Edinburgh and South East of Scotland City Region Deal Joint Committee

10am, Monday 17 December 2018

World Class Data Infrastructure Project Business Case

Item number	4.3

Executive Summary

This report seeks approval to secure funding for, and enact, the World Class Data Infrastructure (WCDI) facility (that underpins the five Innovation Hubs, as part of the Data Driven Innovation Programme, as set out in the WCDI Business Case).

The preparation of this business case has been led by the University of Edinburgh (UoE) - on behalf of City Region Deal consortium partners - in accordance with the HM Treasury Green Book Five Cases model.

Hugh Edmiston

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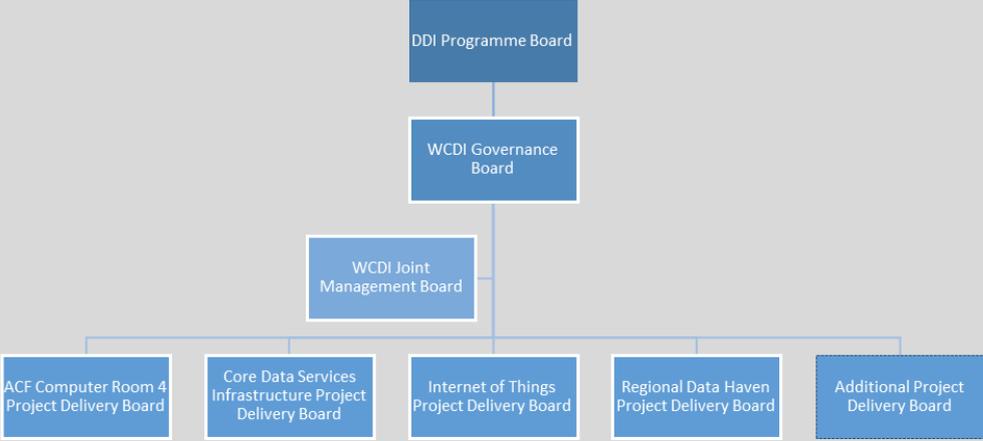E-mail: hugh.edmiston@ed.ac.uk |

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Report

City Region Deal Checklist

Criteria	Details/Link to Document
Contribution to City Region Deal commitments and Inclusive Growth Framework	The WCDI project (as part of the wider DDI Programme) is an innovation programme that supports the inclusive growth ambitions of the partnership including: • **Accelerating inclusive growth** through unlocking new talent pools for business, promoting fair work, and equipping disadvantaged citizens with the skills they need to succeed; • **Removing the barriers to growth** by putting in place intensive family support and targeted skills development to help disadvantaged individual access and progress in work; • **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** that builds workforce capacity and capability in the "Data Driven Innovation" and "Housing, Construction and Infrastructure" sectors; and, • **Social benefit through Innovation** through close working between the IRES and DDI programmes to fully utilise the technological (data visualisation insights) and employment opportunities that will be generated by the sector. 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"; and,* • **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, in the context of the WCDI project, robust, relevant and proportionate community benefits will be incorporated in future procurements of £4million and above, and will be considered in regulated procurements below £4million at strategy stage (i.e. at £50,000 and above).

Criteria	Details/Link to Document
	Where community benefit requirements are included in a WCDI 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.
Alignment, integration with, or dependence on, other City Region Deal activities	The WCDI project provides the underpinning technological base for all DDI Programme activities delivered via the other DDI projects.
Scale and regional distribution of expected outcomes, benefits, and leverage, from activity	The WCDI represents a practical, flexible and cost-effective approach to the delivery of the diverse technological requirements for the five Innovation Hubs of the DDI Programme. The WCDI will develop the most cost-effective, performant, flexible data infrastructure of any region in Europe to allow public and private data to be used in a multitude of ways to develop the Edinburgh City Region into the Data Capital of Europe. The region will benefit from the creation of a regional civic data haven, providing different levels of data access, including an open data store[1] and secure data safe havens for more sensitive data for research, from both the public and private sector. Aligned to the creation of the Regional Data Haven will be an investment in Smart data assembly. This will deliver the capability to access data from existing legacy systems used across the City Region, and to look at innovations around the capture of data supported and supporting collaborative research and service redesign approaches. A range of capital investments in middleware or other data tools and expertise will be undertaken to unlock the data from existing system configurations. As part of this, the region will benefit from the deployment of a LPWAN-based IoT platform and network, covering an area of approximately 7,780 square kilometres. The primary hosts for LoRaWAN gateways within each locality outside of the central city of Edinburgh will be higher and further education establishments and secondary schools, who will have access to the network for educational purposes.
Compliance with financial requirements and agreed expenditure profile	This business case is specifically seeking £80 million towards the £110 million WCDI capital investment.
Equalities Impact	The DDI programme of work sits within the Equalities framework laid out by the Edinburgh and South East Scotland City Region Deal, through its Inclusive Growth Framework, which has five key themes aimed at accelerating inclusive growth and

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[1] WCDI will act as a Regional Hub for Open Data, supporting easier access to this data.

Criteria	Details/Link to Document
	social benefit through innovation, with specific regard to minorities and disadvantaged population groups. The University of Edinburgh 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, an equalities screening will be carried out to ensure that these issues are raised and addressed from project inception through to delivery and evaluation.
Anticipated significant risks and mitigation measures	A risk and mitigation approach has been prepared, and will be updated as the programme develops. The top 4 (current) risks and mitigation approaches are illustrated below: | Risk	Mitigation
Capital project risks	Build in adequate contingencies and apply good procurement practices.
Ability to demonstrate sustainable income generation	Prudent financial analysis with recognition that opportunities may exist to improve the base case position through wider fund-raising, such as targeting philanthropic donations from businesses and individuals supported by the University, or seeking returns from investment in successful spin-outs.
Major data loss from WCDI	Ensure adequate security precautions and limit damage via data encryption.
Negative PR associated with City Region Deal expenditure	Develop communications strategy in line with and a part of overall Programme communications and marketing.	
Alignment and fit with City Region Deal governance arrangement	WCDI Governance, as agreed 7 August 2018, is aligned with the City Region Deal under the DDI Programme Board. The Board is responsible for commissioning the WCDI investment including establishing the WCDI and defining the key resources, financial and KPI delivery parameters within which the WCDI will operate. The WCDI Governance Board is responsible for the overall direction and management of the WCDI activities described in this document. As such, it is ultimately accountable for the success of WCDI and providing unified direction to

Criteria	Details/Link to Document
	the project.
PMO check	All evidence provided.
Government approval	UK and Scottish Government approved the final business case on 29 November 2018.
Partner sign-off	The business case is expected to be approved by the Joint Committee on 17 December 2018.
Advisory Board sign off	The business case was approved by the DDI Delivery Board on 29 November 2018.
Executive Board sign off	The business case was approved by the Executive Board on 22 November 2018.
PMO Recommendation	That Committee approves the implementation of the WCDI programme as set out in this business case.

Report

World Class Data Infrastructure Business Case

1. Recommendations

1.1 To approve the WCDI 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 WCDI will be approved separately by the DDI Delivery Board and reported to the Joint Committee.

2. Background

2.1 As detailed at in the attached project description appendix the Edinburgh and South East Scotland Science and Innovation Audit (SIA), published in November 2016 detailed how the ability to collect, store and analyse data from an array of diverse sources will become increasingly important in driving economic growth, social change and public services. By harnessing this challenge, a Data-Driven Innovation (DDI) Programme was established to ensure that the city region can become the Data Capital of Europe.

2.2 Within the DDI programme there are five data-driven innovation research, development and innovation sectoral hubs: Bayes Centre; National Robotarium; Edinburgh Futures Institute; Usher Institute; and Easter Bush, which each draw upon the World Class Data Infrastructure (WCDI) project to provide the required underpinning data capability, computing and data storage infrastructure.

2.3 To support the development and operation of the five Innovation Hubs, that form the DDI Programme, the programme has designed a shared infrastructure, the WCDI.

2.4 Through this business case, the University of Edinburgh seeks approval for capital investment of £110 million, of which UK and Scottish Governments are asked to fund £80 million in total for the WCDI build.

2.5 This Business Case has been endorsed by UK and Scottish Governments and is now presented to the Joint Committee for approval.

3. Main report

3.1 We are now entering an era when the generation, collection, analysis and monetisation of huge 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 behaviour. Whilst data has become ubiquitous, the challenges for all organisations are

to use this 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) and is the focus of this outline business case.

3.2 As evidenced in a wide variety of Scottish and UK Government policy documents, and in publications by the OECD and global consultancies, Data-Driven Innovation has become a key pillar of 21st century growth with potential to significantly enhance; productivity, resource efficiency, economic competitiveness and social wellbeing. The Edinburgh and South East Scotland Science and Innovation Audit (SIA) identified for the region, in broad terms, that:

- It already is a powerhouse in Data-Driven innovation with a fast growing cluster;

- Growth is at a tipping point and requires further investment to meet demand; and,

- There are a number of industry sectors that are key to the local economy and which align to national areas of focus and opportunity, providing an opportunity for inclusive growth.

3.3 The vision is for Edinburgh to be recognised as a world leader in Data Science. It will do this by playing to its strengths in education and research and boosting commercial activity. Furthermore, it will enable these activities to maximum effect by creating a hub for informatics and data-driven innovation activity within the region thus driving further development and growth in inter-disciplinary and translational data-driven research.

3.4 In order to deliver this ambitious programme for growth, there is a need for the university to invest in high performance computing, data analytics services and IoT that can act as a catalyst for the Data Driven Innovation Programme, enabling the growth of new talent, research, adoption and entrepreneurship, all focused on data.

3.5 The city region has a long history of data excellence and leadership, including the largest computing school in Europe – the UoE School of Informatics, the UK's principal super-computing facility - the Edinburgh Parallel Computing Centre (EPCC) and the largest concentration of internationally significant and world-leading informatics research, in the UK.

3.6 Moreover, in the last four years, the local DDI capability has grown significantly as multiple new initiatives within data science, IoT and analytical capabilities areas have been secured. The city region hosts Scotland-wide initiatives like the Data Lab, the Farr Institute, the Centre of Excellence for Cyber Security Research, and Administrative Data Research Centre, as well as hosting four doctoral training programmes in Data, Robotics, Systems and Analysis.

3.7 The City Region already hosts the UK's most successful computing start-up community around a university and has joined an elite group of key UK universities in data science. However, there are a number of existing challenges for the delivery of future growth

industries, led by data, across the existing infrastructure. These challenges fall largely into two categories:

- **Capacity**: a significant number of sectors display similar patterns of capacity constraint, when it comes to testing and adopting new approaches around data. This relates to the effort required to identify relevant data sets, wrangle them into a state that allows for use and the technical capacity to test value propositions at a low cost of entry; and

- **Capability**: as with the capacity challenges, there are a number of capability constraints facing the city region, particularly in new and emerging fields of analytics. This relates to the techniques and practices required to identify relevant data sets, the expertise to manipulate these into a workable state and to extract value from them.

3.8 The capital investment will enable the region to establish a strong position to flourish in new, data-driven markets by providing the right infrastructure to deliver the programme objectives of the DDI Programme and provide the right conditions for future business growth across the region.

3.9 Underpinning the existing success and reputation of the city region are well-established **TRADE** (i.e. **T**alent, **R**esearch, **A**doption, **D**atasets, and **E**ntrepreneurship) strengths, although these require further development and organised focus. Additionally, considering the delivery of the DDI programme across the region, infrastructure needs to be built to support these activities over the upcoming programme of work.

3.10 The University of Edinburgh has an excellent platform and opportunity from which to grow and consolidate for the future, but investment is required to, robustly, respond to the DDI opportunity. The SIA highlighted the early investments in IoT infrastructure, data and interpretation, that have been made to develop the current critical national infrastructure, but it recognises that the importance for maintaining the data infrastructure cannot be overstated.

3.11 Given the SIA findings, that University of Edinburgh is aligned nationally and has a local strength in DDI, the WCDI business case proposes an overall investment of £110m to develop the world-class data infrastructure required to deliver the programme for growth across the Edinburgh and South East Scotland city region. The significant capital required by this business case, will provide six core components, all of which are intrinsically linked in the delivery of the DDI programmes of activity:

- **Regional Data Haven**: infrastructure to provide a data store for public and private sector data and the integration, combination and leveraging of private/public data for programme purposes.

- **Regional Internet of Things (IoT) network**: a regional IoT innovation network operating at scale i.e. 100,000 sensors deployed to meet the needs of different sectors and develop new services.
- **Smart data assembly**: enabling connectivity to legacy public data systems to support the Regional Data Haven.
- **Data services and analytics capability**: software to enable the region access to the best tools available to operate against the data available in the World Class Data Infrastructure platform.
- **Resilient data compute, networking and storage**: expand the data-hosting environment of the ACF and the necessary IT equipment to support the transformation of data into value.
- **Dedicated Computer Room**: a new data centre room and associated plant room to extend the ACF to house the WCDI IT equipment and IT systems from other stakeholders from the public and private sector.

3.12 In summary, the World Class Data Infrastructure (WCDI) project will provide the enabling data infrastructure platform for the Data Driven Innovation (DDI) Programme. The DDI Programme requires an extremely powerful, high capacity and flexible infrastructure capable of responsive delivery of an expanding array of complex and bespoke data and analytical services.

3.13 By leveraging prior investments in the Edinburgh Parallel Computing Centre (EPCC), and specifically its Advanced Computing Facility (ACF), WCDI represents a practical, flexible and cost-effective approach to the delivery of the diverse technological requirements of the DDI Programme.

3.14 WCDI will be constructed, equipped and delivered by the University of Edinburgh, and will be made available for use to all parties engaged with the DDI Programme. As an enabling investment, WCDI is not directly accountable for DDI Programme outputs rather it will provide the enabling technology infrastructure through which **TRADE** outputs – identified in all the other DDI Business Cases - will be achieved.

4.   Financial impact

4.1   Through this business case UoE seeks approval for capital investment of £110 million (of which Government is asked to fund £80 million) for the WCDI.

4.2   The commitment and continuation of funding will be subject to the approval of detailed Project Propositions by the DDI Delivery Board and will be subject to the projects demonstrating satisfactory progress against agreed objectives and targets.

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 the DDI programme and wider inclusive growth goals.

5.   Equalities impact

5.1   The WCDI will support all Hub activities to improve the flow of disadvantaged individuals into good employment and careers across various objectives:

- Be central to maximising the value of City Region Deal investments by delivering the workforce element;

- Future proof the regional economy through stimulating a positive step change in equality, capacity and productivity;

- Encourage meaningful participation by stakeholders in designing and delivering services and interventions;

- Provide opportunities to strengthen career progression routes for those who face significant labour market disadvantage; and,

- Seek to address poverty and social exclusion by increasing the financial awareness, capacity and inclusion of the most disadvantaged households.

6.   Background reading/external references

- [Edinburgh and South East Scotland City Region Deal Document](): August 2018

7.   Appendices

Appendix 1: WCDI Project Summary

Appendix 1: World Class Data Infrastructure Project Summary

Overview

This is the Business Case for Investment (BCI)[1] in a World Class Data Infrastructure (WCDI), the foundation component of the Data Driven Innovation (DDI) Programme, an integral part of the Edinburgh and South East Scotland City Deal investment proposition.

This business case has been developed by the City Deal consortium partners, in accordance with the HM Treasury Green Book Five Cases model. This business case is specifically seeking £80 million towards the £110 million capital investment in WCDI.

Strategic Intent

WCDI is the enabling data infrastructure platform. To achieve the target outcomes of the various DDI programme delivery projects requires an extremely powerful, high capacity and flexible data infrastructure capable of responsive and secure delivery of an expanding array of complex and bespoke data and analytical services spanning the DDI programme and its multiple industry sectors.
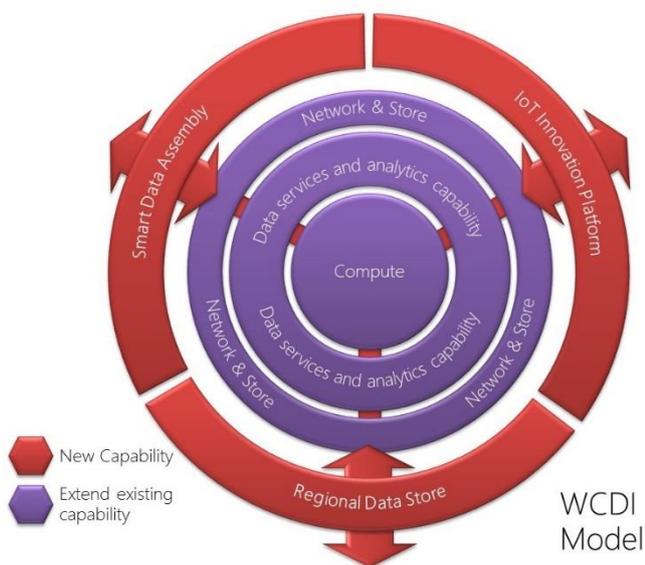
The DDI Programme – and its private, public and third sector stakeholders - will demand a level of service (e.g. resiliency to the loss of power, redundancy of equipment to mitigate the impact of sudden failures) that is not normally required for research computing applications and is not currently supported by existing facilities.

Figure 1: WCDI Model - Explained

What will be Different?

By leveraging prior investments in the recognised national research asset of the *Edinburgh Parallel Computing Centre* (EPCC), and specifically its *Advanced Computing Facility* (ACF), WCDI represents a practical, flexible and cost-effective approach to the delivery of the diverse technological requirements for the five Innovation Hubs of the DDI Programme.

We will build on the world class infrastructure the ACF provides in order to be cost effective. Sharing this capability and capacity in support of all five of the Innovation Hubs, utilising our knowledge and skills, our focussed capital investment will allow us to develop the most cost-effective, performant, flexible data innovation infrastructure of any region in

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[1] Equivalent to the OGC Outline Business Case: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

Europe. Our ambition is to develop this data infrastructure such that it allows public and private data to be used in a multitude of ways to develop the Edinburgh City Region into the Data Capital of Europe.

To address the requirements of its varied target sectors, the DDI Programme seeks to support DDI activities at scale. These activities require a range of data creation, analytics and secure storage capabilities that are not readily and cost-effectively available, across the five themes of innovation (Talent, Research, Adoption, Datasets and Entrepreneurship) within the DDI programme, in the City Region currently. As such, they represent significant barriers to increased levels of data utilisation by organisations.

To overcome these barriers the WCDI infrastructure will provide:

- **Regional Data Haven:** infrastructure to provide a data store for public and private sector data and the integration, combination and leveraging of private/public data for programme purposes;
- **Regional Internet of Things (IoT) network**: a regional IoT innovation network operating at scale i.e. circa 100,000 sensors deployed to meet the needs of different sectors and develop new services;
- **Smart data assembly**: enabling connectivity to legacy public data systems to support the Regional Data Haven;
- **Data services and analytics capability**: software to enable the region access to the best tools available to operate against the data available in the World Class Data Infrastructure platform; and,
- **Resilient data compute, networking and storage**: expand the data hosting environment of the ACF and the necessary IT equipment to support the transformation of data into value.
- **Dedicated Computer Room**: a new data centre room and associated plant room to extend the ACF to house the WCDI IT equipment and IT systems from other stakeholders from the public and private sector.

The region will benefit from the creation of a regional civic data haven, providing different levels of data access, including an open data store[2] and secure data safe havens for more sensitive data for research, from both the public and private sector.

Aligned to the creation of the Regional Data Haven will be an investment in Smart data assembly. This will deliver the capability to access data from existing legacy systems used across the City Region, and to look at innovations around the capture of data supported and supporting collaborative research and service redesign approaches. A range of capital investments in middleware or other data tools and expertise will be undertaken to unlock the data from existing system configurations.

As part of this the region will benefit from the deployment of a LPWAN based IoT platform and network, covering an area of approximately 7,780 square kilometres. The primary hosts for LoRaWAN gateways within each locality outside of the central city of Edinburgh will be higher and further education establishments and secondary schools, who will have access to the network for educational purposes.

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[2] WCDI will act as a Regional Hub for Open Data from City Deal partners, supporting easier access to this data.

The WCDI proposed investment will enable the programme outcomes by:

- Enabling the work of the Innovation Hubs (Bayes, Usher, EFI, Robotarium, Easter Bush) through the expansion of the range of innovative data service and analytical capabilities offered, building on the existing delivery of trusted data safe haven systems for handling sensitive public data within strong proven governance arrangements;
- Leveraging the local expertise in the management of complex data infrastructures and services, in the governance of the programme, and;
- Adding to the existing data storage and processing capacity of the Advanced Computing Facility as a national Data infrastructure asset.

In all of this, the focus is on ensuring that the right data infrastructure is in place to achieve the Programme thematic outcomes of Talent, Research, Adoption, Datasets and Entrepreneurship.

Through this capital investment, the World Class Data Infrastructure will provide an innovation platform that supports data access, data support & inclusive technologies that allow broad public and stakeholder engagement, and a capability to provide rapid scaling of projects to underpin the City Deal delivery programmes and their public and private sector partners.

In assessing the WCDI proposition, we have confirmed that on-going WCDI operation and associated risk profile is affordable, and is capable of being self-sustaining over the longer term if the initial capital costs are met in full by capital grant.

Delivering the DDI programme, underpinned by WCDI

Opportunity

We are now entering an era when the generation, collection, analysis and monetisation of huge 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 behaviour. Whilst data has become ubiquitous, the challenges for all organisations are to use this 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) and is the focus of this outline business case.

As evidenced in various Scottish and UK Government policy documents, and in publications by the OECD and global consultancies, Data-Driven Innovation has become a key pillar of 21st century growth with potential to significantly enhance; productivity, resource efficiency, economic competitiveness and social wellbeing. The Edinburgh and South East Scotland Science and Innovation Audit (SIA) identified for UoE, in broad terms, that:

- It already is a **powerhouse** in Data-Driven innovation with a fast growing cluster;
- Growth is at a **tipping point** and requires further investment to meet demand; and,
- There are a number of industry sectors that are key to the local economy, and which align to national areas of focus and opportunity, providing an opportunity for **inclusive growth**.

Vision

The University of Edinburgh's **vision** is to be a world leader in Data Science. It will do this by playing to its strengths in education and research and boosting its commercial activity. Furthermore, it will enable these activities to maximum effect by creating a hub for informatics and data-driven

innovation activity within the region thus driving further development and growth in inter-disciplinary and translational data-driven research. In order to deliver this ambitious programme for growth, there is a need for the university to invest in high performance computing, data analytics services and IoT that can act as a catalyst for the Data Driven Innovation Programme, enabling the growth of new talent, research, adoption and entrepreneurship, all focused on data.

Current Position – future growth restricted by the existing infrastructure

The city region has a long history of data excellence and leadership, including the largest computing school in Europe – the UoE School of Informatics, the UK's principal super-computing facility - the Edinburgh Parallel Computing Centre (EPCC) and the largest concentration of internationally significant and world-leading informatics research, in the UK.

Moreover, in the last four years, the local DDI capability has grown significantly as multiple new initiatives within data science, IoT and analytical capabilities areas have been secured. The city region hosts Scotland-wide initiatives like the Data Lab, the Farr Institute, the Centre of Excellence for Cyber Security Research, and Administrative Data Research Centre, as well as hosting four doctoral training programmes in Data, Robotics, Systems and Analysis. It hosts the UK's most successful computing start-up community around a university and has joined an elite group of key UK universities in data science. However, there are a number of existing challenges for the delivery of future growth industries, led by data, across the existing infrastructure. These challenges fall largely into two categories:

- **Capacity**: a significant number of sectors display similar patterns of capacity constraint, when it comes to testing and adopting new approaches around data. This relates to the effort required to identify relevant data sets, wrangle them into a state that allows for use and the technical capacity to test value propositions at a low cost of entry; and
- **Capability**: as with the capacity challenges, there are a number of capability constraints facing the city region, particularly in new and emerging fields of analytics. This relates to the techniques and practices required to identify relevant data sets, the expertise to manipulate these into a workable state and to extract value from them.

The capital investment will enable the region to establish a strong position to flourish in new, data-driven markets by providing the right infrastructure to deliver the programme objectives of the DDI Programme and provide the right conditions for future business growth across the region.

Underpinning the existing success and reputation of the city region are **well-established TRADE strengths**, although these require further development and organised focus. Additionally, considering the delivery of the DDI programme across the region, the infrastructure must be developed to support these activities over the upcoming programme of work. Figure 1 overleaf represents an indicative model of how the WCDI may be delivered.

Figure 1: WCDI Indicative Model
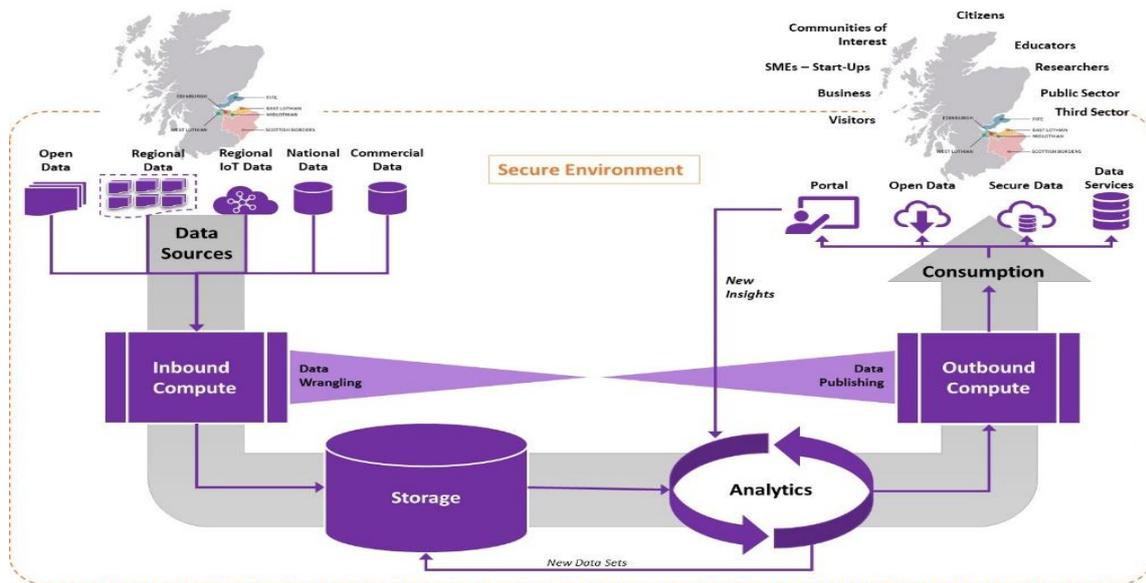
The University of Edinburgh has an excellent platform and opportunity from which to grow and consolidate for the future, but investment is needed to robustly respond to the DDI opportunity. The SIA highlighted the early investments in IoT infrastructure, data and interpretation that have been made to develop the current critical national infrastructure, but it recognises that the importance for maintaining the data infrastructure cannot be overstated.

How UoE will achieve its vision

Given the SIA findings that UoE is aligned nationally and has a local strength in DDI, this business case proposes an overall investment of **£110 million** to develop the world-class data infrastructure required to deliver the programme for growth across the Edinburgh city region. The significant capital required by this business case, will provide 6 core components, all of which are intrinsically linked in the delivery of the DDI programmes of activity:

- **Regional Data Haven:** infrastructure to provide a data store for public and private sector data and the integration, combination and leveraging of private/public data for programme purposes;
- **Regional Internet of Things (IoT) network**: a regional IoT innovation network operating at scale i.e. 100,000 sensors deployed to meet the needs of different sectors and develop new services;
- **Smart data assembly**: enabling connectivity to legacy public data systems to support the Regional Data Haven;
- **Data services and analytics capability**: software to enable the region access to the best tools available to operate against the data available in the World Class Data Infrastructure platform; and,
- **Resilient data compute, networking and storage**: expand the data hosting environment of the ACF and the necessary IT equipment to support the transformation of data into value.

- **Dedicated Computer Room**: a new data centre room and associated plant room to extend the ACF to house the WCDI IT equipment and IT systems from other stakeholders from the public and private sector.

Investing in and addressing core capabilities and gaps: TRADE

Through the SIA, it was recognised that strengthening the world-class infrastructure for data science research & teaching will help enhance the commercialisation of DDI activities. However, in order to grow and prepare for the future it needs to improve. These WCDI investments, totalling £110 million, will be managed and overseen through the WCDI Governance Board. The detail of this investment in TRADE activity is outlined below.

Talent: WCDI will provide the platform that will enable new training and skilling activities associated with the attraction, development and retention of a high volume, higher quality talent pipeline, covering pre-employment and post-employment. Students will be able to develop their talent through a range of "hands-on" activities whether these are credit bearing, extracurricular, Living Labs, or CPD. Sector based training and skilling activities, enabled by sector-based data (10 economic priority sectors) will enable the activities related to talent development to be much broader than is currently possible.

Acquisition of easy-to use intelligent analysis tools will enable these training and skilling activities to drive deeper into sectoral talent pools across both the private and public sector. WCDI will attract industry, delivering more activities associated with DDI projects that engage students to help them can gain experience, increasing inclusivity and employability. New courses in key emerging areas of data management technology including IoT (end-to-end from device build to data analysis), data management, data engineering, data science, deliverable remotely online.

Research: This will deliver a platform for a facility to access IoT infrastructure through Innovation Consortium membership. This will also include a secure facility to access data in the City Data Store. By strengthening the breadth and depth of our data assets and infrastructure we will strengthen our research activities, particularly those with a DDI component. By strengthening our data assets, we will strengthen our international collaborative activity, because data will increasingly become a crucial factor in the selection of international research consortia.

We will increase the level of DDI translational activities enabled by WCDI and increase industry and public sector participation. The WDCI will deliver a significant effort in attracting and retaining more research talent and improving the multidisciplinary DDI research activity.

Adoption: Scotland has a critical challenge to deliver effective matching of talent to industry adoption opportunities and projects. This will look to cover the effective use of the WCDI platform to enable the adoption efforts of companies and public sector organisations - our partners do not have access to these facilities, or the expertise necessary to build them and drive value from them.

By helping cluster organisations to where possible and delivering a series of engagement events and workshops, this will foster closer working relationships and dissemination of best practices, underpinned by the WCDI available. This work will also include, where appropriate, outreach to

schools, additional IoT network gateway placement, STEM learning activities (addition of IoT to Micro:Bit[3]).

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 need attention to make data sharing more accessible. 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 this data to be made more straightforward. The organisations and facilities hosted in the Bayes Centre, will be enabled by WCDI, to increase the City Region's ability to manage, access and utilise a vast pool of diverse data assets, and the associated value that it generates by:

- Regional Data Haven open data and secure data provision and access
- Data acquisition
- Data curation
- Data sharing
- Data integration
- Data ethics and Information Governance
- Design using data
- Marketplaces associated with data services

- Data partnerships
- Data management
- Data archiving
- Auditing the quality of data
- Data cataloguing
- Data analysis
- Data visualisation
- App development to exploit data

Entrepreneurship: The University has expanded and produced a number of new sectoral initiatives for Entrepreneurship using our DDI assets within WCDI. It has also delivered an expanded range of corporate partnerships associated with Entrepreneurships, enabled by increase deal flow. A strong pipeline is required to attract corporate capital and other forms of inward investment, while long-term relationships with entrepreneurs are essential due to assistance to scale-up via the talent pipeline and ongoing innovation capacity.

Many of the corporate partners involved in research and innovation require careful access to IoT infrastructure through Innovation Consortium membership. This would also extend to having appropriate access to data in the City Data Haven. The IoT Accelerator activity is a crucial element of this delivery, as it would utilise a variety of methods to assist in the acceleration of IoT focused company development, e.g. Linkage to CivTech® initiative.

Although there are a number of activities taking place to bring the ecosystem of data innovators together across the Edinburgh region, this work will not be possible without the appropriate infrastructure to support growth. As the city region continues to grow its growth pipeline by opening up EIE to company's outwith Scotland and further refining the number of sectors that companies can apply from, sectors such as IoT, energy, climate and cleantech, digital health, and robotics and autonomous systems, it all hinges on having the supporting infrastructure in place.

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[3] Micro:bit is a tiny programmable computer, designed to make learning and teaching easy and fun. See: http://www.microbit.org/

World Class Infrastructure Target Outcomes – the "so what"

Through significant investment in the infrastructure, the opportunities afforded by and the subsequent impact of the DDI programme will be significantly felt across the region.

Overall Summary

The WCDI is an ambitious and complex undertaking. It will provide a huge boost to innovation at scale in the region and beyond, leveraging world-class capabilities across the city to help drive inclusive growth.