will work together with partners in the ESES region to create the Usher Institute, a world-leading innovation hub, where key organisations from the public, private and third sectors collaborate and access data in a trusted, secure environment, to enable data-driven advances in the delivery of care and create innovative commercial solutions.

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[1] NHS and Healthcare Data: Briefing for the Debate in the House of Lords - http://researchbriefings.files.parliament.uk/documents/LLN-2018-0091/LLN-2018-0091.pdf references August 2016 report by McKinsey Digital on Improving and sustaining quality through digital transformation - https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/health-systems-improving-and-sustaining-quality-through-digital-transformation?cid=digistrat-eml-alt-mip-mck-oth-1608

[2] https://www.gov.uk/government/publications/science-and-innovation-audits-first-wave-reports

The Usher Institute will have a mixed population of circa 950 people, bringing together world-leading researchers from the University of Edinburgh and other higher education institutions, public and third sector organisations, and commercial partners, to offer an unprecedented opportunities to transform approaches to the prevention, diagnosis and treatment of disease, and to drive innovation in the delivery of efficient and effective health & social care.

This interdisciplinary approach will foster collaboration and improve health & social care outcomes through working in parallel with delivery partners in the NHS; UK and Scottish Government agencies; local authorities; and a number of health & social care organisations from across the public, private and third sectors.

1.2. Current position – good, but further investment needed

The City Region has a long history of excellence and leadership in informatics and data science, including the largest computing school in Europe (the University of Edinburgh's School of Informatics), the UK's principal super-computing facility (Edinburgh Parallel Computing Centre) and the largest concentration of internationally significant and world-leading informatics research in the UK.[3]

Moreover, in the last four years, local DDI capability has grown significantly as multiple new initiatives within the data science, robotics and computer systems areas have been secured. The City Region hosts Scotland-wide initiatives such as the Data Lab, the Centre of Excellence for Cyber Security Research, and the Administrative Data Research Centre, as well as hosting four doctoral training programmes in Data, Robotics, Systems and Analysis. Similarly, two relevant data-driven innovation 'hubs' have been created; the Bayes Centre with a focus on Data Science and Artificial Intelligence and the Edinburgh Futures Institute (EFI) which will address growth potential from data innovation in the public sector, financial services and creative industries.

As an essential part of the University's College of Medicine and Veterinary Medicine (here on referred to as the College), the Usher Institute brings together interdisciplinary researchers with expertise in epidemiology, public health, statistics and modelling, informatics, computer science, clinical sciences, clinical trials, sociology, social policy, governance, ethics, politics, medical law psychology, economics, health promotion and medicine.

The Usher Institute operates 'virtually', being located across the University of Edinburgh campus, and comprises four research centres in Biomedicine, Self and Society; Global Health; Medical Informatics; and Population Health Sciences, which includes the Edinburgh Clinical Trials Unit (ECTU). Around 340 academics, researchers and professional support staff with expertise in a varied range of methodologies and topics contribute to research and teaching across these areas. The investment in this Programme will see the number of Usher Institute staff increase significantly, in order to achieve the TRADE objectives.

The Usher Institute's research expertise is at the heart of the educational experience provided in a wide range of taught and research postgraduate programmes, both online and on-campus, Continuing

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[3] https://www.ed.ac.uk/informatics/news-events/stories/2010-2014/ref2014

Professional Development (CPDs) and through contributions to the University's undergraduate medical degree, which has an intake of more than 200 students each year, rising to 250 from 2020. The University is ranked in the top 20 universities globally for medicine and clinical, pre-clinical and health studies.[4]

The work of the Usher Institute is regularly published in the world's foremost medical and biomedical journals, such as the New England Journal of Medicine, Nature, The Lancet and the British Medical Journal. Furthermore, its work is extensively built on by research teams internationally. For example, over the last five years, around 10% of the Institute's publications have been in the top 1% of the publications most frequently referred to by other research groups globally. [5]

Usher Institute staff and departments are, however, dispersed across the city, making collaboration and cooperative working challenging. A limited number of staff benefit from location at Edinburgh BioQuarter, and there is an opportunity - through the current proposal - to ensure that all staff can benefit from co-location.

Similarly, while there are examples of cooperative practice with NHS Lothian, there have been limited opportunities to extend this engagement across the City Region to NHS Fife and Borders. Engagement with industry is equally challenging and there is an opportunity to deliver improved outcomes through collaboration with both established healthcare companies and innovators.

Figure 1 summarises this position and reinforces the SIA's findings that while there are well established capabilities in the University, there are very significant opportunities to improve the current position.

Figure 1: Usher Institute capability assessment

Capabilities	Position	Today	Journey	Destination
Talent	Data skills across students and professionals are uneven		Embed data capability, enabling students and professionals to realise the value of data	
Research	High quality interdisciplinary research capability		Increase engagement with industry and third sector	
Adoption	Strong partnerships with public sector but limited engagement with industry		Effectively bring together the private, public and third sectors on high impact activities	
Data	Access to integrated health & social care data is restricted and inefficient		Efficient, secure access to relevant data, leading to actionable insight	
Entrepreneurial	Very limited success with start-ups and spin-outs		A vibrant innovation hub that facilitates the creation of data driven innovation companies	

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[4] Times Higher Education World University Rankings - https://www.timeshighereducation.com/student/best-universities/best-universities-medicine and QS Top Universities - https://www.topuniversities.com/universities/subject/medicine
[5] Information from SciVal based on 40,869 citations from 2015-18

In addition, while the SIA highlighted these data opportunities, it also recognised that without substantive investment, there is significant risk that the City Region and Scotland might be unable to maintain or build upon its current competitive advantages.

1.3. How the University and City Region Deal Partners will achieve their Vision

This Business Case proposes an overall capital investment of £68m (of which £49.2m funding is requested) in the Usher Institute to achieve the vision of creating a world-leading innovation hub where public, private and third sectors collaborate to enable data-driven advances in the delivery of health & social care.

Achieving this vision will involve three distinct components, all of which are intrinsically linked and, importantly, interdependent:

1. **Address capability gaps**: enhance and develop capabilities in five key areas identified in the ESES SIA - Talent, Research, Adoption, Data and Entrepreneurship (TRADE);

2. **Organise activities effectively**: create an effective operating model to successfully organise, optimise and execute all these activities, underpinned by the creation of robust governance with clear accountabilities and delivery plans; and,

3. **Strategic asset development:** to construct and fit-out the Usher Institute, providing physical space and facilities for the relevant University research centres and external partners to collaborate, innovate and deliver key TRADE activities (£68m capital investment, of which Government is asked to fund £49.2m).

Investing in and addressing core capabilities and gaps: TRADE and Inclusive Growth

This section outlines how the University will address the core capabilities and gaps across the TRADE and Inclusive Growth themes. This will not, of course, be achieved in isolation and a list of internal and external partners that will help to address the core capabilities and gaps is listed in Figure 2 overleaf. The details of how each of these partners will contribute is highlighted in the section below and in Key Players.

Talent

As data science and its impact on health & social care are realised, it is important that the next generation of health & social care professionals can engage with this new paradigm effectively. The Usher Institute designed and provided the world's first certified training course for medical students in health informatics and data science in 2018. Work is ongoing with the US-led Innovations in Global Health Professions Education[6] forum to ensure this approach is embedded in medical curricula globally.

There is also an unmet need to train a generation of scientists who can excel in the interrogation of genetic and genomic information. The University already hosts the MRC Doctoral Training Programme in Precision Medicine - a new, transformational approach to disease treatment and prevention, focusing on tailoring treatment to the patient, based on their genetic, environmental and lifestyle factors.

Figure 2: Addressing capability gaps – 'who does what?'

	Usher Institute delivery partner	Talent	Research	Adoption	Datasets	Entrepreneurship
University of Edinburgh	Usher Institute	✓	✓	✓	✓	✓
	Edinburgh Medical School	✓	✓	✓	✓	✓
	Edinburgh Parallel Computing Centre (EPCC)		✓	✓	✓	
	Edinburgh Innovations		✓	✓		✓
	School of Informatics	✓	✓	✓		✓
	Bayes Centre	✓		✓		✓
	Edinburgh Futures Institute	✓		✓		✓
	Roslin Institute	✓	✓	✓		
	Administrative Data Research Centre for Scotland (ADRC-S)		✓		✓	
External	NHS Lothian, Borders & Fife	✓	✓	✓	✓	✓
	ESES Local Authorities	✓		✓	✓	✓
	ESES Health & Social Care Integration Joint Boards (IJB)	✓		✓	✓	
	The Academic and Clinical Central Office for Research and Development (ACCORD)		✓		✓	
	Health Data Research UK (HDRUK)		✓		✓	✓
	National Services Scotland Information Services Division (NSS ISD)		✓		✓	
	Third sector organisations, such as British Heart Foundation	✓	✓	✓	✓	
	Pharmaceutical companies, such as Glaxo-Smith Kline		✓	✓	✓	
	Medical device companies, such as Siemens		✓	✓	✓	
	Health technology companies, such as Current Healthcare		✓	✓	✓	
	Citizen bodies, such as the Social Care Institute for Excellence	✓	✓	✓	✓	✓

Ensuring decision-makers in our health and care systems understand the benefits and implications of data science allows these methods to be embedded in the everyday business of our health systems. The Usher Institute made the case to the UK Government to invest in developing health informatics leadership capacity and capability. Together with partners at Imperial College London and Harvard Medical School, the Institute won a tender for a £6m initiative to design and lead the NHS Digital

Academy[7], which provides diploma level training in health informatics to over 100 senior healthcare professionals from across the UK each year. Building on this expertise, the University will provide circa 20,000 students and health & social care professionals with the skills needed to realise the value of data. This will be delivered through a blended approach of teaching methods:

- Embedding data science in the **MBChB Medicine 6-year** degree programme will lead to a transformational change in the data capability of the next generation of clinicians. A course in Year 2 (Data Science in Medicine) started in 2018, which will be complemented by an optional Year 4 intercalated BSc Hons in Health Data Science and a Year 5 data project. Over the lifetime of the investment 4,300 semester-long courses in data science will be taken by students. This will be further enhanced with an annual data-driven innovation prize for research projects;

- Further investment and growth of **online distance learning** postgraduate programmes remains a significant opportunity for innovation for the College and wider University and a route to increase recruitment, impact and capacity building. An analysis of opportunities and constraints in this field has been completed by Usher Institute specialists and will action outcomes to deliver supported growth in health data related areas, resulting in circa 2,000 online courses being delivered;

- Build on the success of the Zhejiang University - University of Edinburgh Institute (ZJE), an established partnership with a leading C9 Chinese university, which has seen the development of a **Biomedical Informatics** undergraduate programme. This will be mirrored at the University with additional data science modules for Biomedical Sciences students;

- A need to develop and embed **data skills in the Modern Apprenticeship (MA) frameworks**, has been highlighted by employers, including the NHS. An area of increasing demand, employers require specific data skills to be developed alongside the main MA role focus in a blended way. The ambition of the pilot project being sponsored by Skills Development Scotland (SDS) and the University is to develop data skills enhancement that can be co-delivered as part of the training programme within MA frameworks. This will provide apprentices with relevant data science skills and knowledge contextualised for their business sector and role, including health & social care; and,

- Delivery of an **extensive programme of events** for health & social care professionals from across the City Region, both during construction and following the opening of the new Usher Institute building in Edinburgh BioQuarter. This will include Continuing Professional Development (CPD) accredited events, delivered as part of the wider CPD programme (see *Adoption* on page 17). This will encompass a wide range of events, including lectures highlighting data-driven research and exemplar projects in the practical application of data in health & social care. The co-location with NHS Lothian, the relocated Edinburgh Medical School (opening in 2025) and other health & social care delivery partners will create a vibrant community of engaged and interested professionals.

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[7] https://www.england.nhs.uk/digitaltechnology/nhs-digital-academy/

Research

Realising the potential of digital health is dependent on a highly collaborative approach involving experts from a range of disciplines, including medicine, social sciences, informatics and mathematics. The Usher Institute has been successful in creating a critical mass of world-leading expertise from across all of these areas, who are collectively focused on the development of data-enabled health systems. This expertise is recognised internationally – for example, six of the Institute's researchers are listed in 'The Most Influential Scientific Minds' by HighlyCited.com.[8]

From this foundation, there will be significant further investment in research, focussing on data-driven research that delivers improvements aligned to the national ambition of 'better health, better care, better value'.[9] Six DDI Chancellor's Fellows are being recruited to develop new programmes of research and innovation, working closely with the private, public and third sectors in a data-enabled theme, with a focus on delivering high impact results.

There is also an established record of conducting data-enabled clinical trials to improve outcomes for patients. Heart disease provides a useful case study. Using the existing system of permissions, multiple routinely collected electronic data assets have been linked through a network of NHS Safe Havens to evaluate the impact of new approaches for diagnosis and risk assessment of patients attending Emergency Departments in the ESES region with chest pain.

Through a series of clinical trials, researchers at the Usher Institute demonstrated that the introduction of sensitive tests for the diagnosis of heart attacks into practice improved survival due to the better targeting of treatments[10]. They were the first to identify that the previous generation of blood tests were under-diagnosing heart attacks in women and contributing to inequalities in treatment[11].

By linking data across all hospitals in the region, a new approach to identify low risk patients in the Emergency Department was developed in partnership with Abbott Diagnostics that could substantially reduce hospital admissions and have major benefits for both patients and health-care providers.[12]

These approaches have been adopted into practice and, through linked data, a one-third reduction in the length of stay of unscheduled care for patients with chest pain has been demonstrated.[13] Beyond the region, these observations have changed the way that that heart attacks are diagnosed, and influenced both national and international guidelines.[14]

They also serve to illustrate how harnessing routinely collected data assets can be used to develop novel approaches for assessing risk, and to evaluate the impact of these approaches on patient care and the quality of our health service. Building on this and related expertise, the Usher Institute will, over the life of the DDI Programme, aim to secure £138 million in additional research funding from public bodies, research charities and industry partners. This will generate new opportunities for our researchers in the areas described in the previous section.

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[8] https://hcr.clarivate.com/
[9] https://www.digihealthcare.scot/home/news-and-events/scotlands-new-digital-health-and-care-strategy-published/
[10] https://jamanetwork.com/journals/jama/fullarticle/895839
[11] https://www.bmj.com/content/350/bmj.g7873.long
[12] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(15)00391-8/fulltext
[13] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31923-8/fulltext
[14] https://academic.oup.com/eurheartj/article/40/3/237/5079081

Population health and registries

Through the DataLoch programme (as referenced in *Datasets*, page 18) a comprehensive, accurate and current data repository will be created for the 1.25 million people in the ESES region. Making these data readily available to accredited researchers, clinicians and partners will generate new knowledge and insights into all aspects of health & social care. The data will be structured so they can be interrogated for any acute or chronic condition, clinical pathway or service. This will result in 270 real-world registries providing detailed characterisation of patients and their outcomes by integrating data from primary care, secondary care, clinical investigations, and prescribing.

Blood and imaging biomarker discovery

Linking the data repository to tissue and blood samples surplus to clinical requirement through the NHS Lothian Bioresource[15] will permit the identification and evaluation of new blood and tissue biomarkers. For the first time, there will be a link to Scotland's National Picture Archiving and Communications System (PACS) via Scottish Medical Images, which is a research copy of 23 million different radiological examinations performed since 2007. The development and application of automated image processing methods and statistical machine learning will identify novel biomarkers of disease and improve the efficiency of healthcare delivery.

Artificial intelligence

Artificial intelligence has the potential to transform the practice of medicine. Access to data assets will permit training and testing of machine learning algorithms to aid in diagnosis, risk stratification and targeting of treatments. These algorithms will inform the development of clinical decision support tools. Working in partnership with NHS eHealth, these will be embedded into the electronic health record and their impact on patient outcomes evaluated.

Data-enabled clinical trials

The availability of comprehensive healthcare data for all patients in real-time will revolutionise capabilities to evaluate changes in practice. The tools developed above will support smart clinical trials to evaluate the impact of new clinical decision support tools, diagnostic tests, medical devices and treatment approaches on patient care. By enrolling consecutive patients, and randomising at hospital, ward or practice level, the cost of these trials will be a fraction of those undertaken using conventional methods. For example the Usher Institute recently completed the largest ever randomised controlled trial for any condition delivered entirely using routinely collected electronic patient data, enrolling 48,282 consecutive patients across Scotland using this approach.[16] The cost per patient enrolled was £15 compared to an average of £30,200 for a standard multi-centred pharmaceutical trial.[17] Methods to establish causal drug outcomes using observational data will also be established, using genetic and non-genetic instruments.

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[15] https://www.accord.scot/tissue

[16] https://clinicaltrials.gov/ct2/show/NCT01852123

[17] http://phrma-docs.phrma.org/sites/default/files/pdf/biopharmaceutical-industry-sponsored-clinical-trials-impact-on-state-economies.pdf

Adoption

The strategic plan for the health & social care sector DDI Programme has been developed in collaboration with the NHS Boards of the ESES region as the key external partner.[18] Historically, the UK has not been as successful at commercialisation as it has been at early-stage research.

Overseas competitors are investing more in research and development than the UK, which invests a total of 1.7% of Gross Domestic Product (GDP) whilst the Organisation for Economic Co-operation and Development (OECD) average is 2.4%. UK public funding is also relatively concentrated on early-stage research as opposed to commercialisation.[19]

A focus on commercialisation will be achieved through:

- The **Usher Institute industry engagement team**, which will actively identify industry partners and opportunities to interact and work with Scotland's burgeoning start-up and scale-up company network;

- Working with the **Bayes Centre** to co-create new innovative start-up and spin-out companies, bringing transformative data technologies to the health and social care sector;

- The **DataLoch programme**, where there will be a systematic evaluation of the adoption of new diagnostic tests, treatments and medical devices and technologies into practice;

- A specialist team from **Edinburgh Innovations**, which will embed collaborative partnership and business development expertise in the new Usher Institute to maximise opportunities;

- The Health & Social Care DDI Delivery Team **consulting service** combining academic input and clinical expertise from a network of specialists across various disciplines with programming code and functions that have been developed in the DataLoch; and,

- The development and delivery of modular **Continuing Professional Development (CPD) training** to engage with health & social care professionals. The Usher Institute has growing experience in this area and, working with colleagues across the University, will build on exemplar activities (such as the NHS Digital Academy) to deliver CPD certified courses and events. This will include delivery of Massive Open Online Courses (MOOCs) and piloting other Distance Learning at Scale (DLAS) activities, such as nanodegrees or MicroMasters co-created with industry to ensure continuing skills development across the sector.

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[18]https://org.nhslothian.scot/LothianNHSBoard/BoardPapers/BoardPapers/NHS%20Lothian%20Board%20Papers%2006-02-19.pdf

[19]Industry Strategy Green Paper, January 2017 - https://beisgovuk.citizenspace.com/strategy/industrial-strategy/supporting_documents/buildingourindustrialstrategygreenpaper.pdf

Datasets

Gaining convenient access to 'real' data is a recurring problem. The Open Research Data Task Force has recognised that a number of technical, cultural and behavioural issues that need attention to make data sharing more accessible[20], while the FAIR Guiding Principles for scientific data management and stewardship emphasise the need for data to meet standards of Findability, Accessibility, Interoperability and Reusability.[21]

To enable greater levels of innovation in the local economy, the SIA highlighted the need for 'real' data to inform talent development and research, and for access to these data to be made more straightforward. The organisations and facilities hosted in the Usher Institute, such as the DataLoch, together with the World Class Data Infrastructure (WCDI), will increase the ESES region's ability to access and utilise a combined pool of diverse health & social care data assets in a trusted and safe environment.

The University is a recognised leader in the secure management of sensitive data, and in the development of the ethical, social and legal governance frameworks that allow citizen data to be used in a trustworthy way. It was a lead partner in the development of the Charter for Safe Havens in Scotland, which: *"sets out the agreed principles and standards for the routine operation of Safe Havens in Scotland where data from electronic records can be used to support research when it is not practicable to obtain individual patient consent while protecting patient identity and privacy."* [22]

The Edinburgh Parallel Computing Centre (EPCC) provides the infrastructure and support for the NHS National Services Scotland (NSS) National Safe Haven[23] – a secure environment in which selected healthcare datasets are linked and accessed. There is a significant opportunity to build on this foundation, with the integration of a wide range of structured and unstructured health & social care datasets.

DataLoch

Scotland has a single healthcare provider and world-leading linked healthcare data assets from birth to death through the use of the through the person-specific Community Health Index (CHI).[24] However, the current approach to data access and linkage is fragmented, slow and inefficient, is limited to specific projects, and is a barrier to research and innovation at scale in the region.

There are aspirations to scale the DataLoch and relevant activities but the immediate focus is deploying a successful solution across the City Region in the short- to medium-term. It should be noted that DataLoch is well positioned in this regard since the core infrastructure and main

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[20] https://www.universitiesuk.ac.uk/policy-and-analysis/research-policy/open-science/Pages/open-research-data-task-force.aspx

[21] https://www.go-fair.org/fair-principles/

[22] https://www.gov.scot/publications/charter-safe-havens-scotland-handling-unconsented-data-national-health-service-patient-records-support-research-statistics/pages/4/

[23] https://www.isdscotland.org/Products-and-services/Edris/Use-of-the-National-Safe-Haven/

[24] https://www.ndc.scot.nhs.uk/Dictionary-A-Z/Definitions/index.asp?ID=128&Title=CHI%20Number

development is being conducted by EPCC, which also is the main delivery partner for the National Safe Havens and other key national health and social care data resources, such as the Administrative Data Research programme and Health Data Research UK Scotland.

Where possible, open and reusable technologies - and common data models - will be used for DataLoch. Discussions have commenced to ensure alignment with the four regional NHS safe havens and a number of significant national initiatives, most pertinently the National Digital Platform being led by NHS NES, the new Public Health Scotland agency and the Scottish Administrative Data Research Centre.

This Programme will create a comprehensive and integrated health & social care data ecosystem in partnership with NHS Lothian, Borders and Fife, allied to partners across the social care spectrum. The data repository (DataLoch) will link multiple data assets from primary, secondary, tertiary, and social care, providing same day access to accurate, rich and current data on all aspects of health and care for the population, for any condition, clinical pathway, or service across the region (see Figure 3 below).

Figure 3: Examples of the data assets that will be stored in the DataLoch
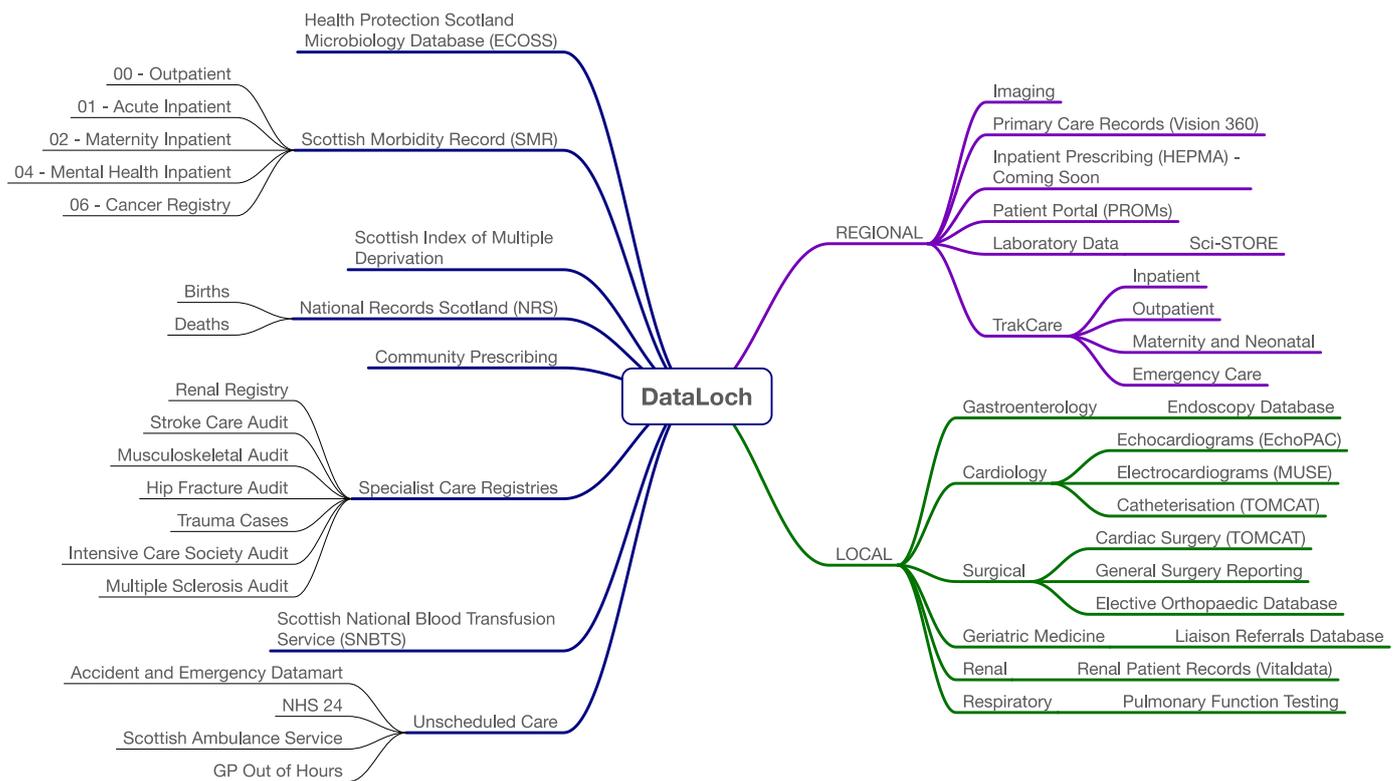
Data from local, regional and national data assets will be linked through the CHI number. These data will be held in a data storage repository that holds large amounts of structured, semi-structured, and unstructured data in its native, raw format.

This differs from traditional data warehouses where data are transformed or processed at the time of import, and often data is discarded. Data lakes have a flat architecture, rather than using hierarchal storage in files or folders, which enables analysts to link data in a more flexible way.

This data repository is being developed in partnership with the NHS Boards in the ESES region, and will facilitate a data-driven approach to prevention, treatment, health and care service provision in our region, and will enable the development of a world-leading learning healthcare system.

A consultancy and governance team (the DDI Prism team) will manage users and approvals for access and disclosure checks of reports exported from the DataLoch (Figure 4), using the existing governance framework set out in the Charter for Safe Havens in Scotland.[25]

This draws on Human Rights Legislation, the Data Protection Act, the General Data Protection Regulation (GDPR), Guidance from the Information Commissioner, and the Scottish Government Identity Management and Privacy Principles, the Scottish Informatics Programme (SHIP) Blueprint, and associated governance framework that defines standards and process for the use of non-consented linked data for health informatics research in Scotland.

Figure 4: The DataLoch will comprise all local, regional and national health & social care data for the residents of the ESES region in its native format (examples of data assets shown)
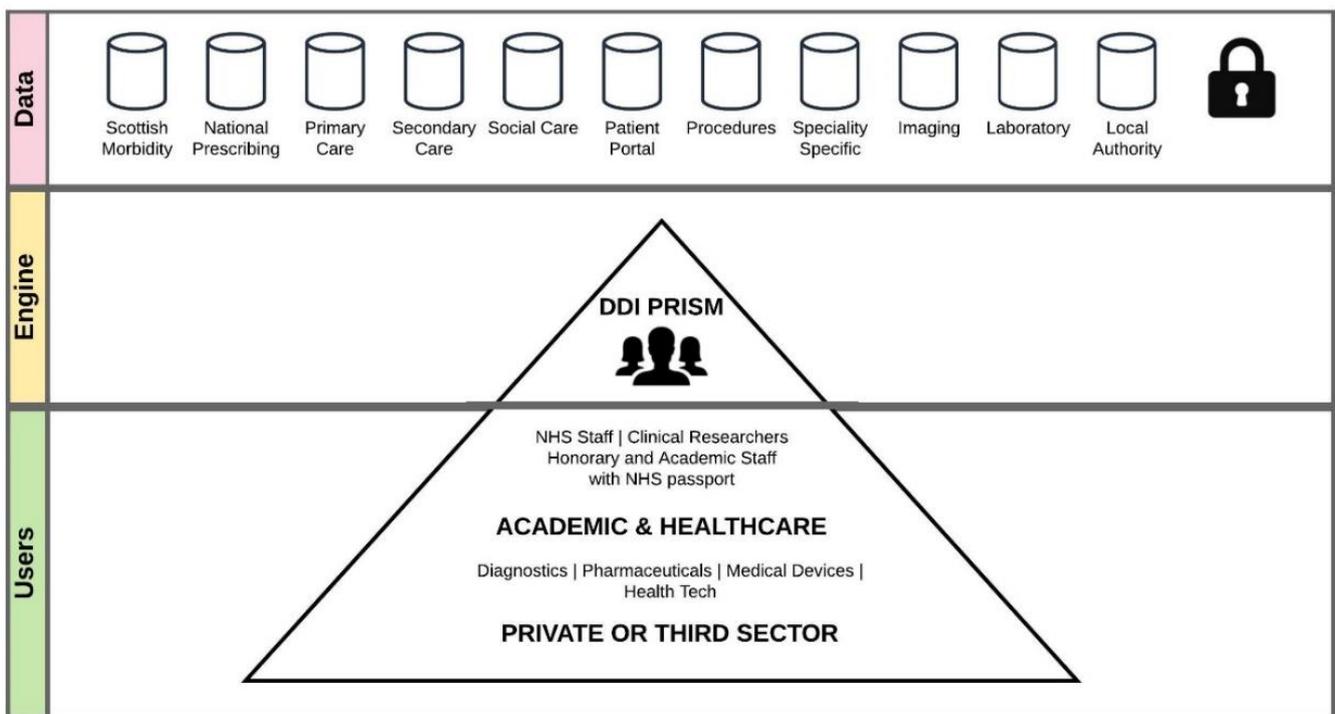
The DDI Prism team (as referenced in the Figure 4) will also offer support to researchers in collaboration with the Edinburgh Clinical Trials Unit within the Usher Institute, and a data analytics and reporting service.

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[25]https://www.gov.scot/publications/charter-safe-havens-scotland-handling-unconsented-data-national-health-service-patient-records-support-research-statistics/pages/4/

The DataLoch will be hosted within the WCDI, which is the same infrastructure as the Administrative Data Research Centre (Scotland), Health Data Research UK Scotland, and national Scottish Data & Informatics Partnership Safe Haven, offering an unparalleled collection of public sector data for research.

This will be complemented by a DataLoch Technical Team, with expertise in software development and engineering. This capability will be enhanced with access to the University's leaders in key related disciplines and technologies, such as machine learning and Natural Language Processing (NLP), to ensure the continuous improvement of the platform.

This team will iteratively improve the DataLoch technical and analytical environment, developing leading industry standards, and will work cooperatively with the technical and industry communities who will be residents in the new Usher Institute.

Standards will be rigorously adhered to, utilising the resources offered by the Scottish Government's Digital First Service Standard[26] and the NHS Digital, Data and Technology Standards[27]. The team will also adopt Agile development methodology and practices, which are articulated by the Government Digital Service (GDS).[28]

The ambition of the DataLoch is to be springboard for international research collaboration - a new type of health & social care DDI ecosystem, which will be a role model for digitally enabled health system re-design globally.

Discussions have commenced to ensure alignment and complementarity with a number of significant national initiatives, most pertinently the National Digital Platform (NDP) being led by NHS Education for Scotland (NHS NES).

The interoperability with other systems, including NHS NES's NDP will be ensured through the use of open and reusable technologies and common data models. DataLoch already incorporates data from more than 30 different NHS data assets and as the NDP matures to replace the existing electronic patient record and hospital administration systems (TrakCare and VISION) then the DataLoch will adapt to integrate data from the NDP. Indeed, to facilitate this and to support the development of the NDP there have been early discussions regarding NHS NES being a resident of the new Usher Institute.

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[26] https://resources.mygov.scot/standards/digital-first/

[27] https://digital.nhs.uk/about-nhs-digital/our-work/nhs-digital-data-and-technology-standards

[28] https://www.gov.uk/service-manual/agile-delivery

Entrepreneurship

A strong focus for the University will be mentoring to support start-up growth and creating a robust pipeline to attract corporate capital and other forms of inward investment.

Many of the corporate partners involved in research and innovation are also interested in engaging with early-stage high-growth ventures that may be acquisition targets or who offer increased competitive advantage.

A core objective of the entrepreneurship activity will be to help build the next generation of 'data entrepreneurs' in the health & social care sectors and data-driven companies of scale. The focus will be on building a sustainable pipeline of high-growth start-up and spin-out data-driven innovation companies operating from the broader ecosystem the Usher Institute will support, that help the City Region to maintain and strengthen its entrepreneurial ecosystem.

This will lead to increased investment in new high-growth companies and create high-value jobs in the region. The Usher Institute will support academics with promising ideas via an in-house translation team composed of experts from science, industry, investment and entrepreneurship, including entrepreneurs in residence, to take research forward.

An accelerator programme offered to high-growth potential start-ups in the area of data-driven health & care will be created and the Usher Institute will support the delivery of the programme in partnership with Edinburgh Innovations and other key delivery partners building on the knowledge of successful similar accelerator programmes.

The Programme will also provide access to capital and other vital resources, and support on all aspects of entrepreneurship, health sector knowledge, data science and investment strategies.

The Usher Institute Accelerator programme will be designed to discover high-growth opportunities within the digital health & social care sector, providing researchers with the skills, knowledge and connections they need to go from concept to a real working prototype, ready to be productionised and commercialised. It is anticipated that the pathway will include various steps:

- Work with the Accelerator partners to look for opportunity with high-growth commercial potential within the Usher Institute;
- Develop market intelligence to understand the opportunity and potential for growth;
- Offer specialist guidance on intellectual property, developing contracts and managing procurement;
- Map out potential paths to commercialisation;
- Access to effective mentoring and guidance from seasoned entrepreneurs, and industry and business leaders;
- Researchers will be given an entrepreneurship toolkit, dedicated mentoring and best practices for turning ideas into marketable products; and,
- Develop a working prototype and support package to those taking the critical first steps towards commercialisation.

Our approach will dovetail with the developing commercial accommodation and will take into consideration offering from other BioQuarter partners, notably NHS Lothian, Scottish Enterprise, the City of Edinburgh Council and commercial partners including those in the adjacent 'Number Nine' building. The operating model will be presented to the BioQuarter group, the decision body for the development and management of the site, before being approved.

Inclusive Growth

The Edinburgh and South East Scotland City Region Deal (ESES CRD) partners are committed to ensuring that Inclusive Growth ambitions are embedded across the deal, reflecting the challenges being faced across the region[29]. An Inclusive Growth framework has been developed which provides an evidence base and a proposed approach to help address these issues. A number of themes are included in the framework, namely: 1) Accelerating Inclusive Growth; 2) Removing the physical barriers to growth; 3) A significant programme of construction; 4) Targeted skills interventions; and 5) Social benefit through innovation.

The link between inequality of income and poor health is well documented[30]. Health inequality remains a challenge across the city region Health Board areas. For example, across the NHS Lothian area the most deprived communities have 76% more patients hospitalised with asthma than the overall average, 114% more patients hospitalised with Chronic Obstructive Pulmonary Disease (COPD), and 26% more premature births. This inequality gap is equivalent to 4,796 deaths each year. Even within the City of Edinburgh Council area there are 76% more preventable emergency hospital admissions for a chronic condition in the most deprived areas than the overall average. Similar inequality gaps can be seen across Fife and Borders Health Board areas[31].

The opportunity presented by the city deal for co-operative working across partners has potential benefits to the health and social care sector. As referenced by the OECD, health data can be used to explore the impact of poor health on life chances and help evaluate the impact of public health interventions on health promotion and prevention.

Work is already underway with a range of partners:

Collaboration with National Services Scotland Information Services Division (NSS ISD) on the Drug and Alcohol Information System (DAISy)

ISD Scotland is responsible for developing the Drug and Alcohol Information System (DAISy), a database to collect Scottish drug and alcohol treatment, outcomes and waiting times data from staff delivering specialist drug and alcohol interventions. The goal of this initiative is to support local and national decision-making, monitor service delivery and improvement, and inform national policy and practice development in this crucial area.

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[29]
https://static1.squarespace.com/static/55c87967e4b05aa55020f656/t/5c263201898583ec74c01146/1546007049724/ESESCR+Deal+Document+6+August+2018+signed.pdf
[30] http://www.healthscotland.scot/health-inequalities/fundamental-causes/poverty/overview-of-poverty
[31] https://scotland.shinyapps.io/scotpho-health-inequalities/

As part of the University of Edinburgh's collaboration with ISD Scotland, we intend to support them with the development of the DAISy database and explore the potential to join person-level data with other datasets. One of the collaboration opportunities ~~being considered~~ is to work with the Alan Turing Data Study Group to bring together relevant organisations from industry, government and the third sector, with multi-disciplinary researchers from academia, to address and innovate solutions for the diverse challenges relating to drug and alcohol abuse.

UNICEF

The Data for Children Collaborative with UNICEF is a joint partnership between UNICEF, The Scottish Government and the University of Edinburgh. The Collaborative seeks to improve outcomes for children locally, nationally and globally. It draws on the strengths of all partners to bring insights and solve problems using data and data science. The Collaborative will prioritise and enable projects linking academics, UNICEF subject matter experts and Scottish Government childhood policy and analyst experts, and foster partnerships with other organisations, with a focus on adoption of actionable insights to inform policy and practice.

The Collaborative is funded jointly by the Scottish Government, through the Scottish Funding Council and the University of Edinburgh for a start-up period of three years. The initial project activity is focussed on nutrition, population and poverty, but the intention is for the Collaborative to look at a broader topic range once these initial projects are delivering insights. Areas under discussion include childhood obesity, enabled by The Data Lab on Obesity (unstructured data review at RGU), and Children on the Edge of Care, (exploring data linkages between Health & Education data for Dundee City and Stirling Councils).

Objectives & Key Performance Indicators

Table 1 overleaf outlines the main TRADE outputs for the Usher Institute over the 15-year lifetime of the programme.

Table 1: DDI Programme investment objectives and KPI's

Theme	Investment Objective(s)	KPIs
Talent	Create a vibrant learning environment that enables students and health & social care professionals to **realise the potential of data**	• **8,709 certified** • **10,620 non-certified**
Research	Facilitate **collaboration across disciplines** to deliver data-driven research that impacts on patient care	• **£138m research income**
Adoption	Drive innovation through **partnerships with the public, private and third sectors** that address the major challenges facing our health & social care sector	• **Interactions with 280 companies**
Data	Harness Scotland's comprehensive healthcare data and expertise in data science to evaluate **health & social care outcomes** in the City Region and beyond	• **270 new data sets utilised**
Entrepreneurship	**Initiate and accelerate the growth** of new health & social care businesses that improve the delivery of care to our citizens	• **49 new companies formed**

1.4 Organising Activities Effectively

Understanding how the University can effectively capitalise on these TRADE opportunities is best explained by describing the **key players** and articulating how the Usher Institute can underwrite delivery of TRADE objectives through the adoption of a Target Operating Model.

Key Players

The ESES City Region already has a number of centres of excellence in health data research and informatics that have underpinned its reputation to date. The Usher Institute operates 'virtually' across University locations, and comprises of four separate research centres in Biomedicine, Self and Society, Global Health, Population Health Sciences, Medical Informatics, and the Edinburgh Clinical Trials Unit, each of whom will play a valuable role in achieving TRADE objectives.

Internal partners within the University

- **College of Medicine and Veterinary Medicine & Edinburgh Medical School**
  The College comprises two schools: the Edinburgh Medical School and the Royal (Dick) School of Veterinary Studies. The **Edinburgh Medical School** was formally established in 1726 and is a large medical school by UK standards, spread across several campuses at Little France, the Western General Hospital, the University central area and Royal Edinburgh Hospital. It is a "World Top 20" medical school in multiple league tables. Across its three Deaneries and five research institutes[32], there are various opportunities to consolidate and develop DDI capability, which will contribute to TRADE objectives.

- **Edinburgh Parallel Computing Centre (EPCC)**
  EPCC is an international centre of excellence in all aspects of high-performance and data-intensive computing, accelerating the effective exploitation of novel computing throughout industry, academia and commerce for over 25 years. EPCC houses an exceptional range of supercomputers, and will make available the WCDI, in which the DataLoch will be housed. EPCC is also needed to develop the new technologies that underpin DDI, and the capability to deploy highly skilled R&D-focused data scientists, architects, and engineers to support health & social care innovation projects.

- **Edinburgh Innovations**
  Edinburgh Innovations (EI) is the University of Edinburgh's commercialisation division. Offering a wide range of services, they assist researchers, students and industry to drive innovation. Through business development specialists, EI develop partnerships for mutual benefit, adding value at each stage of the commercialisation journey. They will develop the Accelerator for Usher Institute, while also embedding specialist expertise in the Institute.

- **Bayes Centre**
  Through activities across education, research, and innovation, the Bayes Centre works to power the interaction of people, data and systems, harnessing world-leading data science and AI research for the benefits of the economy and society. The multi-disciplinary nature of the Bayes community allows the University to support the City Region in becoming the Data

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[32] https://www.ed.ac.uk/medicine-vet-medicine/about/organisational-structure

Capital of Europe by mobilising academic excellence in education, leveraging funding opportunities and developing strategic relationships. While the Usher Institute continues to operate virtually, it will be a vital partner in supporting activities. It will host events and meetings, and enable interactions with partners across the private, public and third sector.

- **Edinburgh Futures Institute**
  The Edinburgh Futures Institute (EFI) will be a global centre for multi-disciplinary, challenge-based DDI research, teaching and impact. EFI will provide thought-leadership in cultural, ethical, managerial, political, social and technological DDI issues by offering opportunities for a broad spectrum of academic researchers, talented students and external partners. The Usher Institute will collaborate with EFI on DDI projects, enhancing the interdisciplinary nature of the offering and working on new programmes, such as those focussed on the future delivery of healthcare.

- **Roslin Institute**
  The Roslin Institute is an institute for animal science research, which aims to enhance the lives of animals and humans through research in animal biology. It receives strategic investment funding from the Biotechnology and Biological Sciences Research Council and is located on the Easter Bush Campus with the Royal (Dick) School of Veterinary Studies. As a fellow research institute in the College, it will be an important strategic partner in achieving the TRADE objectives. For example, there will be the opportunity to collaborate on emerging partnerships, such as with the University of Illinois Discovery Partnership Institute.[33]

- **School of Informatics**
  The School of Informatics is Europe's largest centre for informatics and computing science research with over 250 academic and research staff and 1,400 students from 70+ countries. It is a world-leading research institution in Data Science and AI with a breadth and diversity that is at the forefront of new advances in the field. It will support the programme in various aspects of the TRADE objectives, including the support of research partnerships in health informatics.

- **Administrative Data Research Centre for Scotland (ADRC-S)**
  ADRC-S involves experts in the theory, methods and policy of linking records for secondary uses, including public engagement, ethics, information governance and law; linking and analysing large datasets; crime and criminal justice; and education and social services. Working with ADRC-S the DDI Programme will be able to better understand how to best access and link a rich variety of data sources from the health & social care sector.[34]

  Regarding the ADR investment, SADRC (formerly ADRC-S) are an important partner and the DataLoch team will co-locate with this team at Nine BioQuarter in 2019-20. Regarding PICTURES, the DataLoch team have formed a strong relationship with Dr Emily Jefferson,

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[33] https://dpi.uillinois.edu/

[34] https://adrn.ac.uk/about/network/scotland/our-research/

Director of the Health Informatics Centre at Dundee and lead of the PICTURES project. The systems architect at EPCC (UoE) who developed the infrastructure for PICTURES is also responsible for designing DataLoch and both data repositories will be hosted within the World Class Data Infrastructure. The UoE is a partner in iCAIRD and, following initial discussions with Canon, who are based in Edinburgh, and one of two key industry partners for iCAIRD, we plan to provide access to ESES data and our expertise to help them train and test artificial intelligence algorithms on the iCAIRD platform once it is established.

External partners

The list of external partners below is not exhaustive. Allied to current partnerships and networks within the wider City Region Deal, extensive stakeholder mapping has taken place and an engagement strategy is being developed to ensure appropriate prioritisation.

Public Sector

- **NHS Lothian, Borders & Fife**
  The ESES region is served by three NHS Boards that work together to provide health & social care services to 1.25 million people from the City of Edinburgh, East Lothian, Mid Lothian and West Lothian, the Scottish Borders and the Fife. Together these boards employ 45,000 people across 36 hospitals, including five teaching hospitals, and 180 general practices. Their corporate objectives are to protect and improve the health of the population, improve the quality and safety of health care, secure value and financial sustainability and deliver actions to enable change. The Usher Institute Programme for health & social care has been developed in partnership with the NHS Boards of the ESES region as key external partners.[35] These NHS Boards will be a critical factor in ensuring this Programme delivers for the people of the City Region.

- **ESES Local Authorities**
  The ESES local authorities (City of Edinburgh, East Lothian, Fife, Midlothian, Scottish Borders and West Lothian) are key partners in the City Region Deal, and play a critical role in the delivery of selected health services and many social care services, including those for help at home, housing and care homes, mobility, carers, families and children. Growing relationships with each local authority will be critical to establish expectations for delivery and, where possible, supply data to the DataLoch from relevant resources that can used to improve service delivery to citizens.

- **ESES Health & Social Care Integration Joint Boards (IJB)**
  The IJBs govern and have oversight of health & social care partnership and all commissioning. The main purpose of integration is to improve the wellbeing of people who use health & social care services, particularly those whose needs are complex. They bring together NHS community health services and the local authority's health & social care functions. They are a key facilitator in the Usher Institutes ambitions to bring together data from both health &

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[35] https://org.nhslothian.scot/LothianNHSBoard/BoardPapers/BoardPapers/NHS%20Lothian%20Board%20Papers%2006-02-19.pdf

social care services and initial briefings with these Boards on both the DDI Programme and related DataLoch project has taken place.

- **Academic and Clinical Central Office for Research and Development (ACCORD)**
  ACCORD is a partnership between the University of Edinburgh and NHS Lothian Health Board. By drawing together key research management staff from these organisations, ACCORD provides streamlined access to professional advice, expert regulatory support and world class clinical research infrastructure. This partnership is underpinned by the first joint Research Framework Agreement in Scotland. Providing a single point of entry for researchers throughout the lifecycle of their studies, ACCORD's expertise will help ensure that the programme meets research governance and regulatory requirements, fulfilling legal, ethical and scientific obligations, while nurturing and attracting world class research.

- **Health Data Research UK (HDRUK)**
  HDRUK are an independent, non-profit organisation supported by 10 funders (including public and third sector organisations) and bring together 22 research institutes across the UK, including the Scottish substantive site (HDRUK@Scotland). The HDRUK vision is for, "large scale data and advanced analytics to benefit every patient interaction, clinical trial, biomedical discovery and enhance public health."[36] The expertise, advice and support HDRUK offer, and the ongoing close working relationship with the Usher Institute, will support programme delivery. Professor Andrew Morris is the Director of Health Data Research UK. Prior to this appointment he was Director of the Usher Institute and is currently seconded to this position, while retaining his post as Professor of Medicine and Vice Principal of Data Science at the University of Edinburgh on a part-time basis.

- **National Services Scotland Information Services Division (NSS ISD)**
  NSS ISD is an important ally for the programme to achieve its ambitions, as it provides health information, health intelligence, statistical services and advice that supports quality improvement in health & care. Similar to the DDI Programme, it has partnerships with a wide range of organisations - NHS Boards, hospitals, General Practitioners, Community Health Partnerships, local authorities, voluntary organisations, and many other care and service providers. NSS ISD develops national datasets to support the collection and management of information, and the ambition is that these will be aligned with the DataLoch.

Third Sector, Private Sector and Citizen Bodies

To be successful, the programme must build on the strong base of external engagement with the third and private sectors that currently exists in the Usher Institute and across the wider College and University. These organisations will contribute to multiple areas of the Institutes DDI Programme and will engage across the TRADE themes as appropriate. This will include co-design of services, direct support through funding awards, participation in research and enabling the delivery of innovative products and solutions.

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[36] https://www.hdruk.ac.uk/wp-content/uploads/2019/04/HDR-UK-One-Institute-Strategy-compressed-1.pdf

To ensure that DDI activities are aligned with patient and citizen outcomes, represent all citizens and address inequalities, it will be invaluable to engage with 'citizen bodies' - the organisations that represent these concerns.

Categories and examples of organisations are detailed below:

- **Third sector**
Charitable organisations and trusts fund research and use data to understand the impact of disease and their interventions on a population level. There are many strong examples of current research engagements with the University and College of Medicine and Veterinary Medicine, through the Wellcome Trust, British Heart Foundation and Cancer Research UK, amongst others. Many of the Edinburgh Medical School PhD programmes leverage funding from a variety of third sector organisations (for example, Cancer Research UK) for both clinicians and scientists to undertake data-related projects, and these programmes will be enhanced through the DDI Programme.

- **Pharmaceutical companies**
One of the key targets for industry engagement are pharmaceutical companies. There are current engagements with multiple companies across the Edinburgh Medical School[37]. This includes engagements with Pfizer, Bristol-Myers Squibb, AstraZeneca, and Glaxo-Smith Kline on clinical trials and post-marketing research to evaluate safety and efficacy by linking patient level data with prescribing. The Scottish Allergy Respiratory Academy, which is based at the University of Edinburgh, provides training to companies such as Chiesi and Bausch & Lomb.[38]

- **Medical devices and equipment companies**
Engagement in this sector is limited and an opportunity exists to significantly enhance this aspect in the City Region, to garner further inward investment. This could feature post-marketing research or clinical trials using linked routinely collected patient level data to evaluate safety and efficacy of new medical devices (for example, vascular stents and implantable devices) following adoption. Examples of established partnerships with major global companies in this sector include Abbott Laboratories[39], Siemens Healthineers[40], and LumiraDx. Through the NHS Lothian Bioresource and the DataLoch there is a large potential market to evaluate the impact of new diagnostic equipment and testing on health service delivery and outcomes.

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[37] https://www.ed.ac.uk/medicine-vet-medicine/research/edinburgh-drug-discovery/industry-collaborations

[38] https://www.scottishallergyrespiratoryacademy.org/

[39] https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)31923-8/fulltext

[40] https://heart.bmj.com/content/105/8/616.long

- **Health technology companies**

  Allied to the University of Edinburgh's growing expertise in this area, there is potential in developing algorithms for precision medicine, including the application of novel data-driven techniques such as machine learning and artificial intelligence in improving health outcomes. The University has a wide range of relationships in this area, including its own spin-outs such as Connect Healthcare[41] and Pharmatics[42]

- **Citizen bodies**

  This category involves a range of organisations that will participate in the programme to ensure that it is inclusive and will address inequalities in both the development of health & social care technologies and the provision of services to citizens.

  The University already has strong links to Advance Higher Education's Equality Charters[43] but there are opportunities to extend this, in terms of supporting equality in both how the programme is delivered and the representation of citizens. There are bodies concerned with diversity in health tech, such as OneHealthTech[44], which will be engaged with and supported through the programme.

  In terms of ensuring outcomes address health & social care inequalities and are centred around citizen need, there will be engagement with relevant sector bodies and organisations such as the Scottish Council for Voluntary Organisations (SCVO), the Social Care Institute for Excellence and the Health & Social Care Alliance Scotland.

3.4. Operating Model

The operating model is founded on the need for the Usher Institute to act as a key facilitator of DDI activity that generates value for the City Region, nationally and globally. This will be achieved by harnessing talent and leveraging support across the College and University more widely, to create functional interfaces with private, public and third sector health & social care organisations.

It is also important that the Usher Institute operates in alignment with the wider DDI Programme to maximise the use of resources across the University. As illustrated in Figure 5 below, the Usher Institute will operate in cooperation with the other innovation hubs to ensure the delivery of inclusive growth for the ESES City Region.
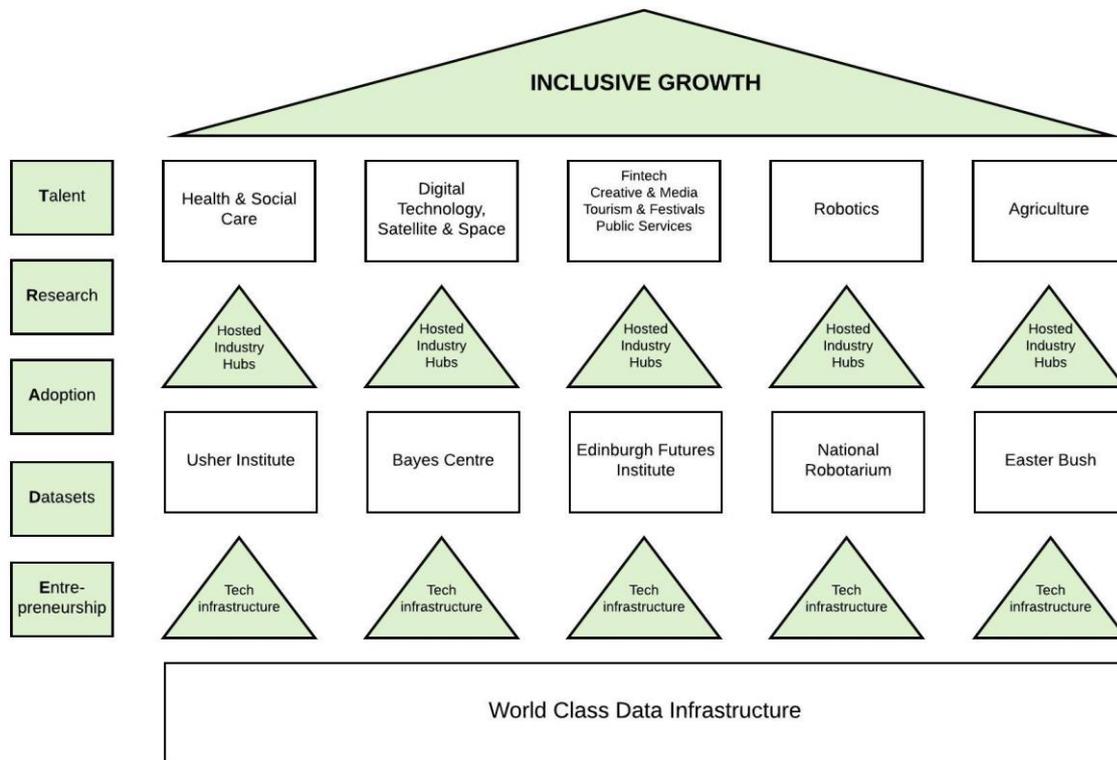
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[41] https://www.connecthealth.co.uk/

[42] https://pharmaticsltd.com/

[43] https://www.ecu.ac.uk/equality-charters/

[44] https://www.onehealthtech.com/

Figure 5: Structure of the overall DDI Programme

The Usher Institute will be supported by the World Class Data Infrastructure (WCDI), which is particularly vital in the context of the DataLoch. Formal governance and procedures are already in place, even at this early stage, to ensure that the innovation hubs collaborate and develop complementary activity plans.

As identified in the Key Players section above, critical relationships internally and externally already exist or have been identified. The power of the operating model will be in sustaining these relationships while being operationally agile and able to respond to changes in the political, economic, social and technological environment that impact the sector.

As referenced in the Current Position, the Usher Institute operates 'virtually' across University locations. Allied to the need for the programme to mine opportunities across the University, it is necessary to create a Target Operating Model to facilitate strategic delivery and put in place a plan to achieve this transition.

**Underwriting delivery of the DDI vision and TRADE objectives**

The operating model underwrites the Usher Institute vision and is aligned with the overall DDI Programme vision: "to establish Edinburgh & South East Scotland as the data capital of Europe."[45]

The Target Operating Model for the Usher Institute outlines how this can be delivered through people, process and technology (Figure 6). It is a representation of how the services can be best organised to

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[45] https://ddi.ac.uk/about-us/data-capital-of-europe/

efficiently and effectively achieve goals. The mode of delivery will enable University colleagues to adopt and benefit from the DDI Programme, and contribute towards TRADE objectives over the lifetime of the City Region Deal programme.

Figure 6: Target operating model alignment
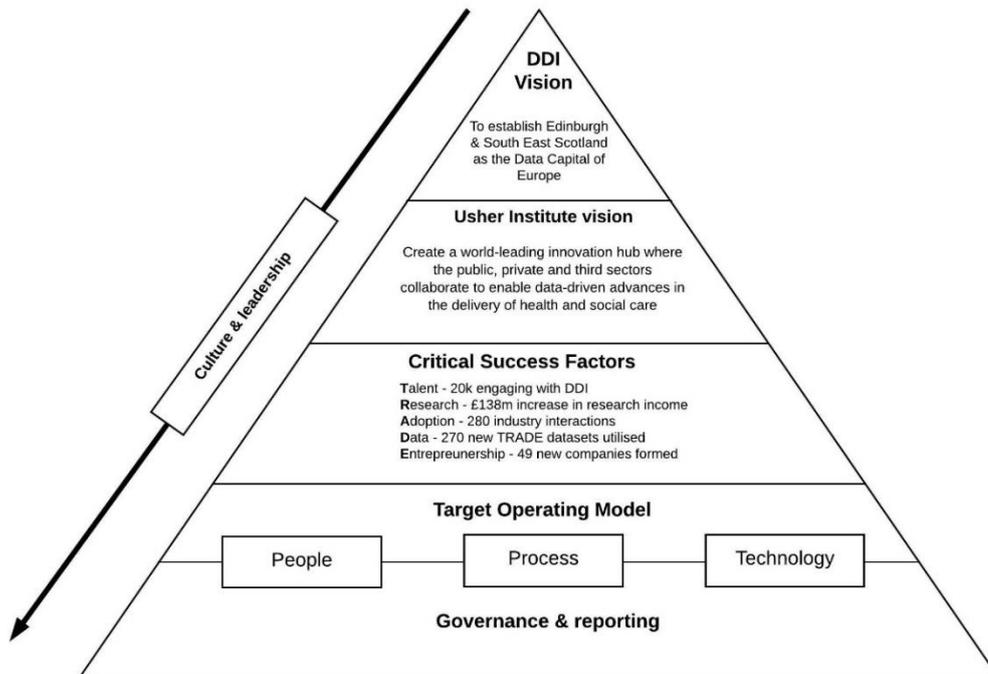
A strong foundation of governance and reporting is equally critical in ensuring that the programme achieves its objectives and drives improvement, allied to maintaining legal and ethical standing within the sector and wider regulatory environment.

People, processes and technology are the key components that underwrite the successful delivery of the Target Operating Model. The impact and necessary changes in these areas have been identified and interrogated through the Financial Case.

Target Operating Model

Figure 7 depicts the high-level view of the Target Operating Model and the relationship between the University and external organisations, which are critical to the success of the model. Further explanation of each tier is given in this section.
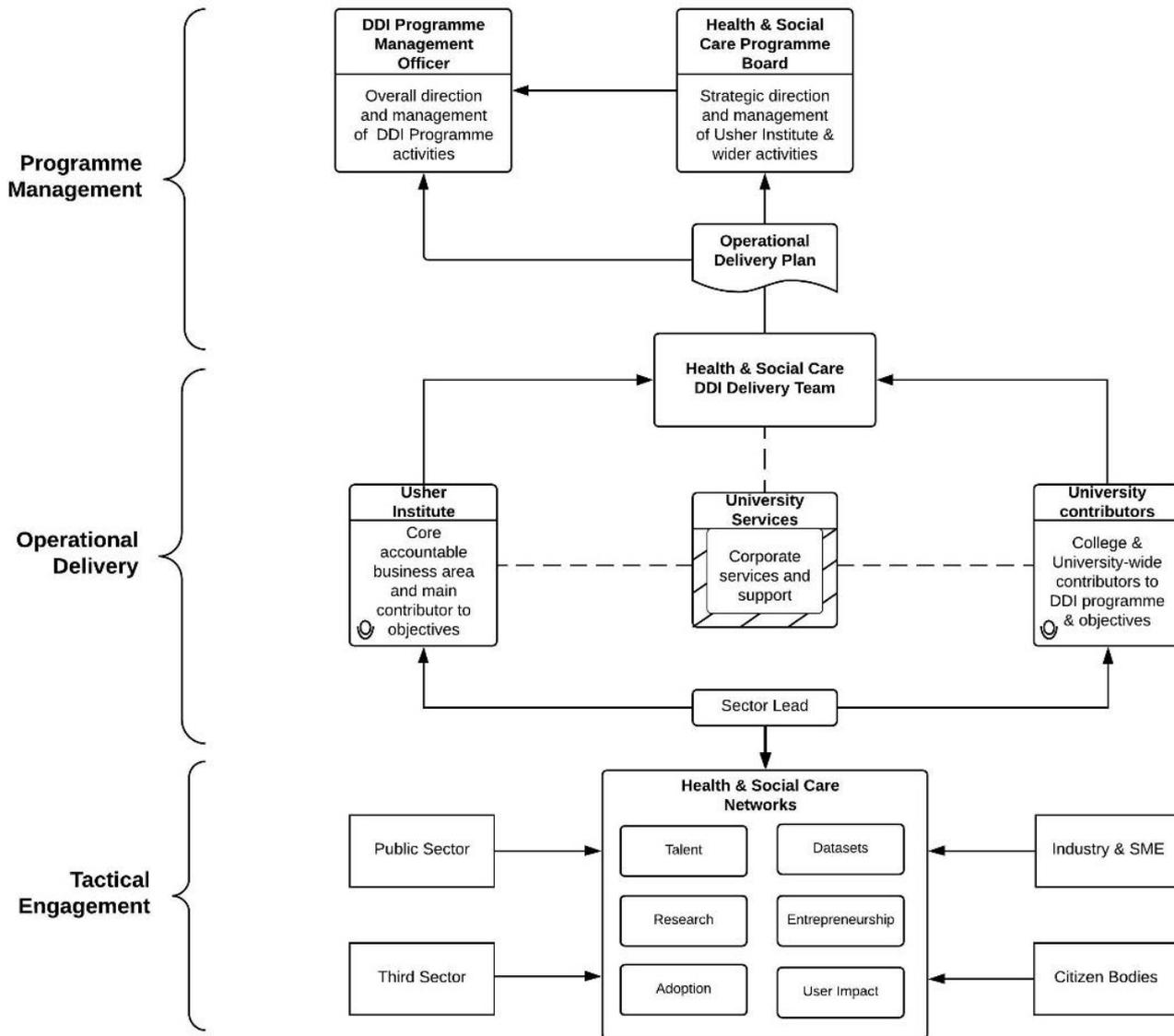
Programme Management

As referenced in Figure 8 below, the **Health & Social Care DDI Delivery Team**, is critical to the delivery of the programme. This team will be accountable for the day-to-day operations and delivery of the programme and be based in the Usher Institute but with a remit to work across the University, to drive best value for the programme. It will report to the **Health & Social Care DDI Programme Board** and the **DDI Programme Management Office (PMO)**.

Figure 8: Programme Management tier
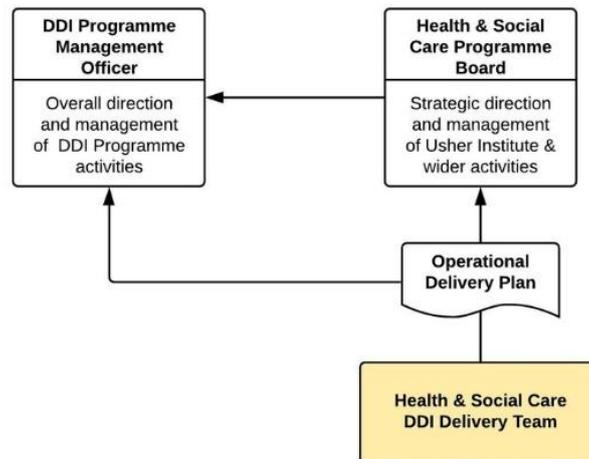
This team is the principal owner of the **Operational Delivery Plan**, by which activities across the TRADE themes will be aligned to ensure that there is an appropriate balance of effort and that objectives are being met. The Health & Social Care DDI Delivery Team will be led by the Chief Operating Officer (COO) and will manage key programme activities, including:

- Sector programme management;

- Resource management;

- Communications;

- Project alignment, coordination and oversight;

- TRADE KPI reporting;

- Financial management; and,

- Compliance against relevant regulatory and legal standards.

The interface with the Programme Board and DDI PMO also ensures that there is a 'chain of command', in terms of alignment with the wider programme and ensuring that communication and messaging is effective.

The purpose of the Programme Board is primarily to offer strategic direction and oversight, and to ensure that the Operational Delivery Plan is aligned with the Usher Institute and College plans by:

- Developing and owning the health & social care sector strategy;

- Approving the Operational Delivery Plan;

- Authorising any major deviations from the agreed Operational Delivery Plan;

- Ensuring the required resources are available;

- Resolving any conflicts escalated by project teams, internal or external stakeholders; and,

- Providing overall strategic direction for the programme.

Operational Delivery

As a mature research institute, the **Usher Institute** is recognised as the key facilitator for the delivery of the TRADE objectives, as outlined in Figure 9 below. The research centres associated to the Usher Institute (see Figure 10 overleaf) are aligned to the TRADE themes and will contribute significantly to objectives.

Figure 9: Operational Delivery tier
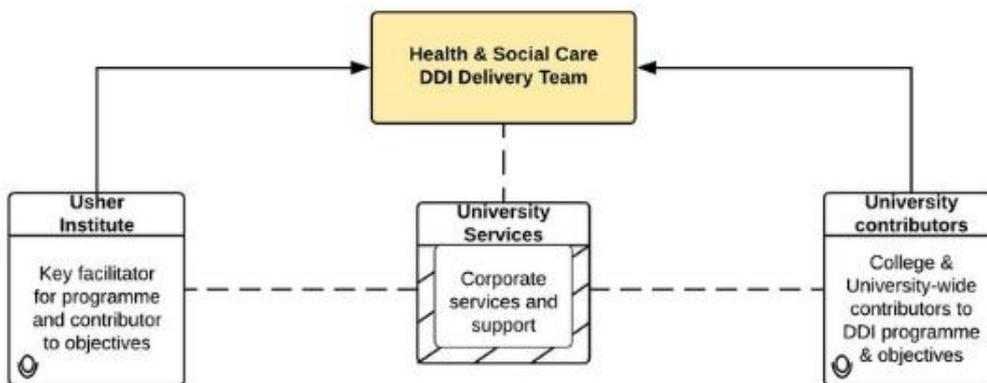
As identified in Internal Stakeholders, there are also a rich variety of Schools, Research Institutes and Centres across the University with capability that is well aligned with DDI in health & social care and have strong connections with sector organisations, which will be valuable in delivering impact. For this reason, there are opportunities to drive value for the College and University as a whole by extending the reach of the Health & Social Care DDI Programme.

*Figure 10: Usher Institute structure*
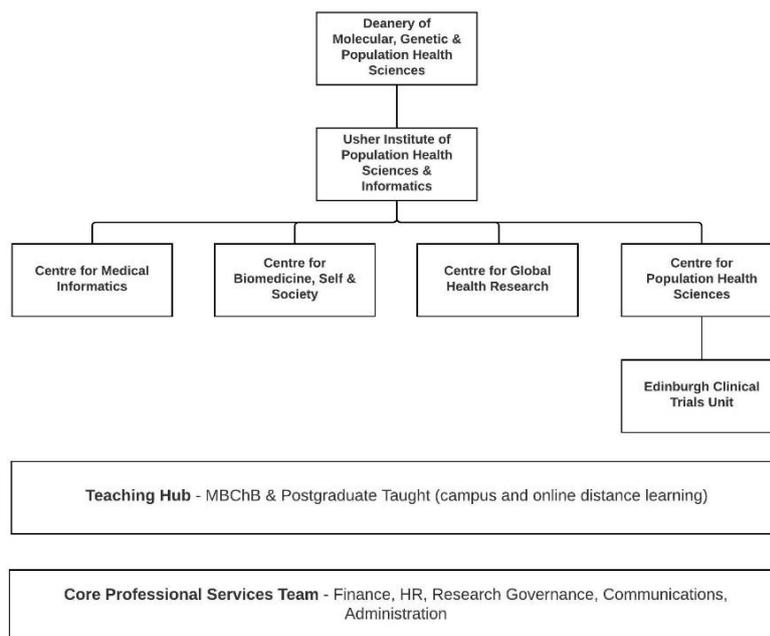
Where possible, University contributors will be co-located in the new facility, to ensure they have exposure to the collaboration opportunities with private, public and third sector organisations. In the case that this is not possible, the use of University Professional Services, such as Information Technology infrastructure, allows for excellent collaboration frameworks.

Tactical Engagement

The implementation of the Target Operating Model will put in place the structure necessary to ensure functional interfaces internally. However, the success of the DDI Programme has a critical dependency on public, private and third sector partners as recognised by the engagement tiers in Figure 11 below.

Figure 11: Tactical Engagement tier
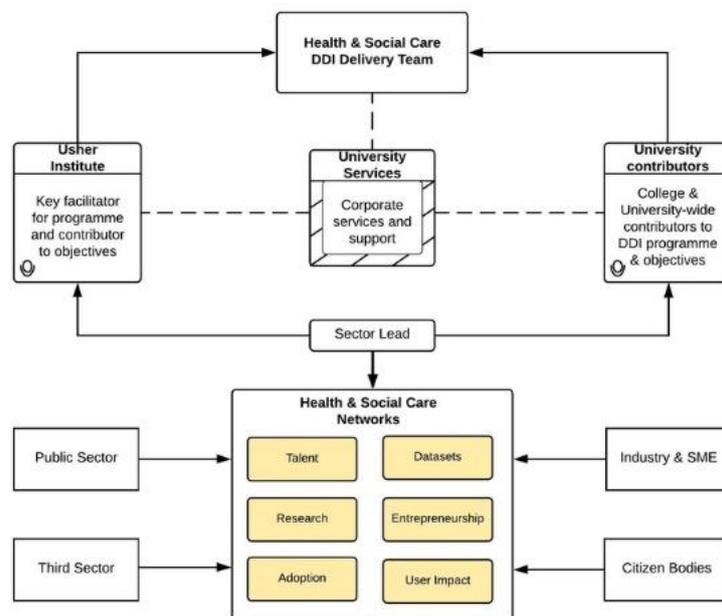
The range of External Stakeholders is significant and it is important that identification and prioritisation of potential partners takes place across the TRADE themes to increase efficiency and effectiveness of delivery. The ultimate goal is to create sector advocates and influencers who can leverage support and ease delivery.

For this reason, **six networks** of subject matter experts are being developed across the TRADE themes and *User Impact*. Members of these theme networks are being drawn from across the public, private and third sector as appropriate.
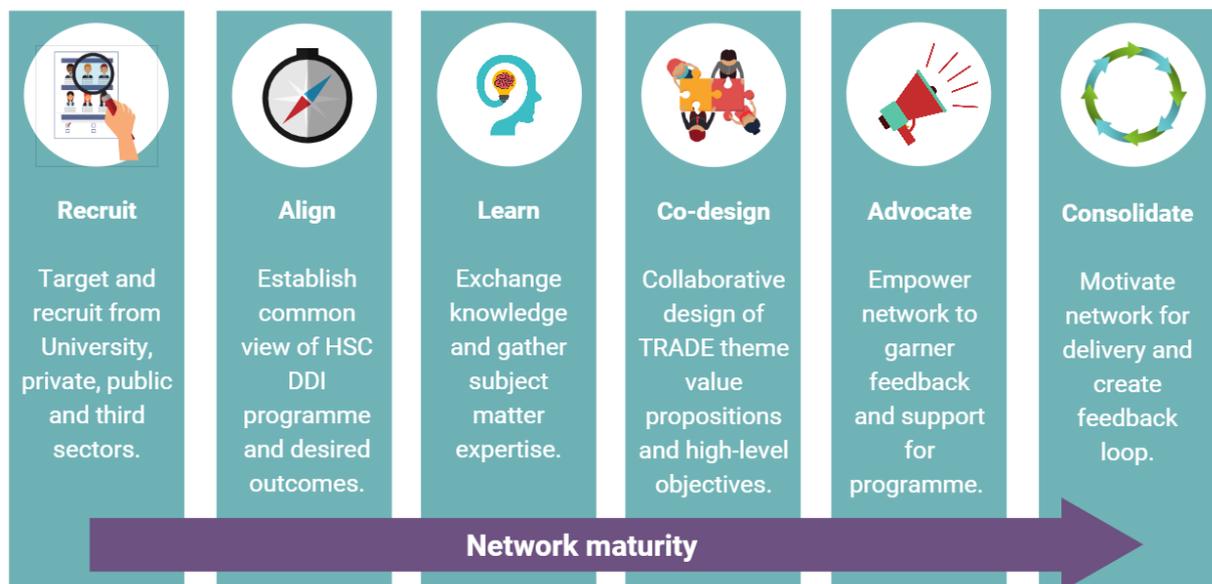
The User Impact network will ensure that appropriate actions are being taken to understand the impact of the programme on the end user or citizen. Where DDI impacts on service delivery to citizens of the City Region and more widely in Scotland, it is imperative that appropriate development and

evaluation methods are adopted. This has been articulated in the Scottish Approach to designing public services[46] and, for digital services, the Digital First Service Standard[47].

The **Sector Lead** role will provide a sector-specific focus that will align the market and commercial opportunities with delivery capability and is the key mechanism for driving engagement in emerging segments of opportunity. The post has been created to amplify the City Region Deal within the sector and pump prime the pipeline of sector and data related projects.

Each of the networks will follow the same development model, ensuring they reach operational effectiveness in a timely fashion. This is illustrated in Figure 12 below.

Figure 12: Network development model

Recruit	**Align**	**Learn**	**Co-design**	**Advocate**	**Consolidate**
Target and recruit from University, private, public and third sectors.	Establish common view of HSC DDI programme and desired outcomes.	Exchange knowledge and gather subject matter expertise.	Collaborative design of TRADE theme value propositions and high-level objectives.	Empower network to garner feedback and support for programme.	Motivate network for delivery and create feedback loop.

Network maturity

Developing the pipeline

Given the importance of industry engagement, as reflected in the TRADE KPIs, a healthy pipeline of engagements is vital. While programmes such as the DataLoch will have the dedicated DDI Prism team for industry consultancy and engagement specifically for that purpose, the Health & Social Care DDI Delivery Team will manage the industry pipeline across the TRADE themes.
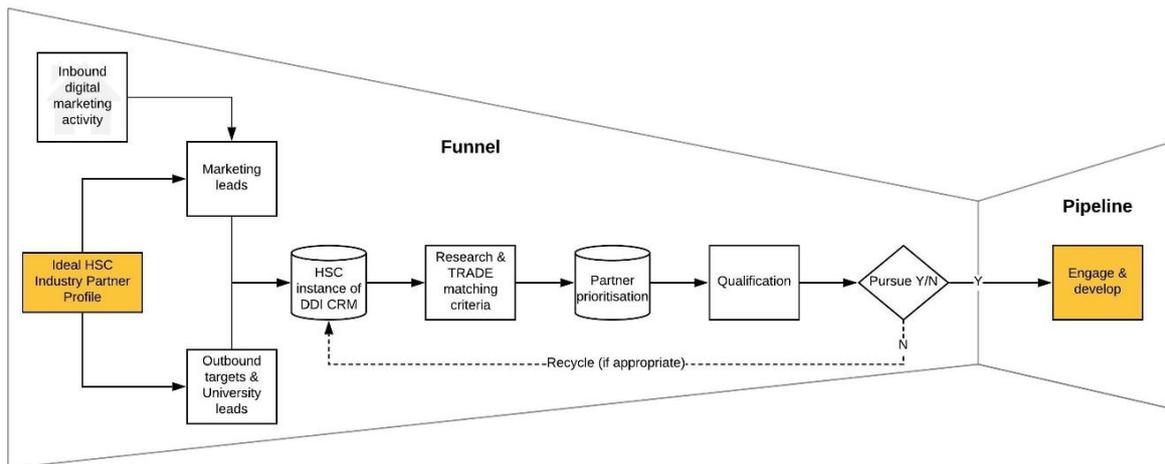
The process and systems to underwrite this are already in development and early-stage execution, resulting in the development of innovation propositions with multiple potential partners. As is illustrated in the Figure 13, it is important to understand what a 'model' industry partner profile is for each of the TRADE themes and how the partner can be targeted and engaged.

The process ensures operational efficiency and reduces wasted engagements that will not deliver to TRADE objectives or contribute to KPIs. To support this process, a Customer Relationship Management (CRM) system has been procured and deployed.

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[46]https://resources.mygov.scot/37f87d5/designing-public-services-in-scotland/why-we-need-design-for-public-services-in-scotland/a-scottish-approach-to-design-for-public-services/

[47] https://resources.mygov.scot/standards/digital-first/

Figure 13: Industry engagement and pipeline

Through this process we will significantly expand the opportunity for private sector companies - large and small - to deliver successful health and social care innovations of all types.

We will draw upon a range of activities and partner organisations (e.g. Scottish Development International, Edinburgh Innovations and University strategic partnerships teams) at the front end of opportunity funnel in order to ensure that we have access to a range of high-quality industry collaboration opportunities, including possible inward investments.

Using the Nesta 'innovation spiral' (see Appendix G) as a reference framework, Table 2b overleaf illustrates how the scope and scale of business innovation engagement opportunities will be transformed.

Table 2b: Changes in approach to engagement and partnerships with industry

Approach & Focus	Summary Description	Current Activities		Future Activities		Example Initiatives
Identify opportunities & challenges (SME & corporates)	Better understand opportunities and challenges around healthcare issues to inspire new ideas	◕	Opportunity identification tends to be driven in collaboration with healthcare providers	●	Engage a broad range of organisations to identify and validate high-impact opportunities and challenges	• Data for Children collaborative • ACRC proposition shaping
Generate ideas (SME & corporates)	Explore and develop ideas that address health & social care opportunities and challenges	◔	Occasional engagements with organisations including Microsoft in the generation of new ideas and concepts	●	Engage a broad range of organisations to identify and validate high-impact opportunities and challenges	• ACRC proposition shaping
Development & testing (mainly SME focus)	Test ideas in practice so that plans can be refined and improved.	○	Not a focus area currently	◕	Make extensive use of dedicated on-site accelerator capabilities to validate early stage concepts	• Establish Advanced Care Research Centre • DDI student placements
Making the case (mainly SME focus)	Persuade others that an idea works better than existing approaches	○	Not a focus area currently	◕	Make extensive use of dedicated on-site accelerator capabilities to validate new business models	• Dedicated health & social care sector accelerator
Deliver & implement (SME & corporates)	Moving ideas from concept to reality	○	Not a focus area currently	◕	Make extensive use of dedicated on-site accelerator capabilities to market-test new products	• Healthcare Technology Accelerator Facility (HTAF) • Dedicated health & social care sector accelerator
Grow & scale (SME & corporates)	Enact strategies that grow and spread innovations	◐	Track record of collaborations with SE for the support of companies incubated at the University of Edinburgh	◕	Systematically collaborate with SE and other partners to incubate a long pipeline of digital healthcare companies	• Dedicated health & social care sector accelerator • Partnership with Wayra UK Accelerator Programme
Systems change (mainly corporate focus)	Identify changes in the health & social care sector that enable new ways of thinking & working	◔	Track record of collaboration with innovation centres to support health and social care innovations	◑	Apply challenge-based innovation approach that engages organisations of all types and sizes	• DataLoch health & social care pathway re-design • Data-led healthcare delivery transformation

Key

○	Low level of activity	◑	Occasional activities with SMEs & corporates
◔	Occasional activities with SMEs or corporates	◕	Extensive activities with SMEs or corporates

● Extensive activities with SMEs & corporates

This expanded range of innovation activities will create engagement opportunities for SMEs and corporates alike, including possible inward investors that are seeking to grow their commercial activities in the City Region. The engagement activities across the various innovation methods, driven by our sector team, has already produced a pipeline of opportunities as illustrated in Appendix F. Highlights include:

- The **Data for Children Collaborative** is, initially, a three year joint partnership between UNICEF, The Scottish Government and the University of Edinburgh. The Collaborative seeks to improve outcomes for children locally, nationally and globally, drawing on the strengths of all partners to bring insight and solve problems using data and data science. The Collaborative will prioritise and enable projects linking academics, UNICEF subject matter experts and Scottish Government childhood policy and analyst experts, and will foster partnerships with other organisations, with a focus on adoption of actionable insights to inform policy and practice. Whilst initial project activity is expected to focus on nutrition, population and poverty, the Collaborative will look at a broader topic range once these initial projects are delivering insights;
- The university is working with a large financial services provider potentially to collaborate on creating an **Ageing Care Research Centre** (ACRC), with a potential investment of £15m. This work will focus on the research needed to address the issues of multi-morbidity in the ageing population, together with consideration of the changes required to the health and social care system. The activity will be taken forward through collaborative partnership working with other relevant institutions, and would be a key influencer in our work with the regions' Local Authorities and Health Boards.
- The **partnership between the University of Edinburgh and a large Chinese Institution** (registered on the Hong Kong stock exchange) to create an investment and revenue model that will see two Chinese academic innovation campuses directly linked to the University through data exchange. The initial area of focus will be on diabetes through the creation of an international centre that will link to a number of large Chinese hospitals (+3,000 beds each) to study patients' journeys and outcomes which will be underpinned by the successful research undertaken in Scotland, that has seen a 40% reduction in blindness and amputations is patients afflicted with diabetes. If this model can demonstrate a similar success, it is expected that it can be scaled across the country. This also affords an export opportunity for UK-owned SMEs.
- As part of a partnership with **Amazon Academy**, two world-leading centres at the University of Edinburgh, the Euan MacDonald Centre for Motor Neurone Disease Research and the Centre for Speech Technology Research, will create a new venture to translate the research developed within the Speak:Unique project whose ultimate ambition is for people to be able to use communication aids that speak for them in their own voice.

Whilst we intend to maximise access to these engagement opportunities to as many organisations as possible, they are most likely to occur where there is a compelling fit with the unique skills and capabilities of the University. Using the framework detailing action for the prevention, early detection and early intervention of type 2 diabetes[48] developed by the Scottish Government (see

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[48] https://www.gov.scot/publications/healthier-future-framework-prevention-early-detection-early-intervention-type-2/pages/7/

Figure 13b below) as an example, the following areas represent key areas of activity that are most likely to result in effective data-driven collaborations:

- Development of data-driven solutions supporting type 2 diabetes patients risk stratification and promotion;
- Design and evaluation of interventions tailored to their risk category.

Given the areas of opportunity highlighted in this example, we would expect to engage private sector organisations with capabilities in the following areas:

- International healthcare providers
- Health and social care data science and artificial intelligence;
- Healthcare econometrics;
- Specialist diabetes healthcare suppliers; and,
- Medical device companies.

Figure 13b: Industry engagement and pipeline
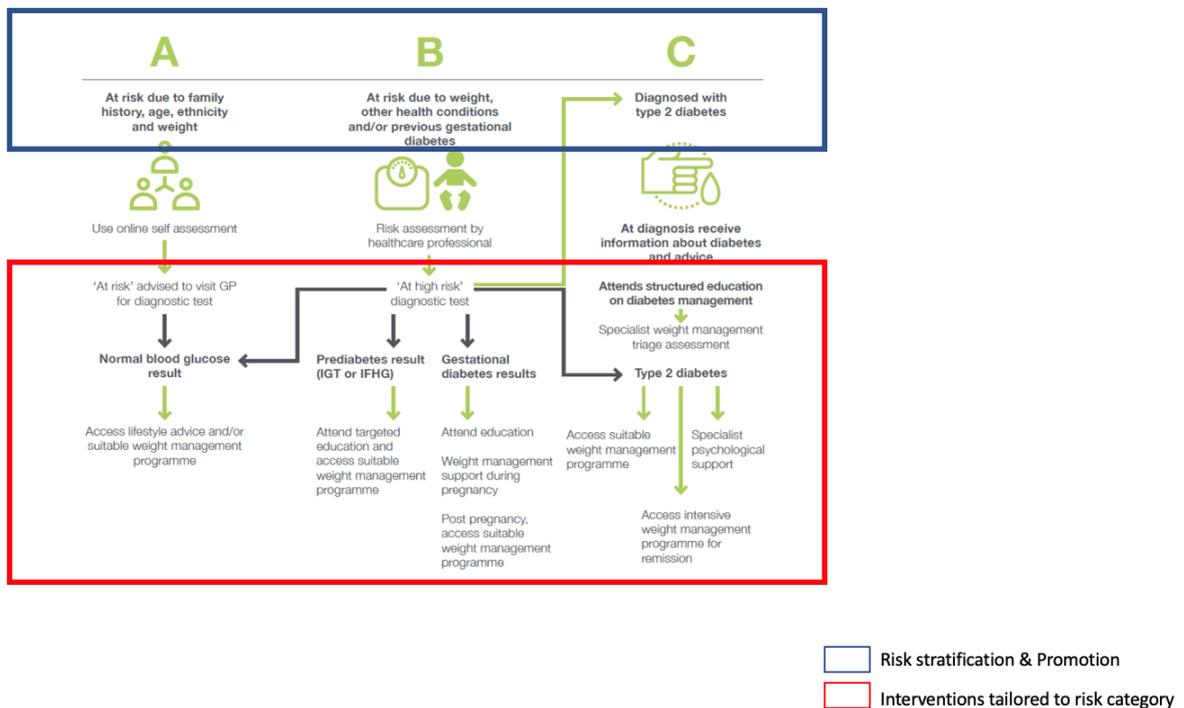
1.5 Strategic Asset Development

The new Usher Institute building presents a unique opportunity to establish the vision of a 'world class innovation hub', as an intrinsically healthy, smart building, facilitating research and innovation, with space for collaboration, engagement and a public focus.

It will be positioned centrally and prominently within Edinburgh BioQuarter[49], a leading destination for healthcare delivery, ground-breaking medical research, life sciences innovation and entrepreneurship.

It will be located in close proximity to NHS Lothian's Royal Infirmary of Edinburgh, a large teaching hospital, the Royal Hospital for Sick Children and several research centres, such as the Queen's Medical Research Institute (QMRI).[50] The new Edinburgh Medical School, a major investment from the University that is due to open in 2025, will be located opposite the Usher Institute.

The project is entering RIBA Stage 3 ('Developed Design') in summer 2019, and the proposed design aims to be a hard-working, healthy building that provides a variety of work settings and spaces that facilitate not only the current research and work practices, but also to serve the future aspirations of the Usher Institute (Figure 14).

Figure 14: Illustration of the exterior aspect of the new Usher Institute building

Designed to be a collaborative space for data-driven innovation, the ability to adapt is central to the design. This could be through the growth of a research centre or the establishment of a new start-up business within the partner workspaces.

The ability of the building to house and facilitate a diverse range of occupants is key to its success and the proposed population mix can be seen in Figure 15 overleaf.

[49] Edinburgh BioQuarter is a partnership between the University, Scottish Enterprise, NHS Lothian and the City of Edinburgh Council - https://edinburghbioquarter.com/about/our-partners/

[50] https://www.ed.ac.uk/medicine-vet-medicine/institutes-centres-facilities-networks/institutes-and-centres/queens-medical-research

600
Usher Institute staff and students, including academics, researchers, data scientists, visiting academics and professional services.

50
NHS Lothian Accord with the expectation that other health and social care sector bodies, including policy makers, will use the facility.

200
Allocation for space available to lease, encouraging industry partners to co-habit with Usher and NHS staff.

100
Co-working spaces for SMEs, including sector start-ups and scale-ups. This will also support the sector accelerator programme.

As can be seen in Figure 16 overleaf, the mixture of Usher Institute and partner workspaces will encourage cooperative working. The flow of users around the building will be through a series of hubs and common areas, reflecting the inclusive and collaborative values of the DDI Programme. As the Usher Institute has a strong focus on public health, the new building will aim to provide a healthy, active workplace and be representative of the Institute's values.

Figure 16: Blending of Usher Institute and partner spaces
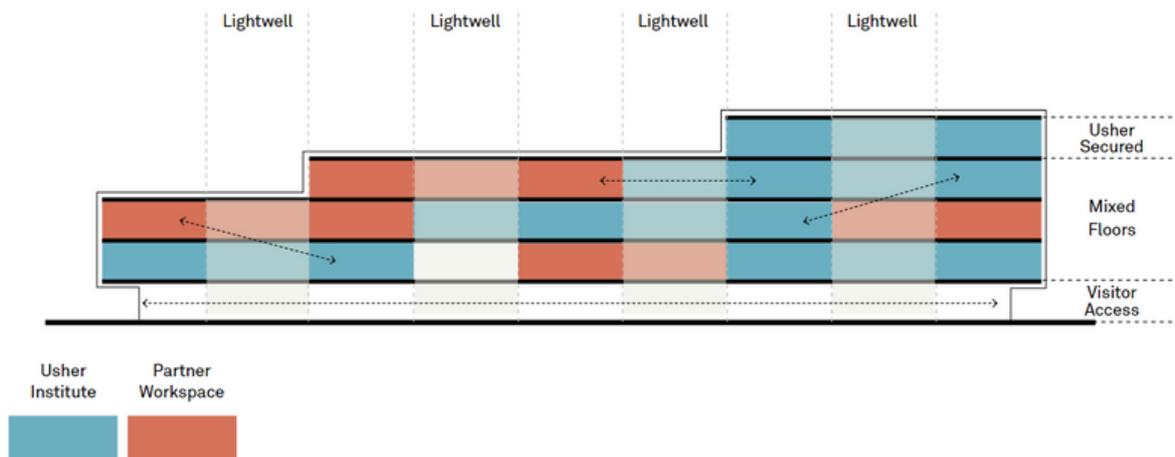
Both during the development and active use of the building, the local community will be an important focus. There will be an outreach room for public engagement and other public spaces that allow the Usher Institute to connect directly with the community.

For further details of the emerging building design see Output-Based Specification.

1.6 Usher Institute Target Outcomes – the "so what?"

Through the investment in capability, the effective organisation of resources to face the market and co-locating in a purpose-built facility, the University expects to make a substantial impact.

Table 3: the Usher Institute Key Performance Indicators (KPIs)

Theme	KPI	Incremental target 2017-32	Notes
Talent	Certified - Undergraduate	4,300 semester long courses taught	The College strategy is to embed data capability in elements of MBChB Medicine and other relevant UG programmes, such as Biomedical Sciences.
Talent	Certified - Postgraduate	510 FT and PT	Covers a range of part-time and full-time courses (incl. PhD), taken both on campus and online.
Talent	CPD (Non-Credit Bearing)	10,620	Includes Massive Open Online Courses (MOOCs) where certification is not purchased and non-CPD certified events attended by health & social care professionals.
Research	Research income	£138m	Income is forecast across public, private and third sector sources.
Adoption	Industry interaction income	£15.7m	Based on 283 industry projects over the lifetime of the programme and lease income for industry partners of circa £2m from 2022-32.
Adoption	CPD (Credit Bearing)	4,580	Focussed activity to develop DDI-related CPD to help relevant NHS and social care professionals realise the benefit of data.
Datasets	New TRADE datasets utilised	270	The DataLoch Programme is forecast to deliver wholly against this target.
Entrepreneurship	Company formations	49	This will be delivered by a number of activities, including the Edinburgh Innovations Accelerator programme

As illustrated, in Table below, over the 15 years of the DDI Programme, the Usher Institute will deliver a forecast net present value (NPV) of gross value added (GVA) of £412 million[51]. By applying the discounted public sector cost of £54.4 million, the UK Cost Benefit ratio is likely to be around 1 to 7.4.

Table 4: the Usher Institute GVA benefits

Benefit Ratio for Usher Institute based on Govt funding contribution: 1:5.6				
	City Region	**Rest of Scotland**	**Rest of UK**	**UK, as a Whole**
GVA (£ million)	118	57	237	412

Overall the DDI Programme, and associated risk profile, is affordable and capable of being self-sustaining over the longer term if capital costs are met in full by capital grant being requested here.

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[51] All benefit streams are captured over a fifteen year period except talent effects which, given the pervasive impact of DDI upon future productivity account for uplifts in graduate lifetime GVA (discounted back to present day values).

Both the capital investment and programme activities proposed can be accommodated within current University business procurement and estates management processes. The income and spend profiles are detailed in Table 5 below with revenue ramping up from 2022. Note that 2028 is the breakeven point.

Table 5: the University Usher Institute Income and Expenditure

£ million	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Totals
Income	1.2	1.9	2.9	4.8	7.1	8.8	10.5	12.8	15.0	17.3	19.2	21.9	22.6	23.1	23.7	192.9
Total expenditure	1.1	1.7	2.7	4.3	77	10.2	11.7	13.7	15.6	17.5	19.0	21.2	21.6	22.0	22.4	192.5
CRD contribution	0.6	3.3	8.4	9.5	20.1	6.6	0.7	-	-	-	-	-	-	-	-	49.2

1.7 Overall Summary

The Usher Institute, and the diverse range of groups and activities that it will host, is an ambitous and complex undertaking. It will be a catalyst for the transformation of health & social care in the City Region and beyond, leveraging world-class capabilities and simeultaneously driving improved outcomes for citizens and inclusive growth.