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Enabling a World-Leading Regional Digital Economy through Data Driven Innovation

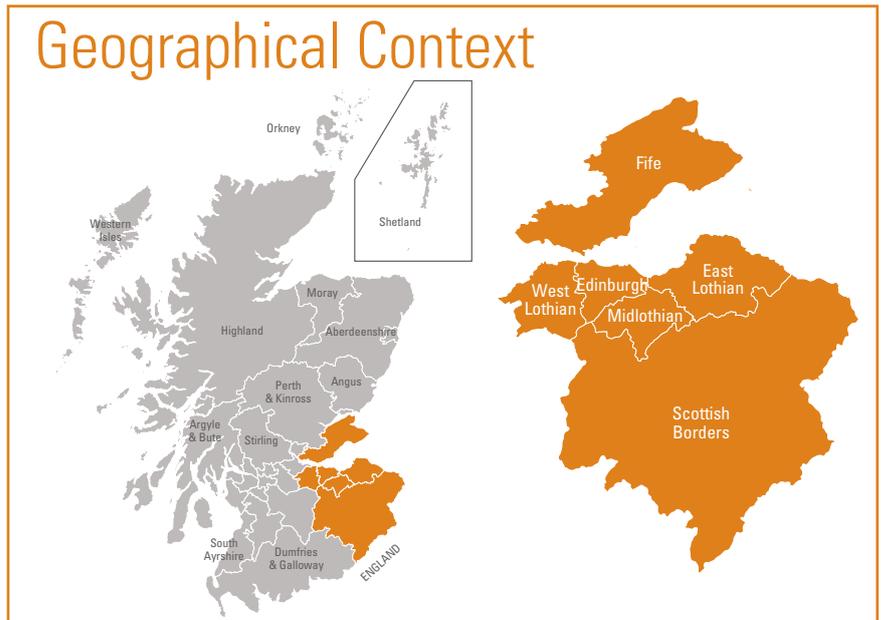
**Edinburgh & South East Scotland City Region
A Science and Innovation Audit Report sponsored by the
Department for Business, Energy & Industrial Strategy
SUMMARY REPORT**

Introduction

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 effectively to use this data to shape, develop and deliver innovative processes (including new digital products and services) to consumers and citizens. ***This is what we call Data Driven Innovation (DDI) and is the focus of our regional Science and Innovation Audit (SIA).***

Economic Development Context

In Autumn 2015 the UK Government announced SIAs to catalyse a new approach to regional economic development. In the Edinburgh and South East Scotland City Region (the City Region), we focused on our rapidly growing strength in Data-Driven Innovation (DDI). Here we summarise the key results from the SIA, including the challenges and the substantial opportunities for regional economic growth.



Market Context

The digital and data economy is growing 2-3 times faster than the economy overall¹. The Government's Shakespeare report (2013)² states that data and its manipulation lie at the heart of the next phase of the digital and data revolution. The importance of addressing critical shortages of digital and data skills has also been recognised by both Scottish and UK Governments³⁻⁸. Whilst the integration of digital within wider businesses is immature, in an open economy the only rational approach is early adoption and a commitment to benefit from these global forces. The primacy of investment in research, development, innovation and skills to improve productivity and economic growth is frequently highlighted⁹⁻¹⁰. Government reports call for action but stop short of providing specific proposals for investment. This SIA audited the digital and data science capabilities in the Edinburgh City Region. It provides clarity on our regional vision, the required investment priorities and the anticipated economic and societal benefits. We are poised to act to maximise the regional economy gains accruing from DDI.

Data-Driven Innovation Strengths

We have audited DDI, a key driver of the digital economy, in the Edinburgh City Region and have identified globally-competitive strengths on which we can build:

- A strong base of already-digital and data-ready businesses, including 2 'unicorns', and public sector organisations (e.g. 21,335 Digital Technology Economy Jobs in Edinburgh¹¹)
- A strong base of talent & skills delivered by outstanding universities (e.g. 15,205 STEM students in region¹²)
- A strong base of scientific research and associated infrastructure, including key data assets
- A strong track record in innovation & entrepreneurship that has created a vibrant ecosystem.

Case Study: Unicorn

Headquartered in Edinburgh, Skyscanner is a leading global travel planning and booking site used by 50 million people per month. Founded in 2003, Skyscanner now employs over 800 staff and its products are now available in over 30 languages and 70 currencies¹³.

"Skyscanner customers demand that we act locally. Our 400-strong Edinburgh team is, and will continue to be, a core hub for the company as we add data products for our consumers and the global flights industry." Alistair Hann, Technical Fellow



Case Study: Unicorn

FanDuel is an online fantasy sports game and the largest daily fantasy sports company. Launched in 2009, FanDuel has raised \$363 million funding and now employs over 400 staff across 5 offices in Scotland and the US¹⁴.

"The birth and explosive growth of FanDuel would not have been possible without early-stage support from the University of Edinburgh, Scottish Enterprise and Pentech Ventures coupled with the wealth of tech talent available in Scotland. We have recently launched our first ever product outside of North America - one-day fantasy football here in the UK and are continuing to develop our offerings and scale the business." Lesley Eccles, Co-Founder

Growth Opportunities

The ubiquitous and disruptive nature of DDI within the digital economy offers substantial opportunities for cross-sectoral GVA growth. We can achieve improved competitiveness by harnessing data and technology skills more effectively to increase productivity, "taking the handbrake off" our digital sector and boosting jobs. Examples include increasing the regional share of the growing Fintech marketplace, growing more global services companies from start-up to "Unicorns", and re-inventing processes for delivery of public sector services such as healthcare, transportation, civil infrastructure and Local Authority administration.

These opportunities are all enabled by focussing on the practical application of DDI across the economy to harness the increased productivity of a much broader data-savvy workforce. This will enable the delivery of transformational data-driven services with a high digital content. By addressing a wider workforce we can tackle the political, social, and human factors that have inhibited productivity growth. The opportunity for impact is robust and inclusive, embracing:

- providers and consumers of services, including customers and citizens
- all sectors of the economy (private, public and third)
- all scales of the economy, from start-ups to large corporates to Government. A key priority is continued investment in entrepreneurship activities to create and scale new companies, and align new services into the supply chains of existing large corporations and Government
- a wide range of key regional industries including creative/digital, financial and business services, life sciences, healthcare, tourism, energy and higher education.

Case Study: Global Technology Company

Founded in 2004, Amazon's 110-strong development centre in Edinburgh is part of a global team that invents and develops innovative products and solutions for Amazon's customers around the world. World class data scientists are at the heart of the solutions Amazon's team develops, using its unique data sets to provide the best products and services to its customers¹⁵.

"The unique skillset of our Edinburgh team contributes hugely to Amazon's ability to support its customers around the world. Our Edinburgh development centre reflects the world-class data science capability and talented individuals that live and work here. The quality of life offered in Scotland's capital city enables us to attract top talent from around the world, so that we can offer Silicon Valley jobs here in the heart of Edinburgh."

Graeme Smith, Managing Director, Amazon Development Centre (Scotland)

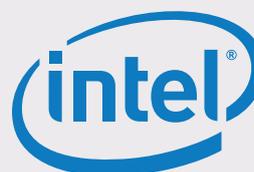


Case Study: Global Technology Company

As part of a strategic data science partnership with the Alan Turing Institute, Intel has established a processor design team in Edinburgh to feed new algorithms developed by the Institute into the design of future microprocessors¹⁶.

"By establishing a team in Edinburgh, and collaborating with the Turing Institute, we will be able to access to ground-breaking technology insights that will power future product designs."

Rod O'Shea, Intel EMEA Sales & Marketing Director



Our Vision for 2025-35

By 2025, the Edinburgh City Region will be home to a digital cluster that is the best in Europe in terms of its size and dynamism. It will be a location of choice for organisations that power services through data science, exceeding London, Berlin and Paris. Digital will touch everyone. The City Region will have taken a lead in embracing the opportunities of data driven innovation throughout the economy, in public, private and third sectors. Through a regional partnership we will:

- Make the City Region a global destination of choice for organisations that power services through the application of data science
- Create a trusted public-private-third sector partnership that will have secured £500 million of investment and unlocked economic opportunities worth in excess of £5 billion¹⁷, delivering 50,000 new jobs and a further 50,000 up-skilled jobs
- Deliver transformational efficiency gains across the public sector
- Exemplify a strategy for UK regional growth and data-driven societal prosperity.

In October 2015, the Organisation for Economic Co-operation and Development (OECD) published a report¹⁸ on data-driven innovation which found *"that countries could be getting much more out of data analytics in terms of economic and social gains if governments did more to encourage investment in Big Data and promote data sharing and reuse"*. These themes resonate strongly with our City Region's vision for 2025-35.

Gap Analysis

SITUATION	2025-35 AMBITION	GAPS & PRIORITIES
Regional growth strategy performing relatively poorly against UK and Europe with regard to productivity	A cohesive exemplar for UK regional growth and data-driven societal prosperity	Adoption Broad DDI adoption across the private and public sectors to take the brakes off regional growth
Growing UK digital cluster is limited by talent, access to data & investment	Global location of choice for DDI companies - powering regional growth and attracting investment from the UK and internationally	Research A globally competitive DDI talent pool trained in using high quality, diverse datasets and leveraging our world-class research
Data sharing is confined to specific sectors limiting levels of innovation and value realisation	Data sharing and re-use is ubiquitous within strong data governance models	Datasets Universal data sharing agreements within well defined ethical and practical standards
Fragmented entrepreneurship activities receiving limited investments	Trusted cross-sector partnership investing in DDI at scale to drive innovation and entrepreneurship	Entrepreneurship A Regional Data Science Innovation Cluster implementing a coherent entrepreneurship strategy
Public sector under extreme fiscal pressure and not realising efficiency gains	Public sector transformed through delivery of high efficiency DDI services	Talent Open Datasets and increased pool of talent & expertise to leverage service innovation within our major public sector organisations

Case Study: Aspiring Technology Company

Edinburgh-based Brainn Wave is a new start-up company aiming to provide a world-class data and services marketplace (Brainnwave) to customers and researchers seeking specific, up to the minute, high-value open and commercial data in specialist domains (e.g., energy, security, geospatial etc.)¹⁹.

"Our technology is built using leading edge research. This is not something we could have afforded on our own as a start-up. Scotland has built strong cross over ties between business and academia. We established our research team in Edinburgh as a result of the ease of doing business and engaging with our academic partners at the University of Edinburgh and the University of Glasgow. This has enabled us to accelerate our technology research and build upon state of the art science that has been built in research labs. This gives start-ups like Brainnwave the opportunity to have the equivalent research scale of any global company without the overhead cost."

Steve Coates, CEO



Case Study: Aspiring Technology Company

Quorate is a spin-out from the Centre for Speech Technology Research at Edinburgh University. Quorate has developed a highly adaptable Automatic Speech Recognition platform which is targeted towards natural-style speech. By training acoustic models on hundreds of hours of audio and language models on many billions of words, the system can be optimised for different domains and applications²⁰.

"Quorate continue to maintain close ties into the informatics research community. These relationships not only provide us with visibility over the latest potential advancements in our field, they also offer academics a powerful insight into the real-world problems that we solve for our customers in the financial services, media and aerospace sectors."

Nick Rankin, CEO



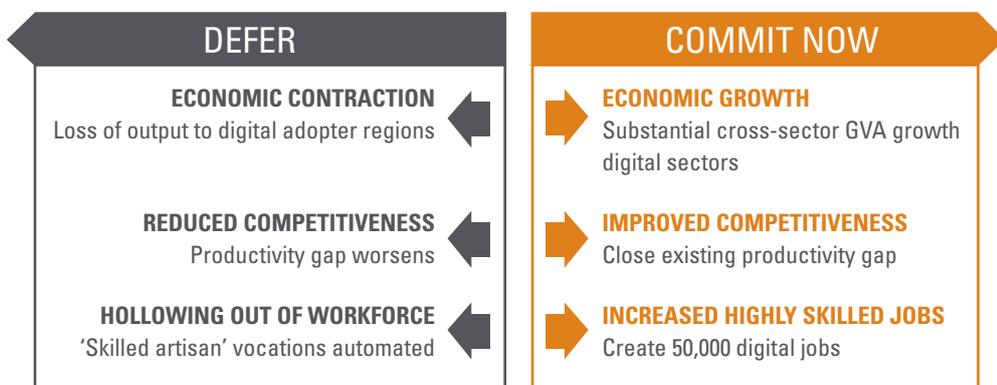
Networking and Collaboration

Our Consortium comprised all regional representative elements including Higher Education Institutions (led by the University of Edinburgh), local innovation organisations (The Data Lab, Interface), Scottish Enterprise, Local Authorities (led by the City of Edinburgh Council), Scotland IS (the trade body for digital ICT in Scotland) and business. The broad spectrum of networking and collaboration with business has been exemplified by the preceding six case studies. The SIA has already increased interactions between these partners. Specifically it has:

- catalysed deeper engagement between the Universities, industry and public sector partners around DDI and related themes such as innovation hubs, low carbon and Internet of Things networks.
- increased the intensity of collaboration within the University of Edinburgh, stimulating diverse multidisciplinary working across academic boundaries.
- supported implementation of a new operating model in which the University is more accessible, highly networked and open to a range of collaboration models with private and public sector partners that have spawned numerous high level company interactions. In turn, these have surfaced common interests between companies enabling the SIA team to broker new business-business contacts
- benefited from the existing networks and collaborations in two of our key DDI assets: the MRC Farr Institute in Scotland and the ESRC Administrative Data Research Centre (ADRC). The Farr is a collaboration between 6 Universities and NHS Scotland, working closely within a national Farr network in Wales, Manchester and London to create a UK network for data science and innovation in health and social care. ADRC Scotland promotes research on routinely collected administrative data (including geographical, social, economic, educational and governmental), bringing together social scientists and data scientists from 7 Universities with statisticians from Government organisations. Crucially, the Farr and ADRC have proven the efficacy of the model proposed in the SIA combining physical and e-infrastructure to facilitate collaboration whilst ensuring the trustworthy use of data.
- initiated engagement with student leaders who have responded positively to the new opportunities.
- strengthened relationships with Scotland IS and built new interactions, particularly in Fintech through Scottish Financial Enterprise (the trade body for Financial Services). We anticipate these new interactions, catalysed by the SIA, will endure.
- re-invigorated discussions with Scottish Enterprise.

The Tipping Point

The SIA leads to clear conclusions. The City Region is already a powerhouse of DDI activity. It is a significant cluster in the UK and is growing fast. However, this growth is at a tipping point. Without targeted investment the growth will stall. Investments made now will enable us to harness the disruptive potential of data science at which we already excel. However, the exact scope, scale and timing of these impacts remains unclear. The question we face is simple; is now the right time to commit fully to the DDI opportunity?



We have provided evidence that we must take concerted actions so that the City Region will benefit from the disruptive effects of DDI. If investment is deferred, we run the risk of losing both competitiveness and output to other digital clusters that have the confidence to invest. We also risk losing jobs in myriad parts of the economy as a result of automation extending into knowledge-intensive services. We recommend action now to mitigate these risks and fully realise the region's substantial potential.

Proposal

The SIA demonstrates a compelling business case for Regional transformation that will deliver tangible progress as soon as we can secure the necessary investment. Moving forward rapidly we propose to create a disruptive regional ecosystem that *unlocks value from public data and delivers sustainable gains in private sector activity, public sector transformation and digital skills*. We will do this through investment in a **Regional Data Science Innovation Cluster** comprising three closely-linked nodes which will bring together over 5,000 people from business, the public sector, academia and the community. With investment in this cluster we will harness our trusted existing partnerships across the public sector to create the foundation for a unique data-driven regional economy operating at a significant scale. Beyond the immediate opportunities for public sector efficiencies and reform, this will afford a substantial opportunity for industry to build on the already impressive technology cluster in the Edinburgh City Region. Specifically, we propose:

1. Stimulate innovation and entrepreneurship in the City Region by creating sector-focused open innovation locations bringing together industry, the public sector, students and academia in collaborative environments all underpinned by data and access to digital technologies. Partnership models will include business-to-business, business-to-public sector and business-to-academia, as well as creating opportunities for public sector ownership in private data-driven innovation companies and open innovation competitions.
2. Create value chains from sensors to data assets to research prototypes to new products and services.
3. Rapidly build a data-skilled workforce to support the growth and scaling up of the digital economy and regional private sector cluster. Our ambition is for every university student and suitable graduate in the regional workforce to be offered a "hands-on" data science or digital content course appropriate to their occupational ambition.
4. Facilitate collation, integration, analysis and interpretation of high volumes of regional data across a range of sectors, where previous cross-sector analysis has been disjointed or non-existent. Improved access to public sector data will enable better-informed policy decisions, and help Government to understand how to optimise the use of big data. Suitably governed, it will also offer a substrate for private sector innovation and growth.
5. Harness the University of Edinburgh's expertise in social science to develop a trusted social compact through public engagement and community involvement on the ethical use of data. The University is a global leader in this domain, having already developed a trusted "safe haven" where NHS, social science, research and government datasets are integrated for discovery and innovation.

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The cover image is from the Turing Suite by Sir Eduardo Paolozzi (1924-2005), one of the most versatile artists from Britain after 1945. Educated mainly in London and Paris, he always had strong ties to his hometown Edinburgh.

Alan Turing was an informatician who, in the 1930s, worked on the theory that brains are computational devices. He developed the Universal Turing Machine, helping fix the limits of mechanical computation; modern computers directly descend from his ideas. As well as being a key figure during the Second World War at Bletchley Park, Britain's code breaking centre, Turing is also considered the father of artificial intelligence, and the first computational biologist.

The Turing Suite portrays Turing's contribution at Bletchley Park. Paolozzi was interested in genius and wanted to depict Turing's work in deciphering the Enigma Code. The vivid colours evoke the intensity of Turing's inner vision of the natural world. Edinburgh's Informatics Forum houses one of the limited edition printsuits.