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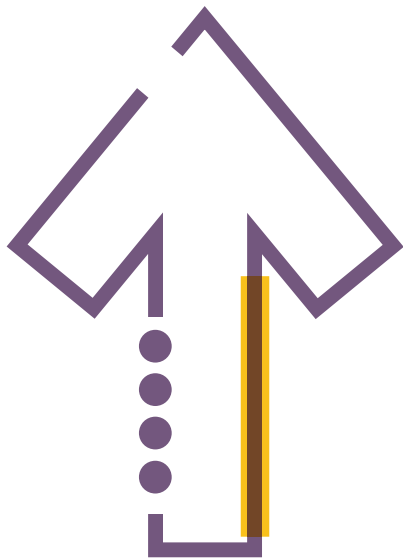
DDI Data-Driven Innovation

Part of the Edinburgh & South East Scotland City Region Deal

Development Opportunities in the Scottish Borders

Evolving Data-Driven Innovation and the Entrepreneurial Ecosystem

Preliminary Analysis Report

Development Opportunities in the Scottish Borders

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Foreword

For decades, the natural resources in the Scottish Borders fuelled the area's economy, from the waters of the River Tweed and its tributaries powering textile mills through to the fertile soils underpinning its farming. People continue to flock to the area for its rural beauty, either as tourists to enjoy its mountain biking and fishing, or as residents, drawn by its restored railway line and road links to Edinburgh.

Yet that same attractive countryside brings with it challenges. Small communities, separated by many miles, make it more difficult for businesses to find customers and for public services to be delivered – a growing issue as an ageing population requires greater access to health and care services.

That same rural isolation poses problems for entrepreneurs too. Innovators who love living in the Scottish Borders find it hard to connect with like-minded people who can support them and help to grow their businesses.

However, the fragmented nature of the area's population also creates an opportunity. Data-driven innovation (DDI) can help to connect these communities, not only by bridging the gaps created by geography but also by bringing together diverse sectors to share ideas and experiences that will help to grow the area's digital economy.

The Scottish Borders is in a unique position to access the help it needs to capitalise on this opportunity. The area is part of both the South East of Scotland City Region Deal and the Borderlands Inclusive Growth Deal, enabling it to access funding from multiple sources and – just as important – to forge links with partners either side of the border.

The coronavirus pandemic has shone a light on the importance of data. Entrepreneurs have harnessed digital technology to connect with peers throughout Scotland and further afield; the challenge now is to use those same tools and techniques to connect businesses and customers within the Scottish Borders and to plug the area into the wider national and international economy.

Scottish Borders Council, South of Scotland Enterprise, and other partners in the area have an opportunity to harness the city region's DDI programme to boost economic growth across sectors including food and drink, renewable energy, and tourism, and to deliver public services, from remote healthcare through to demand-led public transport. The city region deal allows the Scottish Borders to tap into expertise at the University of Edinburgh and link in with other universities and further education colleges throughout the region.

Harnessing DDI also presents opportunities to create the entrepreneurial infrastructure needed to boost the Scottish Borders' innovation ecosystem. Creating incubator and accelerator services, combining online and in-person support, will offer entrepreneurs the boost they need to create the jobs and wealth that will fund the delivery of public services.

DDI gives the Scottish Borders many of the tools it will need to fulfil its wider economic development goals, including through its green energy objectives and workforce mobility plans. Experts at the University of Edinburgh and in the wider entrepreneurial ecosystem stand ready to help the area achieve these objectives.

Jarmo Eskelinen
Executive Director, Data-Driven Innovation, University of Edinburgh/City Region Deal

Shona Haslam
Leader, Scottish Borders Council

Scottish Borders COUNCIL

Executive Summary

This report was commissioned to identify opportunities in the Scottish Borders for the development of Data-Driven Innovation (DDI) activities,[1] partnering with the Data-Driven Innovation Programme.

The Scottish Borders is part of both the Edinburgh and South East of Scotland City Region Deal (ESES CRD), and the Borderlands Inclusive Growth Deal. In addition, since April 2020, the newly founded economic development agency, South of Scotland Enterprise (SoSE), is working with Scottish Borders Council (SBC) and Dumfries and Galloway Council to develop a regional economic strategy.

The study's objectives were to:

Understand current innovation and entrepreneurial ecosystems in the Scottish Borders to evaluate options and identify opportunities and gaps; and

- Outline the alignment of existing and emerging interests and perceived gaps between the DDI programme and key private and public sector organisations in the Scottish Borders.

The work was conducted between July and October 2020 at a time of uncertainties and challenges related to Covid-19. First, the study team conducted a series of gap analyses relating to innovation, entrepreneurship and skills needs in the Scottish Borders by interviewing 30 representatives from the public and private sectors, including entrepreneurs and businesses' managers encompassing different industries. Second, we consulted key actors and partners engaged in DDI activities at the University of Edinburgh (UoE) and identified specific opportunities for DDI activities across the key sectors in the Scottish Borders.

To realise the DDI-related development for the inclusive growth agenda, SBC, SoSE and the partners need to agree on what they prioritise by fine-tuning the connections and building on existing initiatives.

Scottish Borders innovation and entrepreneurial ecosystems

The Scottish Borders is characterised by diverse geography and industry sectors. Its large rural geography with distributed infrastructure and aging population pose challenges in terms of economic development and welfare (health and social care). The economy is dominated by farming and tourism with some strengths in light manufacturing.

In 2013, the SBC published the Scottish Borders 2023 Economic Development Strategy, identifying "textiles, tourism, food and drink, renewables and creative" as key target industries. Approaches to economic development focused on: "creating the conditions for businesses to compete; building on assets; developing the workforce of the future and providing leadership". In recent years, given the growing visitor economy, there has been a renaissance in tourism, combined with new entrepreneurial and innovative opportunities such as mountain biking and increasing awareness of opportunities to support the sustainability agenda (e.g. energy, resources management).

Within the Scottish Borders, there are already existing innovation support capabilities. For example, in textiles, existing capabilities include the Centre of Excellence in Textiles in Hawick and School of Textiles and Design, Heriot-Watt University in Galashiels. The Mountain Bike Centre of Scotland (MTBCOS) has supported innovation in cycling since 2014. Under the Borderlands Inclusive Growth Deal, a new MTB Innovation Centre in Innerleithen has been planned in partnership with Scottish Cycling, Edinburgh Napier University, Borders College, Scottish Enterprise, SoSE and SBC. Furthermore, Borders College has also developed hubs for upskilling and reskilling: the STEM Hub at Hawick, the Tweedbank Construction Hub, and the Borders Technology Enhanced Care (BTEC) Hub in Galashiels.

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1 https://ddi.ac.uk/about-us-data-innovation/ The University of Edinburgh and Heriot-Watt University are delivering DDI activities.

There are many existing innovative firms and entrepreneurial start-ups in the Borders. Our interviews, however, indicate that many businesses feel disconnected from each other and that business support needs better coordination. In particular, to support the growth and survival of entrepreneurial businesses in the Scottish Borders, the evidence from existing entrepreneurs suggests that integrated support such as incubator services and mentoring would help businesses better access resources such as specialist knowledge, finance and human capital.

There are also wider questions linked to the inclusive growth agenda and connectivity issues in the Scottish Borders and across the City Region. Businesses and communities require specific support that meets their needs. Given the dispersed nature of the geography and distance to urban centres, innovative and creative solutions are needed to improve physical infrastructure and connectivity by utilising existing hubs and facilities in the region, better connecting entrepreneurial networks and coordinating resources and training opportunities available elsewhere in Scotland. There is momentum for SBC and SoSE to collaborate with other partners in the City Region and the Borderlands by fine-tuning the way these organisations work together for economic recovery and regional growth by developing innovative way to improve such infrastructure, connectivity and networks.

Proposed DDI opportunities

Five specific opportunity areas were identified for DDI activities aligned with key economic sectors identified in the Scottish Borders Economic Development Strategy:

- **Tourism**

- **Health and social care**

- **Advanced manufacturing**

- **Energy**

- **Agriculture**

We present the following five opportunities with specific clusters of expertise that the DDI and CRD partners can deploy in the Scottish Borders. Our first recommendation is for SBC, SoSE, and other partners in the region to decide their priority areas to pursue, create a clear strategy and establish a plan to develop DDI activities aligned with the place-based needs and key priority sectors.

- **Digitally integrated destinations (data integration, mobility as a service, hybrid virtual and augmented reality experiences, digital twins, etc.)**

- **Predictive and responsive wellbeing technologies (data analytics, wearable technologies, digital support and assistance, etc.)**

- **Smart high-added-value manufacturing (design informatics, textiles, mountain bike research and development (R&D), etc.)**

- **Energy-efficient infrastructure (construction, renewables, zero-carbon transport etc.)**

- **Autonomous systems for resources and assets management (remote sensing, robotics in agriculture, renewables management, etc.)**

The ESES CRD and Borderlands Growth Deal will provide opportunities to address the perceived gaps in digital skills provision and provide a stronger foundation for addressing inclusive growth agenda and the region's existing societal challenges.
In line with the DDI Programme objectives,[2] we recommend talent development through training and skills provisions in collaboration between UoE and Borders College. The focus should be on data skills and digital up-skilling for both traditionally dominant economic sectors and emerging sectors. We recommend the university increase its direct contacts, visibility and physical presence in the Scottish Borders, by utilising existing networks (e.g. Interface) and building on the work of sector leads and business development managers to work on raising awareness to local businesses and organisations about wider DDI opportunities. The following areas for collaboration are highlighted for SBC, SoSE and other partners to consider:

Align existing local infrastructure and assets with addressing digital skills gaps and green energy agendas (e.g. ESES CRD Workforce Mobility project; Borderlands Master Energy Plan)

- Collect data to widen participation, increase retention of students after graduation, and support diversity and inclusion in apprenticeships and other training opportunities in communities; and

- Encourage smarter use of procurement data for regional economic impact and innovation.

We encourage the formation of a standing working group on DDI for Scottish Borders Economic Development (DDI-SBED), where the opportunities identified in this report can be explored further and a stable collaboration framework established.

2 The key areas of DDI programme include: **talent, research, adoption, data** and **entrepreneurship**.

Introduction

Scottish Border Council (SBC) is committed to supporting two City/Growth Deals – the Edinburgh and South East Scotland (ESES) City Region Deal (CRD), and the Borderlands Inclusive Growth Deal. In this study, we will mainly focus on the ESES City Region Deal, however, we highlight potential synergies between the two Deals. Since April 2020, the newly founded economic development agency, South of Scotland Enterprise (SoSE),[3] is working with SBC to develop regional economic development capabilities.

The Data-Driven Innovation (DDI) Programme is part of the Edinburgh and South East Scotland City Region Deal (ESES CRD). At its core, is a mission to help organisations and individuals benefit from cutting-edge research and development in the generation, storage, analysis and use of various forms of data. The DDI programme aims to "help establish the region as the data capital of Europe, drawing in inward investment, fuelling entrepreneurship and delivering inclusive economic growth". Aligned to this is the Integrated Regional Employability and Skills (IRES) Programme, which includes a DDI theme to improve digital skills through working with schools, further and higher education, employers, and training providers.

This study specifically analyses some of the emerging opportunities for developing the academic, commercial and civic collaboration between the DDI Programme and partners and stakeholders in the Scottish Borders around DDI. In particular, this report addresses this in the context of the ambitions of the overarching economic development and inclusive growth agenda. In the Scottish Borders, there are some higher education institutions (HEIs) present: Heriot Watt University shares a campus in Galashiels, and Scottish Rural University College (SRUC) has some facilities in the region. Borders College is a key local skills provider, having campuses in Hawick and Galashiels. Heriot-Watt University has a campus in Galashiels with the School of Textiles and Design. The University of Edinburgh has collaboration with SRUC and is developing collaborative activities with Borders College.

This report presents the findings of the study based on a series of interviews conducted between July and October 2020 at a time of uncertainties and challenges related to Covid-19. First, in order to understand the current innovation and entrepreneurial ecosystems at work, the study team interviewed 30 key stakeholders covering industry, academic and governmental sectors, including entrepreneurs and representatives of businesses of different sizes and industries. Second, based on the interview findings and further consultation, the study team identified the alignment of existing and emerging interests and perceived gaps between the DDI programme and key private and public sectors in the Scottish Borders. As the background context of this study, the geographical and industrial profiles of businesses in the Scottish Borders and their economic activities were analysed drawing on a number of secondary data sources (e.g. Fame database, ONS data, Regional Skills Assessment). Following an overview of the interview findings, we identify gaps and opportunities in the Scottish Borders entrepreneurial and innovation ecosystems. The report then presents the key economic sectors in the Scottish Borders matched with the University of Edinburgh's key DDI capability; it identifies the existing and emerging alignment of interests between the DDI activities and key private and public sectors. We evaluate options and identify opportunities and gaps, and conclude by recommending possible next steps.

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3 https://www.southofscotlandenterprise.com/
4 See https://ddi.ac.uk/ for more information. [all online sources were accessed as of 6 November 2020]
5 See http://esescityregiondeal.org.uk/

The geographic and demographic profile of the Scottish Borders

Scottish Borders is a region in the South Eastern part of Scotland, south of the capital city of Edinburgh.
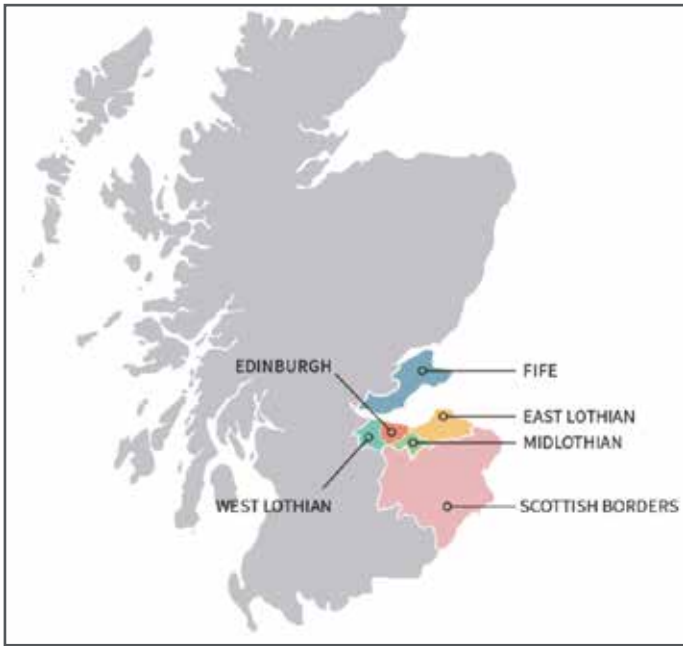

Fig 1 – Scottish Borders and the Edinburgh and South East Scotland City Region. Source: http://esescityregiondeal.org.uk/

Scottish Borders covers an area of 1,827 square miles (4,732 km^2) with a population of 115,510[6]. This gives a population density of 63/square mile (24/km^2), making the Scottish Borders the sixth largest council by land area and the seventh least densely populated. This large administrative area was created in 1975, with the merger of parts of five historic Scottish counties into a two-tier region, and later a unitary authority in the 1990s.

There are big differences between the northern part of the Scottish Borders with its links to Edinburgh, and the small towns and villages along the Tweed Valley or coastal villages in Berwickshire. It borders East, West and Mid- Lothian and the City of Edinburgh Council areas to the north, South Lanarkshire and Dumfries and Galloway to the West and the English counties of Cumbria and Northumberland to the south. It also has a short coast line between the holms of Lumberton and Cove. The area is a key route south from Edinburgh, with the A1 (along the east coast), the A7 (towards south-west and the M6) and the A68 (across the middle of the Scottish Borders).

There is one main east to west connection, the A72. Railways run along similar routes, the east coast main line in the east, the Borders Railway down the middle (to Tweedbank only) and the west coast main line to the west (although it skirts outside the Scottish Borders area)

Fig 2 – The geographical layout of the Scottish Borders, using satellite image. Source: NASA/ESA via Google Maps.

Scottish Borders has an ageing population, with the older age groups (65+) projected to nearly double in size by 2035 (from a 2010 baseline, see Table 1 below). Critical issues related to this trend are the increasing need for adult social care services, as well as a drop in working-age population (also projected at 10-20% in the same time period), leading to lower tax returns and fewer available workers to support expansion of health and social care provision.

Age group	2018	2028	% change	Scotland % change
All people	115,270	116,435	1.0	1.8
0 to 15	19,046	17,842	-6.3	-6.0
16 to 24	10,238	10,298	0.6	-0.9
25 to 44	22,325	23,207	4.0	3.1
45 to 64	35,558	31,726	-10.8	-5.5
65 to 74	15,863	17,499	10.3	14.4
75 and over	12,240	15,863	29.6	25.4

Table 1 – Projected population change by age group, Scottish Borders, 2018 and 2028. Source: Sub-National Population Projections (2018-based)

6 https://statistics.gov.scot/atlas/resource?uri=http%3A%2F%2Fstatistics.gov.scot%2Fid%2Fstatistical-geography%2FS12000026&collection-uri=http%3A%2F%2Fstatistics.gov.scot%2Fdef%2Ffoi%2Fcollection%2Fcouncil-areas

Scottish Borders' economy

In terms of economic activity, extraction of natural resources, agriculture and textile manufacturing were the traditional domains until the 20th century. The latter in particular has a world-renowned heritage in the textile mills along the River Tweed. However, globalisation and deindustrialisation has hit the region hard, with the decline of the traditional industries and lack of inward investment in new opportunities.

Though the Scottish Borders have had a brief industrial revival as part of the Silicon Glen electronic industry surge in the central belt of Scotland in the 1980s and 1990s, this too has since depleted. Like the rest of Scotland, the Scottish Borders has experienced a succession of closures and redundancies in manufacturing over the past few decades. A long-term decline in agricultural employment is going alongside the growth in tourism, which has been one of the few sources of new employment, sometimes through the diversification of farm businesses.

Although there are successful and innovative businesses in the region, the public sector is the largest source of secure and relatively well-paid jobs. More recently, new opportunities have emerged in renewable energy, tourism and in the revival of (high-added-value) textile manufacturing (see Figure 3 for sectoral breakdown of Scottish Borders businesses).
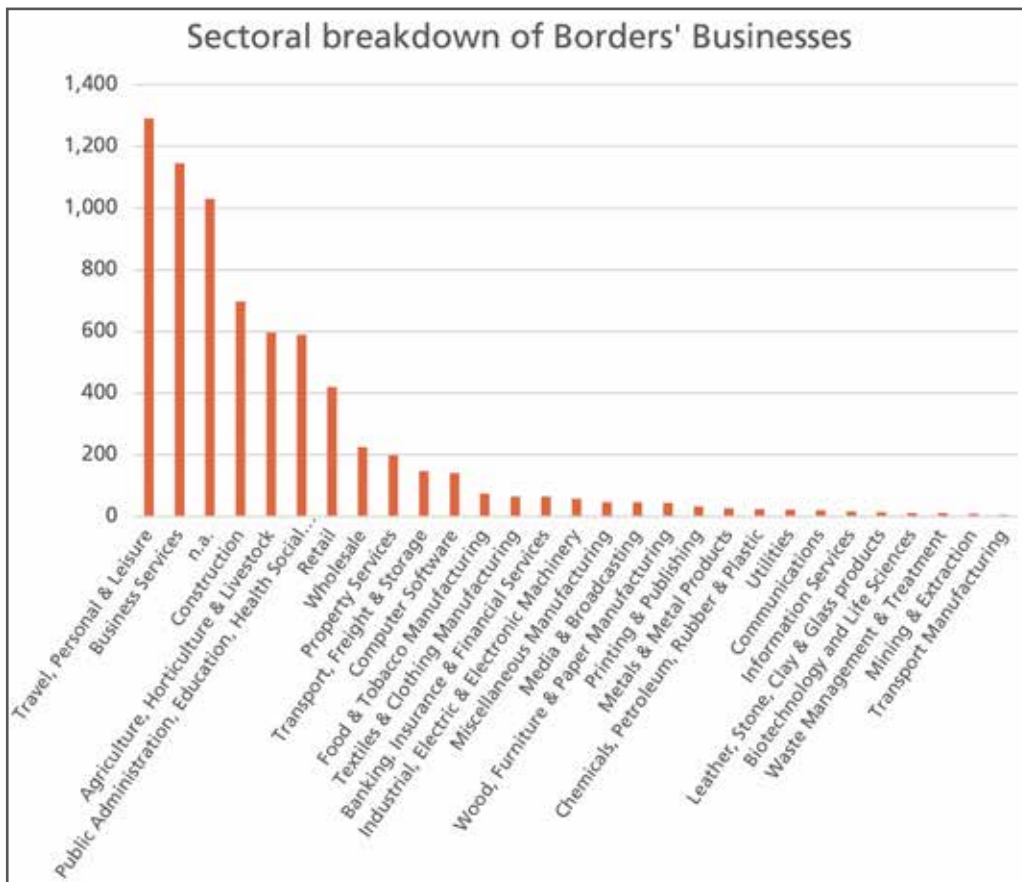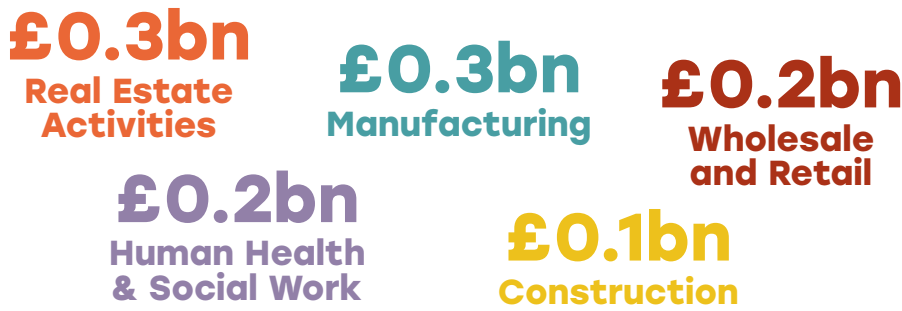

Figure 3 – Breakdown of companies by sector (N=7088). Source: Fame Database, 2020.

According to the Regional Skills Assessment (RSA), Gross Value Added (GVA), a measure of the value of goods and services produced in an area, in the Scottish Borders in 2019 was £1.9bn, one per cent of overall Scotland's output (£138.8bn). This share of GVA ranks the Scottish Borders as the smallest contributing RSA region to the Scottish economy. From 2009 to 2019 the Scottish Borders economy, measured by GVA, grew by 1.9 per cent on average each year, which was higher than Scotland (1.4 per cent growth on average each year). In 2019, the highest value sectors in the Scottish Borders were:

£0.3bn
Real Estate Activities

£0.3bn
Manufacturing

£0.2bn
Wholesale and Retail

£0.2bn
Human Health & Social Work

£0.1bn
Construction

The key sectors contributing most to GVA growth in the Scottish Borders from 2019 to 2029 are expected to be health and social care, financial and business services, energy and construction.[7] The largest employers remain the public services (health, education and social care in particular), as well as retail, light manufacturing and hospitality (see Figure 4).
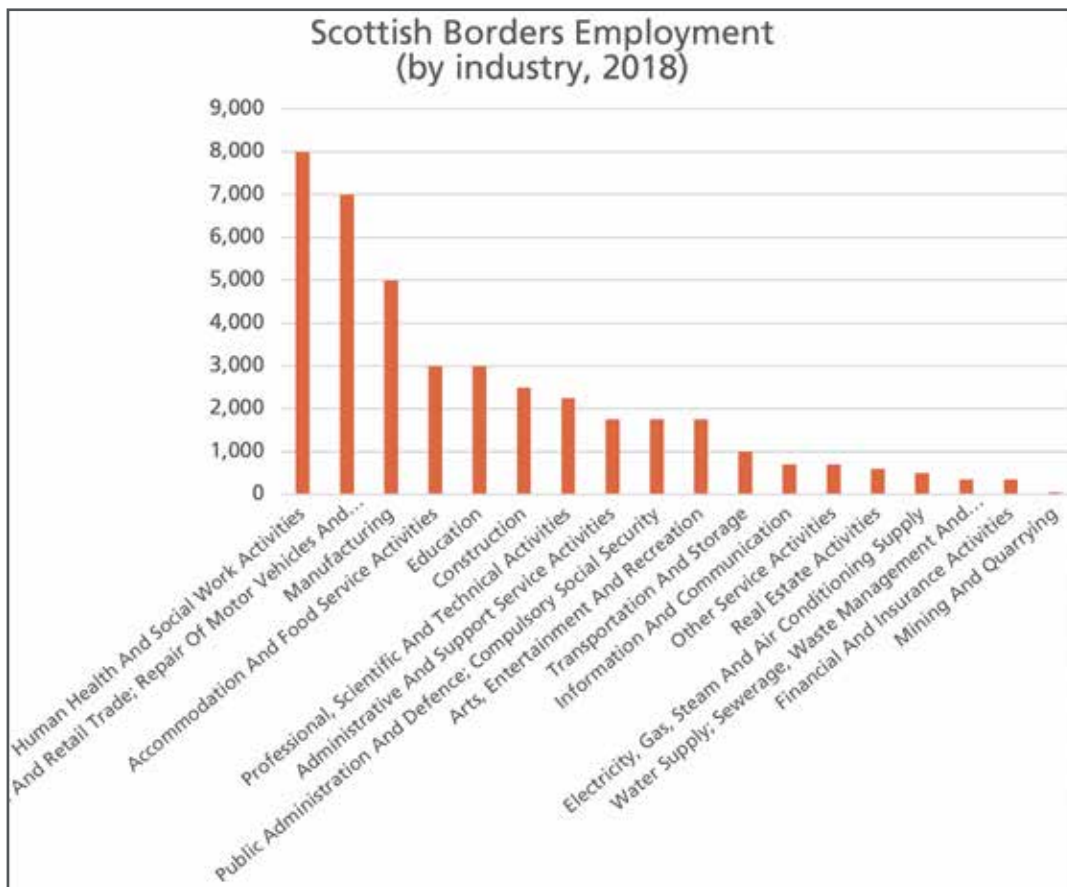

Figure 4 – Breakdown of jobs in the Scottish Borders in 2018 by industry sector. Source: ONS, 2020.

7 Regional Skills Assessment, the Scottish Borders (SDS, 2019)

While the large sectors are an important source of jobs for the Scottish Borders economy, the concentration of smaller sectors is also important. Agriculture, forestry and fishing was the greatest focus of specialism, with the percentage of employment in this sector four times greater in the region than the Scottish average. Other sectors that had above average concentrations in the Scottish Borders were manufacturing (1.5 times more concentrated), arts, entertainment and recreation (1.5 times more concentrated) and electricity, gas, steam and air conditioning supply (1.4 times more concentrated).[8] There is a high intensity of food and drink business stock in Scottish Borders.[9]

Productivity is calculated by dividing total regional GVA by total regional employment (i.e. number of jobs). The Scottish Borders has suffered low productivity and stagnating wages and living standards, coupled with cuts to public services due to the UK Government's fiscal austerity. In 2019, productivity per person in the Scottish Borders was £37,900. This was lower than the Scottish average of £50,400. Nevertheless, from 2009 to 2019, the rate of growth of productivity in the Scottish Borders was 1.9 per cent on average each year, which was higher than what occurred across Scotland (Average annual productivity growth across Scotland was 1.3 per cent over the period; the equivalent for the UK was 0.8 per cent).[10]

The largest towns in the Scottish Borders (in order of population size) are Galashiels, Hawick, Peebles, Selkirk, Kelso, Jedburgh, Eyemouth, Innerleithen, Duns, Melrose, Coldstream and Earlston, with only the first two having more than 10,000 inhabitants. Much like the population, the economic activity is heavily concentrated in a handful of principal locations, most notably in the larger towns along the River Tweed and its tributaries, next to which are the main transport routes (Figure 5). The undisputed business capital of the borders is the town of Galashiels and the neighbouring Tweedbank, with several industrial estates, Borders Railway railhead and transport interchange, as well as the main campuses of the college and HEIs (Borders College and Heriot-Watt University Scottish Borders Campus). Newtown St Boswell is the administrative centre of the Borders. This area is also geographically at the centre of the Scottish Borders, on the main crossroads of the north-south and east-west routes.
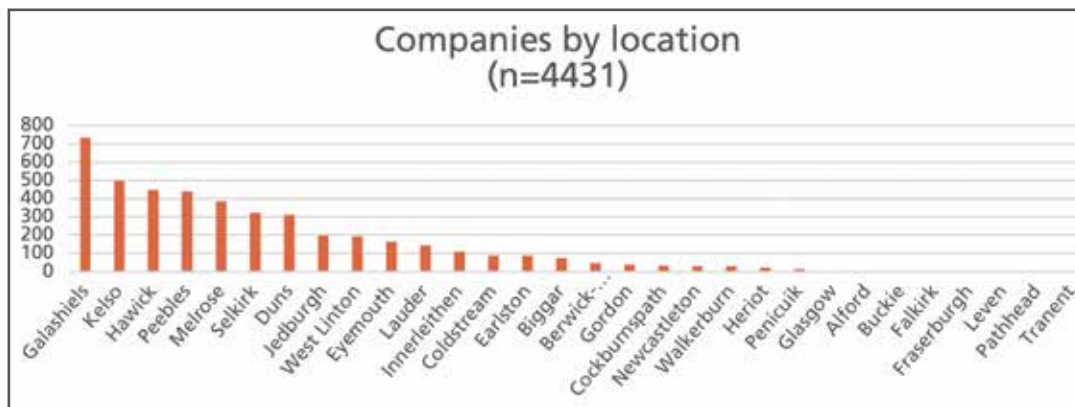

Figure 5 – Breakdown of companies by location (N=4431). Source: Fame Database, 2020

8 Regional Skills Assessment, the Scottish Borders (SDS, 2019)

9 Scotland's Business Base - Facts and Figures (2017) https://www.housingnet.co.uk/pdf/Scotlands%20Business%20Base%20-%20Facts%20and%20Figures.pdf

10 Regional Skills Assessment, the Scottish Borders (SDS, 2019)

As can be seen on Figure 6 based on ONS data, the vast majority of the enterprises and business units are small (+85 per cent with fewer than 10 employees), with only 10 or so large employers (with more than +250 employees). However, reflecting the dispersed geography and difficult economic conditions, the "middle part" of the company size (and growth) scale is slightly compressed in comparison with the rest of Scotland (by about two percentage points). Borders businesses are also less innovative than the Scottish average, with business expenditure on R&D at £64 per head, compared with £230 per head for the whole of Scotland.[11]
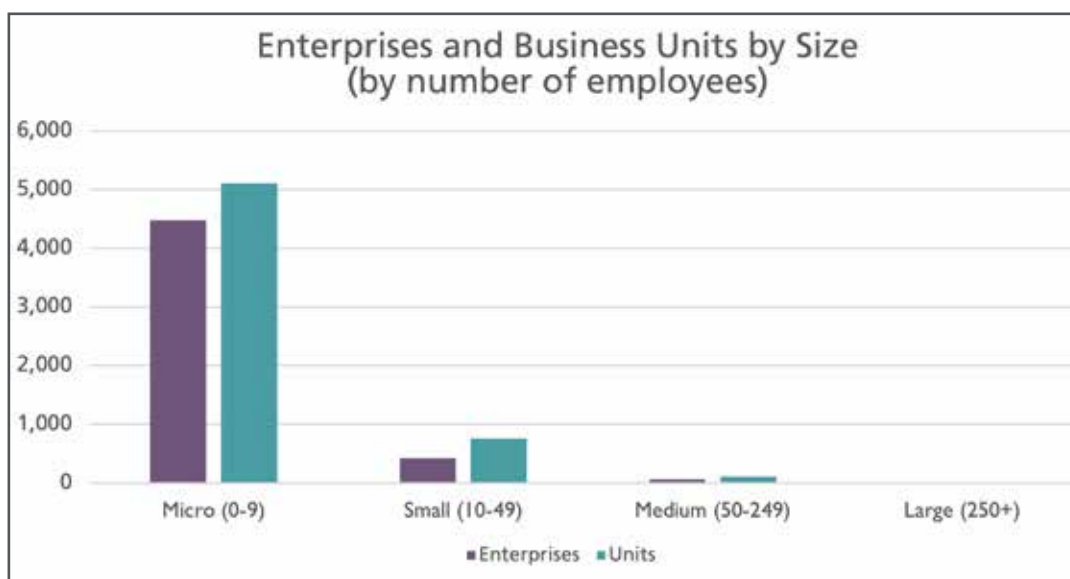

Figure 6 – Breakdown of enterprises and business units by size. Source: ONS, 2020.

11 https://www.stchads.ac.uk/wp-content/uploads/2019/06/Bryan-McGrath-ILG-Market-Towns-Seminar-10th-July.pdf

Imperatives for inclusive growth in the Scottish Borders

From a regional economic development point of view, there are several paradoxes at play. As a whole, the Scottish Borders may be seen as an affluent area of Scotland with a conservative socio-economic outlook. This is due to the historical and geographical context, as an intensely rural area with a relatively large number of wealthy landowners and significant proportion of valuable arable land.

In addition, the Borders has been a local hub in tourism/hospitality, established centuries ago through the pilgrimage to the Tweed Valley monasteries/abbeys, later surpassed by textile manufacturing as the second largest economic activity (after farming). However, whilst the rural areas are statistically affluent, many of the towns are economically and socially disadvantaged as evidenced on the Scottish Index of Multiple Deprivation (SIMD) (see Figure 7 below).[12] Areas highlighted in red and dark red are within the top 20th and 10th percentile of SIMD –

showing that parts of Galashiels, Selkirk and Hawick are amongst the most challenged areas in Scotland. One of the potential reasons for this is having a "low wage economy" because the (2018) "median weekly wage of full-time employees working in the Borders is £482.20, which is 86 per cent of the national level (£563.20)", ranking 30th out of the 32 Scottish local authorities.[13]

Figure 7 – Scottish Index of multiple deprivation (SIMD) 2020 results for a section of the central Scottish Borders. Source: Scottish Government.

13 https://simd.scot/#/simd2020/BTTTFTT/13/-3.9433/55.8961/
14 https://www.stchads.ac.uk/wp-content/uploads/2019/06/Bryan-McGrath-ILG-Market-Towns-Seminar-10th-July.pdf

However, as can be seen on Figure 8, over half of the employment in the region is in professional, skilled and management occupations, implying that it is not career attainment but lack of local value added (productivity) that is depressing wages.[14] Hence, in order to advance more inclusive economic growth in relation to the rest of Scotland and the UK, investment in R&D and innovation is an untapped opportunity to develop a competitive advantage for Scottish Borders' firms.
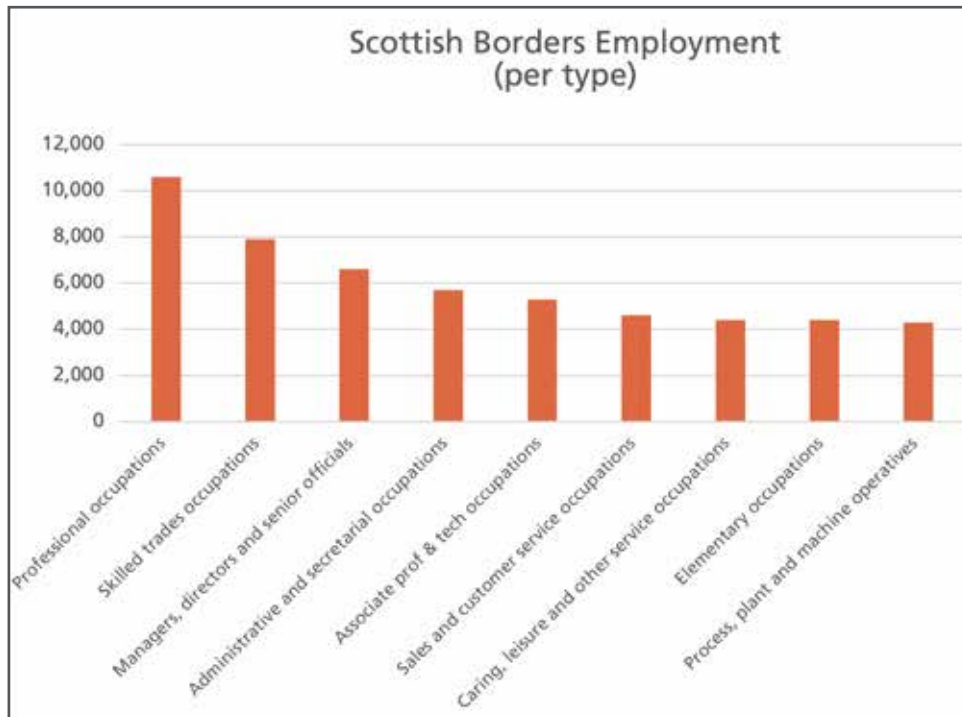
Figure 8 – Scottish Borders employment by type of job. Source: ONS, 2020.

In addition to economic deprivation, Scottish Borders geography is also challenging for equality of opportunities through the challenges it presents in allowing access to life-changing public services, like education and health and social care. These are particularly significant in the young and old age groups, which are more reliant on local services and/or public transport provision. With an ageing population, the challenge to secure equal distribution of these services will increase, in particular in the smaller settlements.

All of these challenges add further impetus to the need for coherent policies supporting inclusive growth by developing new economic opportunities, while addressing the key challenges.

14 Some of this high career attainment profile in the face of low productivity could be explained by the rise in commuter residents who, while living in the Borders, work (and contribute to GDP) in the neighbouring capital, Edinburgh. If so, then the "true" average salary may be even lower than previously estimated.

Economic development policies and landscapes in South of Scotland

As already mentioned, the Scottish Borders is characterised by diverse geography and industry sectors. The current economic strategy is the Scottish Borders Council *Scottish Borders Economic Strategy 2023*[15] published in June 2013, which identifies "textiles, tourism, food and drink, renewables and creative" as key target industries. Approaches to economic development focused on:

- **creating the conditions for businesses to compete;**

- **building on assets;**

- **advanced manufacturing**

- **developing the workforce of the future and**

- **providing leadership**

Other key policy areas identified included: Raising SME competitiveness (raising innovation, increasing exporting, promoting enterprise and business, supporting agriculture & fisheries); Promoting low carbon – moving towards a low carbon economy; Improving connectivity, including ICT and Borders Railway.

Over the past decade, there has been a perception that the South of Scotland - Scottish Borders, along with Dumfries and Galloway - has been "forgotten" in comparison with the central belt and the Highlands and Islands. In the South of Scotland context, the Scottish Borders Council, Dumfries and Galloway Council and Scottish Enterprise had formed a "South of Scotland Alliance" and developed the South of Scotland Rural Regional Economic Development Programme (2014-16).

The South of Scotland Economic Partnership (SOSEP) was established in January 2018 to respond to the economic needs and opportunities of the South of Scotland, in advance of the establishment of the new agency in April 2020. In April 2020, South of Scotland Enterprise (SoSE) was founded as a new economic development agency in Scotland, working along with the two existing ones: Scottish Enterprise (SE), and Highlands and Island Enterprise (HIE).

The overarching aims of SOSE will be to drive inclusive growth and ensure the region benefits from a new approach that supports a diverse and resilient economy, sustains and grows communities, and harnesses the potential of people and resources.[16]

15 https://www.scotborders.gov.uk/downloads/file/456/economic_strategy
16 https://www.gov.scot/policies/economic-growth/south-of-scotland-enterprise/

Recognising the distinctiveness of the region, the new agency encourages "place-based approaches", and promotes fair work, sustainability and innovation, by working with existing and potential businesses across all sizes and with communities to support inclusive growth.

It aims for the South of Scotland to have[17]:

- businesses with increased productivity, ambitious for the future, investing in innovation and offering good conditions of employment paying higher wages

- a skilled workforce with both the skills needed now, and the ability to develop the skills needed for the future

- more opportunities for young people so that they can see a future in the area, and to attract people who want to locate in the area

- communities better equipped to play a greater role in the economic, social and environmental success of their area

- a clear commitment to inclusive growth, taking a holistic look at the barriers that are getting in the way and taking action to address them.

SoSE works in partnership with the Scottish Borders Council and Dumfries and Galloway Council to achieve these ambitions. The creation of SoSE is described as one of the biggest changes in the economic development landscape in Scotland for many years, along with City Region Deals and Growth Deals, signalling a shift towards a greater concern with "regional equity".[18] The establishment of SoSE on 1 April 2020 coincided with the onset of the Covid-19 pandemic. The severity of the economic impact of the pandemic was evident from the unprecedented scale of support measures announced by the Scottish and UK governments. These include significant funding support for businesses, in addition to schemes covering job retention, vat deferral and loans. Scottish Borders Council, Dumfries and Galloway Council, and SoSE have focused on responding and mitigating the impact of Covid-19 since April 2020. The pandemic is hitting businesses in the tourism and hospitality sector in this area in particular.

The Scottish Borders Council has worked in partnership across the public sector, with businesses and other types of organisations. In the recent UK and Scottish contexts of economic development policy and public investment, the Scottish Borders Council is in a unique and strategic position as it is involved in two deals – the Edinburgh and South East Scotland (ESES) City-Region Deal (CRD) and the Borderlands Inclusive Growth Deal. In Scotland, City Region Deals and Growth Deals are agreements between the UK Government, Scottish Government and local partners that invest in projects tailored to the needs and strengths of Scotland's regions.[19] The Borderlands partnership is unique as it encompasses local authorities in both the North of England and South of Scotland, and investment from the UK Government (up to £265 million) and the Scottish Government (£85 million).[20]

17 https://www.aspenpeople.co.uk/sose/about.html

18 Clelland, D (2020), *South of Scotland Enterprise – A new approach, in the midst of a crisis*, Policy Scotland, 24 April 2020
   https://policyscotland.gla.ac.uk/south-of-scotland-enterprise-a-new-approach-in-a-crisis/

19 https://www.deliveringforscotland.gov.uk/investment-projects/city-region-deals/

20 https://www.borderlandsgrowth.com/Story-So-Far/the-story-so-far

	Edinburgh & South-East Scotland CRD	Borderlands Inclusive Growth Deal
Partners	Six local authorities (City of Edinburgh Council, Midlothian Council, West Lothian Council, East Lothian Council, Fife Council, and Scottish Borders Council), with universities, colleges and the private sector in the region.	Five local authorities (Dumfries and Galloway Council, and Scottish Borders Council in Scotland; Carlisle Council, Cumbria Council, and Northumberland Council in England.)
Investment	The UK and Scottish governments are each investing £300 million, out of an £1.3bn total.	£394.5 million from the UK and Scottish governments.

Table 2 – ESES CRD and Borderlands Inclusive Growth Deal

Structural investment from these deals is initially focused on physical infrastructure, in particular transport networks, innovation/business parks/hubs and R&D support and facilities. The ESES CRD focuses on: "Research, Development and Innovation; Integrated Regional Employability and Skills Programme; Transport, Culture; Housing".[21] The deal includes developing "smart infrastructure" through a universities-led Data-Driven Innovation (DDI) Programme. The explicit Scottish Borders element of the CRD is: Housing, Skills, the Borders Innovation Park. The Borderlands Inclusive Growth Deal focuses on agendas such as improving transport, digital infrastructure, energy, rural innovation, culture and tourism.[22] It supports locally identified sources of competitive advantage and inclusive economic development (e.g. green energy; circular economy). There are also wider themes linked to the inclusive growth agenda and connectivity issues in the Scottish Borders and across the ESES City Region.

Data-Driven Innovation and the University of Edinburgh

The University of Edinburgh (UoE) has engaged with the DDI research agenda for several decades and has globally been leading expertise in informatics and data science, as well as in related fields of engineering and natural and social science.

Given the University of Edinburgh's focus on Data-Driven Innovation (DDI) as part of the ESES CRD, and its desire to engage with the needs and aspirations of local partners, there is a potential that the DDI Programme can play a significant role in improving the local industry's economic performance and enhance the inclusive growth agenda in the city region.

The DDI Programme is centred around five innovation hubs: Edinburgh Futures Institute (EFI); Easter Bush; National Robotarium; Bayes Centre; Usher Institute. They are aligned with the key DDI TRADE (Talent, Research, Adoption, Datasets and Entrepreneurship) objectives.

In addition to these innovation hubs, there is relevant expertise at the university. For example, the university is keen to develop links between the Advanced Care Research Centre (ACRC) and Borders College. There is a strong link to the ESES CRD framework through the proposed Health and Social Skills Gateway. The collaborative relationships extend further and could encompass areas in the North of England (e.g. Newcastle).

We also note that there are relevant existing initiatives within the university in a wider City Region context (e.g. Rosyth Advanced Manufacturing Park in Fife and the proposed Digital Academy). By closely working with the colleges (e.g. Fife, Borders, Dumfries and Galloway) these initiatives could potentially link up with relevant digital manufacturing skill needs in the Scottish Borders and South of Scotland.

The procurement office at the university is another key actor in the DDI activities. This can be done by leveraging supplier spend data for a picture of economic and innovation capacity of a region (e.g. agriculture and agri-tech; tourism and hospitality), and for a more strategic engagement with groups of local suppliers (e.g. social enterprises) to align with Community Wealth Building and Procurement Community Benefits. The university and public bodies in the region could work together to take a more strategic approach with procurement suppliers to incorporate training, local supply chain spend, innovation and work on the shared challenges based on evidence of needs and opportunities (e.g. funded opportunities to work with cohorts of students from the college; working on carbon dioxide reduction etc.).

21 City Region Deal Edinburgh & South East Scotland https://esescityregiondeal.org.uk/

22 Borderlands Growth Deal Heads of Terms Agreement https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816873/Borderlands_Growth_Deal_-_Heads_of_Terms_2019.pdf

**Data-Driven
Innovation**

Investigating entrepreneurial and innovation ecosystem in the Scottish Borders

Set against the evolving economic development landscape in the South of Scotland, this study asked the following questions:

- What are the factors and conditions that attract and support innovative and entrepreneurial people, institutions, and businesses?

- In what ways can the local government and the regional economic development agency develop and deliver a programme of activity that supports coordinated efforts across the public and private sector to drive innovation and entrepreneurship in the region?

In this study, we employ the concept of the "entrepreneurial and innovation ecosystem", which means: networks of organisations and people that interact to cultivate ideas into successful start-up and enterprise activities. The creation of entrepreneurial and innovation ecosystems has been considered to be an effective way to nurture and support this process.

Figure 9 – Entrepreneurial and innovation ecosystem.

The term ecosystem was first used in biology and, at a later stage, adopted and used widely in fields such as economics and business. Like natural, biological ecosystems, the entrepreneurial and innovation ecosystems consist of many different moving parts, such as businesses, universities and research institutes, human capital (e.g. entrepreneurs; skilled employees), information technology infrastructure, financial capital, private sector, and government. Despite many similarities, entrepreneurial and innovation ecosystems are different in many ways. In particular, entrepreneurs and their ventures are at the core of entrepreneurial ecosystems. Although successful commercialisation is key to an innovation ecosystem, it is normally built upon a particular technological or scientific output.[23]

In order to better understand and analyse the nature of place-based approaches to an ecosystem, instead of separating innovation and entrepreneurship as distinctive domains/systems, we see links and continuity between innovation activities in existing organisations and a creation of businesses through entrepreneurs' start-up activities. An entrepreneurial and innovation ecosystem is more than just the individual components of a system: it is based on the relationships between all these pieces and interactions, and the networks and support mechanisms between them.

The concept of the entrepreneurial and innovation ecosystem is particularly relevant here as we have noted an emerging entrepreneurial and innovation ecosystem as well as a lack of certain local connectivity in the Scottish Borders ecosystem.

There are many existing innovative firms and entrepreneurial start-ups in the Borders. Within the Scottish Borders, there are already existing expertise and place-based innovation support mechanisms and capabilities. For example, in textiles, existing capabilities include the Centre of Excellence in Textiles in Hawick and School of Textiles and Design, Heriot-Watt University in Galashiels.

There are distinctive cross-sectoral and place-based innovation support mechanisms developing in the Scottish Borders (e.g. Innovation Clinic at Mountain Bike Centre of Scotland – see Box 1 below).

1 Mountain Biking – Innovation, business growth and talent attraction in the Scottish Borders[24]

The Mountain Bike Centre of Scotland (MTBCOS) is based at Glentress in the Scottish Borders. It is a joint initiative hosted by Edinburgh Napier University, with project partners (Developing Mountain Biking in Scotland/Scottish Cycling, and Scottish Enterprise). It is Scotland's national centre for mountain biking innovation and excellence and it has supported innovation in cycling since 2014. For example, the MTBCOS Innovation Clinic has supported start-up businesses (e.g. FINDRA, mountain biking fashion apparel) and innovation in existing businesses. The project is funded by the Scottish Government and Edinburgh Napier University.

Under the Borderlands Inclusive Growth Deal, the business case to establish a new Mountain Bike Innovation Centre in Innerleithen has been worked on in partnership with Scottish Cycling, Edinburgh Napier University, Borders College, Scottish Enterprise, SoSE

and SBC. The project will be a significant driver for growth and development in the Borders mostly in the tourism sector as well as the innovation support. With more than 160,000 visitors forecast and a significant draw for business relocation, inward investment and talent and could transform the economy in Tweed Valley and wider area.

Borders College and DIRT School also run a unique training programme: the Borders Academy of Sporting Excellence (BASE) Mountain Biking Performance course, which includes aspects of the data and entrepreneurial skills as well.

23 Xu Z., Maas G. (2019) Innovation and Entrepreneurial Ecosystems as Important Building Blocks. In: Maas G., Jones P. (eds) Transformational Entrepreneurship Practices. Palgrave Pivot, Cham. https://doi.org/10.1007/978-3-030-11524-1_2

24 Sources: https://mtbcos.co.uk/; https://img1.wsimg.com/blobby/go/410c20b3-1f1a-4173-8ba5-3a97a3a53433/ downloads/1cetcnmd9_734837.pdf?ver=1605017306191 ; http://www.borderscollege.ac.uk/courses/base-mountain-biking-/

In recent years, there has been a renaissance in tourism in the Scottish Borders, including the re-opening of the Borders Railway[25] connecting Edinburgh with Galashiels and Tweedbank. This is combined with new entrepreneurial and innovative opportunities in the visitor economy with the creation of a destination management and marketing organisation covering the South of Scotland – South of Scotland Destination Alliance (SSDA) and "Scotland Starts Here" initiative (see Box 6, later). Such development is supported by local initiatives and community development in the area. The Mainstreet Trading Company is an example of the creation of local destination by renovating a former auction house turned into a bookshop and café in St Boswells in the Scottish Borders.

The entrepreneurs we interviewed (from a pre-market stage to firms up to 10 years old) shared similar experiences with start-up support including business advice from Business Gateway, followed up by other support mechanisms and funding opportunities (e.g. Interface, Scottish EDGE, Converge Challenge, Accelerator programmes elsewhere). Our interviews, however, indicate that many businesses feel disconnected from each other and that business support needs better coordination.

One of the limiting factors they pointed out was the lack of incubator facilities, mentoring and entrepreneurial networks within the Scottish Borders. They benefit from their wider networks and connections available in Edinburgh, Glasgow and elsewhere, but the travel time and accessibility to these wider entrepreneurial networks were seen as a burden on their business development. During the pandemic, the increased online availability of accelerator and incubator programmes seems to be providing some advantages to entrepreneurial businesses in the Scottish Borders.

2 Innovation-driven entrepreneurship in the Scottish Borders – ThermaFY

ThermaFY is an award winning and innovative software company enabling real-time thermal analysis. In November 2019, it entered Scottish Edge pitching competition and was awarded one of the top prizes of £100,000. The founder and director of ThermaFY Group, Amanda Pickford, emphasises the importance of networking and identifying opportunities across different sectors. Currently they are working with NatWest's Climate Entrepreneur Accelerator, and Microsoft's AI for Earth programme in partnership with the Social Tech Trust. Its body temperature analysis software, ThermaFY Protect has been developed during the pandemic, and is now used by the NHS in England. It has collaborated with a number of universities and colleges in Scotland, including the Dick School of Veterinary Studies at the University of Edinburgh, and through Interface, it has recently benefited from specialist expertise at Fife College and Robert Gordon University.

ThermaFY
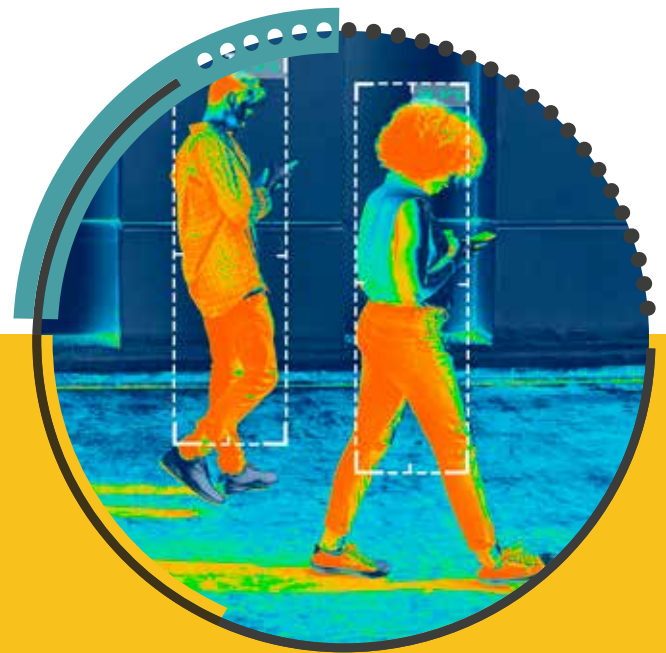
25 1,919,392 passengers used the Borders Railway in 2019-20 (including 819,384 who travelled via the 3 stations in the Scottish Borders). Source: Office of Rail and Road, Estimates of Station Usage, 2019-20.

To support survival and further growth of entrepreneurial businesses in the Scottish Borders, the evidence from existing entrepreneurs suggests that integrated local support such as incubator services, mentoring in the Scottish Borders, and connecting entrepreneurial networks within and beyond the Scottish Borders would help businesses better access resources such as specialist knowledge, finance and staff.

Some of the companies with longer experience (over 10 years) pointed out that, with the exception of tourism and hospitality industry, the links between businesses are not strong in the Scottish Borders, including both industry (sector) specific networks and more general business support mechanisms and networking opportunities. As one interviewee put it:

There isn't a single umbrella or a single entity or a single network that people can go to to get that. And so, rather than lots of people doing different things, this, that and the other; it's probably trying to create that single network where you might end up having hubs in throughout the Borders. It might be four or five hubs, but you've got those drop-in environments where you've got that type of support and infrastructure in place.

In recent years, social enterprises have infused new dynamism into the entrepreneurial and innovation ecosystem in the region. Recognising the challenges women are facing in the Scottish Borders ecosystem, Advancing Eve was created as a social enterprise in 2020, supporting enterprising activities by women through mentoring and coaching. The Female Entrepreneurial Achievement Programme has been developed in partnership with Royal Bank of Scotland providing support for female entrepreneurs in the Scottish Borders.[26] Another social entrepreneur we interviewed pointed out networks among social enterprises in the area are not well developed, while

Scottish Borders Social Enterprise Chamber community interest company is aiming to create such dialogues.

In terms of the changing business support landscape, the businesses we interviewed emphasised the importance of the ownership, continuity and consistency of the business support mechanisms, and also, trust and personal relationships between the company and individual business support professionals. The recent change in the economic development policy landscape with the creation of SoSE in the South of Scotland is perceived with a mixture of expectations and uncertainties. This is combined with the challenges and uncertainties brought by Covid-19.

People are a vital component of an entrepreneurial and innovation ecosystem. Borders College plays a critical role in terms of connecting local businesses and new skills development opportunities. The college has developed hubs for upskilling and reskilling: the STEM Hub at Hawick, the Tweedbank Construction Hub, and the Borders Technology Enhanced Care (BTEC) Hub in Galashiels. The Scottish Borders Learning and Skills Partnership is chaired by Borders College and is comprised of a range of public and private sector representatives to identify the key skills and learning challenges facing the region. Developing the Young Workforce (DYW), which comprises mainly private sector with some public sector representation, bridges the gap between industry and education to engage, inspire and shape our young workforce in the Borders.

26 https://www.thesouthernreporter.co.uk/business/opportunity-women-achieve-dreams-2947954#gsc.tab=0

Opportunities for data-driven innovation in the Scottish Borders

Our next set of questions concerns the Data-Driven Innovation (DDI) related opportunities that may exist in the Scottish Borders.

- What are the benefits of DDI research and other related activities for businesses and communities in the Scottish Borders?

- What specific forms of DDI activities that could be adopted by businesses and communities in the Scottish Borders and how that could be sustained?

- What are the impacts and what are the motivation for businesses to engage with DDI?

Based on the extensive study of the historical and contemporary political, social and economic conditions in the Scottish Borders, a set of key trends has emerged for data-driven innovation-inspired development opportunities. Our proposal for the improvement of ecosystem conditions revolve around two key premises – that the Scottish Borders geography is a key determinant (mainly barrier) of economic activity and that extending the data-driven digital applications in business operations and new products and services can transcend this critical limitation.

In particular, through the analysis of existing policy documents and interviews with key stakeholders, we identified specific opportunity areas for DDI activities across the key economic sectors in the Scottish Borders aligned with the Economic Development Strategy - tourism; health and social care; advanced manufacturing; Energy; and Agriculture. In particular, we believe there are five opportunities with specific clusters of expertise that the DDI and ESES CRD partners can develop in the Scottish Borders.

Digitally integrated destinations (data integration, mobility as a service, hybrid VR/AR experiences, digital twins, etc.) - this is the most strategically significant opportunity, as it builds on a series of existing and emerging programmes (chiefly with South of Scotland Destination Alliance). Using advanced data pooling and analysis techniques can support the development of digital-twin infrastructure across Scottish Borders that integrates front-facing hospitality, leisure and mobility solutions and the required background resources and operations management across public and private services.

- **Predictive and responsive wellbeing technologies** (data analytics, wearable technologies, digital support and assistance, etc.) - with an ageing population and reduction in tax income, new technological solutions for at home health and social care are a significant development priority. Working through a partnership with public (SB Cares), private (Bupa) and academic (Advanced Care Research Centre), wearable technologies, predictive analytics and smart home systems can be integrated to provide a real-time round the clock service.

- **Smart high-added-value manufacturing** (design informatics, textiles, mountain bike R&D, etc.) - the Scottish Borders is already home to several types of light manufacturing industries, in particular textiles, electronics and chemicals. To build on these successes, the innovation and business parks across the region could expand R&D engagement with research organisations (in particular Edinburgh universities, some of which is already taking place in Galashiels, Innerleithen and Hawick). Particular growth opportunities are in combining different fields of advancing expertise, such as in wearable electronics integrated into textile and light machinery (i.e. mountain-bikes) as well as supporting digitisation and robotisation of operations and production (in 3D-printing manufacturing, solid state electronics, green chemicals, etc.). These activities should also link with the emerging Advancing Innovative Manufacturing in the South of Scotland (AMIS) project, coordinated by National Manufacturing Institute Scotland (NMIS) and funded by the Scottish Government's £15.8m Advancing Manufacturing Challenge Fund.

- **Autonomous systems for resources and assets management** (remote sensing, robotics in agriculture, renewables management, etc.) - with an increase of renewable energy generation facilities, as well as existing dispersion of agricultural land use and infrastructure, new automated and responsive asset management solutions are needed. Working with the key partners in the argitech cluster at Easter Bush and offshore renewable energy projects off the East Coast, Scottish Borders can capitalise on advances in machine-learning and robotics to support entrepreneurs investing in high-added value mapping/forecasting/prediction data analytics through autonomous remote sensing (from internet of things sensors, drones and satellite).

- **Energy-efficient infrastructure** (construction, renewable energy, zero-carbon transport, etc.) - with the ambitious Scottish zero-carbon targets, rural areas such as the Scottish Borders need to re-imagine infrastructure development to ensure maximum green energy generation and smart/efficient consumption. Working with existing local energy sources (offshore and onshore wind and hydro) and key private sector partners (power companies, National Grid, etc.), the Scottish Borders stakeholders can build distributed infrastructure combining small-scale local energy generation, shared zero-carbon transport services (in particular the "anchor" Borders railway) and low-carbon construction. An opportunity to articulate this vision is within the emerging Borderlands Energy Masterplan.
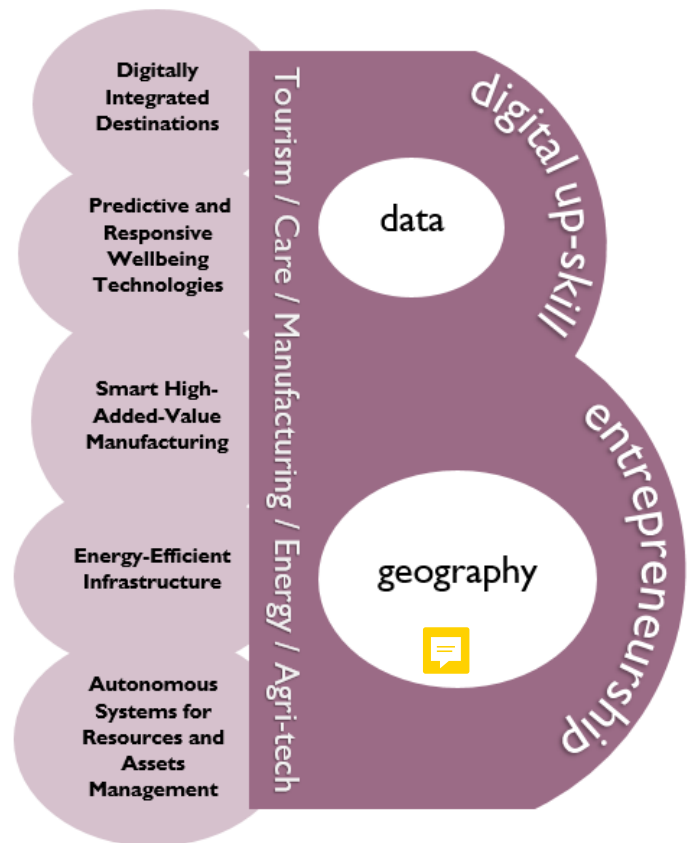

Figure 10 – Strategic grouping of key ecosystem elements, core existing sectors, strategic development priorities and specific opportunity areas

**Data-Driven
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Table 3 (below) summarises the details behind all five DDI opportunity themes and matching key actors in the Scottish Borders, as well as in the contexts of wider South of Scotland, ESES CRD and Borderlands Growth Deal. It indicates the University of Edinburgh and partners' (e.g. Innovation Centres in Scotland) capability related to DDI and further potential areas of development (see the next section).

	Scottish Borders actors, assets and capabilities	ESES CRD; Borderlands Growth Deal; SoSE; other South of Scotland projects and partners	UoE and Partners' Capability Related to DDI
Digitally Integrated Destinations	• Tourism (Scottish Borders Tourism Partnership – now part of SSDA) • Transport (e.g. Borders Busses; Borders Railway) • SBC • Live Borders	• the ESES CRD (e.g. Workforce Mobility Project) • Borderlands Growth Deal • South of Scotland Destination Alliance (SSDA) 'Scotland Starts Here' • VISIT Scotland	• Data-driven marketing and forecasting for tourism industry – *Business school* • Transport real-time data – *Bayes; EPCC; Edinburgh Living Lab* • *Data Lab* • *CENSIS*
Predictive and Responsive Wellbeing Technologies	• SBCares • NHS Borders • Borders College -The Borders Technology Enhanced Care Hub (BTEC)	• ESES CRD - the Health and Social Skills Gateway proposal	• Social care and technology – *The Advanced Care Research Centre (ACRC)* • Data health work with NHS – *Usher Institute*; Digital Health Institute • Data analytics, IoT/sensors, AI/Robotics – *Bayes Centre; Robotarium; Edinburgh Living Lab*
Smart High-Added-Value Manufacturing	• the Centre of Excellence in Textiles in Hawick • School of Textiles and Design, Heriot-Watt University in Galashiels • MTBCOS/ Edinburgh Napier University - Mountain Bike Innovation Centre (Innerleithen) • Borders College	• Borderlands Growth Deal • Advancing Innovative Manufacturing in the South of Scotland project	• *Design informatics / Creative Informatics* • Data analytics, IoT/sensors, AI/ Robotics - *Bayes; Robotarium*; • the proposed Digital Academy (Rosyth) / *School of Engineering* • *CENSIS*
Energy-Efficient Infrastructure	• SBC • Borders College - Sustainable Construction STEM Hub; • Offshore wind farm in Eyemouth – Eyemouth Harbour Trust	• Borderlands Energy Masterplan (Under Inclusive Growth Deal) • ScotRail	• Sustainability – *Edinburgh Centre for Carbon Innovation (ECCI); Sustainable Scotland Network* • Sustainable Construction - *Civil engineering / Centre for future infrastructure* • *Procurement office* • *Construction Scotland Innovation Centre*
Autonomous Systems for Resources and Assets Management	• Agriculture facilities (arable) • Forestry • Renewables infrastructure (off-shore wind and local hydro)	• Dairy Innovation Investment (SRUC in Dumfries and Galloway) • Borderlands Forestry Innovation Centre; Dairy Nexus • Natural Capital Innovation Zone	• Agri-tech - *Easter Bush; Agri-EPI Centre* • Crop yield prediction, land use change - *Bayes; Space and Satellite Innovation Programme* • *SMEs*: Ecometrica/Carbomap/ GSi; Crover

Table 3 - Five DDI opportunity themes and matching key actors and capabilities in the Scottish Borders with UoE DDI Capability
In order to capitalise on these opportunities, we propose to build on the challenges afforded by geographical dispersion and so far low uptake of digital technologies in the region. In particular, we propose to use the existing and emerging capabilities in digital data upskilling to accelerate the expansion of economic activity within existing firms. In addition, we suggest an ambitious entrepreneurship support programme through targeted R&D and establishment of new collaborative projects with partners across the region.

Digital up-skilling

The digital technology and data revolution has put data at the core of many things, from personal privacy to public health, wealth creation to environmental protection. This is particularly important for employers, whether large or small businesses, public sector organisations or charities, because using data to create or improve products and services is key to unlocking economic growth and job creation.[27] The UK government has pinpointed several areas as key industrial strategies for economic growth. These are: artificial intelligence, additive manufacturing, automation & robotics, smart technology, Fourth Industrial Revolution (4IR) and Augmented Reality.[28]

The Scottish Government also has an economic strategy with four strategic priorities that place digital at the epicentre of future investment and innovation trends. As a result, Scotland has developed a strategic agenda for realising its full potential in the digital arena[29]. Among the key goals of this strategy, we find:

- Stimulating innovation, welcomes investment and promotes its digital technologies industries

- Becoming recognised internationally as a natural test bed for innovation in connectivity; and

- Developing internationally competitive, digitally mature businesses across all sectors

- Focusing education and training systems on expanding the existing pool of digital skills and capabilities

The DDI Programme is part of the Edinburgh and South East Scotland City Region Deal (ESES CRD) that aims to help organisations and communities benefit from the data revolution. The Programme is expected to increase the contribution of university research and in-demand graduate skills to the region's economy, launching more spinout companies, attracting start-ups and established businesses, and driving public and private sector investment.[30]

27 http://esescityregiondeal.org.uk/new-blog
28 Department for Business Energy and Industry Strategy, Science & Innovation Audits summary report 2016).
29 https://www.gov.scot/publications/realising-scotlands-full-potential-digital-world-digital-strategy-scotland/pages/2/
30 See https://ddi.ac.uk/about-us-data-innovation/

While there is a recognition of the growing relevance of the DDI agenda in UK and Scottish Government strategies, there is no one-size-fits-all approach to tackling these issues and tapping into opportunities related to DDI, given the rapidly changing technological landscapes as well as local socio-economic and demographic challenges. There are a few recent exemplar DDI initiatives in the Scottish Borders. These are locally embedded initiatives with the involvement of businesses and employers, Borders College and other organisations in the area, as seen in Box 3 below.

3 Borders College's approaches to DDI[31]

At the Borders Technology Enhanced Care (BTEC) Hub in Galashiels, Borders Care Career Academy (BCCA) was created in 2018 in partnership with SBC, SBCares and NHS Borders, to support the delivery of the integrated health and social care. BTEC brings latest SMART Technologies and Data Science to the Health and Social Care industry. Border College has embedded the programme on data literacy into their core curriculum. It is taught online to over 170 full time students across a range of subjects (Construction, Business, Hospitality, Hairdressing, Beauty Therapy, Sport and Horse care). The programme consists of a pilot group of unemployed individuals that are developing data literacy skills learning about Data Citizenship, Data Science, Information Technology Skills and Communication.

Given the perceived gaps in digital skills provision, and in response to existing societal challenges and to the economic crisis during the pandemic, there is an imperative to support and integrate DDI activities in the Scottish Borders under the ESES CRD framework, and potentially with other initiatives in the South of Scotland policy contexts. Activities in this area should comprise both raising awareness of new digital and data analytics tools as well as partnering with organisations and individuals in the ecosystem to develop new user-led solutions.

These opportunities for digital up-skilling should also link to relevant existing initiatives, such as the South of Scotland Learning Network programme. This is part of the Borderlands Deal and involves a partnership between Scottish Borders and Dumfries and Galloway Councils and also Borders College and Dumfries and Galloway College. The network is proposed to use a 'hub and spoke' approach focusing on sectors identified here as having significant data-driven innovation opportunities, in particular Care, Renewable Energy, Construction and Engineering, with activities based at college campuses in Dumfries, Galashiels, Stranraer and Hawick as well as online.[32]

31 http://www.borderscollege.ac.uk/downloads/Borders-College_Strategic-Ambition_2020-2025.pdf ; http://esescityregiondeal.org.uk/new-blog ; http://www.borderscollege.ac.uk/courses/technology-enhanced-care-hub/

32 https://www.gov.scot/news/better-access-to-learning/#:~:text=The%20Skills%20and%20Learning%20Network,Scotland%20Economic%20Partnership%20(SOSEP).&text=%E2%80%9CThe%20Scottish%20Government%20has%20now%20approved%20funding%20for%2030%20SOSEP%20projects.

**Building infrastructure for entrepreneurship and businesses**

In order to better support entrepreneurship, there is a need to better connect opportunity areas with specific R&D projects that can catalyse company growth and formation. Having interviewed a series of local entrepreneurs and those involved in business support, we highlight below a set of initiatives that can advance economic activity within the selected targeted opportunity areas. New infrastructure for entrepreneurship development can revolve around better physical connectivity, a set of place-based innovation hubs and building digital-twin infrastructure for integrated use of data.

Existing local infrastructure and assets in the Scottish Borders could be aligned with some of the recent initiatives in the ESES CRD (e.g. Workforce Mobility Project, see Box 4) and the Borderlands Inclusive Deal, addressing digital skills gaps and green energy agendas - delivered through existing and new local private partners.

4 Workforce Mobility Project – ESES CRD

Public transport provision is fundamental enabling improved access to employment and training opportunities in the ESES City Region. For the Scottish Borders the provision of public transport is critical for the inclusive growth agenda, enabling training and employment initiatives (e.g. apprenticeships). The CRD partners could improve supply and demand information by supporting engagement with local public transport service providers, bringing together workforce travel demand data (e.g. Mobility heatmaps) optimising transport delivery and investment by enhancing data-driven and citizen-driven sustainable approaches.

This could build on existing discussions about Mobility as a Service (MaaS) in Scotland,[33] bringing all means of travel, transport providers and payment options together into one single service, giving customers instant access to all public transport, from trains and trams to buses and bikes. The development, testing and deployment of products and services in this area could be a significant opportunity for entrepreneurial firms. Furthermore, better connectivity can improve the place-based ecosystem conditions, which can attract more businesses to locate in the Scottish Borders.

CITY REGION DEAL
Edinburgh & South East Scotland

33 https://maas-scotland.com/what-is-maas/
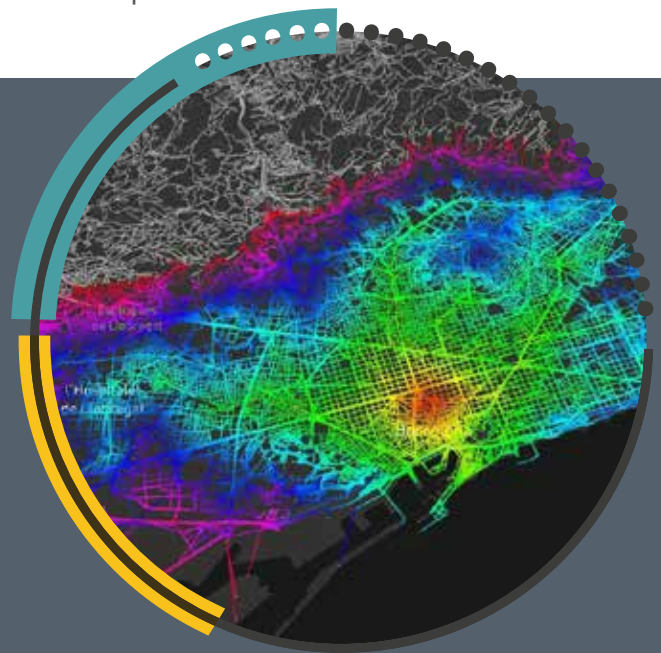
In addition, as there has been an increasing awareness of opportunities to support the sustainability agenda (e.g. energy, resources management). For instance, Scottish Borders Council is part of the Forth and Tay Offshore Cluster together with Angus, Dundee City, East Lothian, and Fife Councils, Scottish Enterprise, and the private sector. Through the development of the offshore wind along the East Coast of Scotland, large companies are being attracted to the Borders, including recent development of offshore wind maintenance facilities at Eyemouth (see Box 5). Establishing a regional hub can lead to significant second-order effects in the value chain, leading to new jobs and start-up companies.[34]

5 Offshore wind opportunity in the Scottish Borders[35]

Scottish Borders Council approved plans jointly submitted by Neart na Gaoithe (NnG) Offshore Wind Limited and Eyemouth Harbour Trust for an Operations and Maintenance (O&M) building for the in Eyemouth. This relates to the development of critical capability for Offshore Renewables operations and maintenance along the East coast of Scotland and a significant positive development for the local community, As the offshore wind power generation is expanding, so is the need for constant (remote) monitoring, management and maintenance of the associated infrastructure.

Three sets of data-driven solutions are emerging: advance deployment of sensors to monitor state of materials and structures within wind turbines; use of autonomous platforms (drones, submergibles, etc.) to quickly and repeatedly access relevant inspection points; and high-data throughput analytics (including machine learning/artificial intelligence) to develop models of predictive failure/maintenance forecasting.

This is a potentially significant DDI-expansion area, with highly relevant expertise available at the Edinburgh and Heriot-Watt universities in internet-of-things sensors development, autonomous robotics and software design. There are also several spin-off and start-up opportunities in this field as well as opportunities to work with existing SMEs in the city region.

NnG OFFSHORE WIND

EYEMOUTH HARBOUR TRUST
SCOTLAND'S FIRST PORT OF CALL

34 https://www.forthandtayoffshore.co.uk/
35 https://www.industryprojectstechnology.com/green-light-for-eyemouth-operations-and-maintenance-building-for-nng-offshore-wind-farm/

**Data-Driven
Innovation**

Given the potential of the visitor economy in Scotland, the tourism sector provides a potential for DDI development. A digital-twin data-driven decision enhancement tool is proposed that will identify gaps and prioritise opportunities for investment in Scotland's tourism infrastructure. This can encourage new hospitality ventures and make the existing ones (more) sustainable. Within the context of the Scottish Borders, there is a recent initiative to create a destination management and marketing organisation that connects diverse areas in the south of Scotland (see Box 6).

6 Destination management and tourism data in the Scottish Borders and South of Scotland

South of Scotland Destination Alliance (SSDA) has developed from Midlothian Tourism Forum; Scottish Borders Tourism Partnership and Visit South West Scotland (in Dumfries and Galloway) – previously all working independently on developing industry leadership skills and new opportunities in these key regional sectors.

This partnership is built on a flagship campaign, Scotland Starts Here, which received much acclaim from across the various stakeholders, as it was one of the first initiatives to pull all hospitality, amenities and leisure businesses and community groups together (app launched in 2019, website in early 2020). The SSDA has now secured £4m funding for developing a digital upgrade across the South of Scotland for marketing and integrated destination service provision.

The first phase of the digitisation of destination data has identified opportunities for further data-driven innovation. In particular, seamless integration and analysis of transport data, hospitality data and user data can lead to significant capacity needs forecasting (in transport, accommodation, human resources, etc.) as well marketing opportunities. In addition, with abundance of interesting amenities, the use of experiential digital environments (i.e. augmented reality) can expand the appeal of the intersection of cultural and environmental heritage by real-time exploration of layered the information about place and time.

**SOUTH OF SCOTLAND DESTINATION ALLIANCE**

Borderlands is a Natural Capital Innovation Zone under the Borderlands Inclusive Growth Deal and there is scope and need to quantify and manage these resources. Of particular interest are the aspects of biodiversity, water and air quality, as well as the ecosystems of peatlands and woodlands. Using geoscience's and biological expertise, local knowledge from a variety of public and private partners, as well as data from deployment of IoT-powered sensors can be a specific opportunity. This can address the policy and economic frameworks for the evidencing, management and exploitation of natural capital resources, and the development, piloting and roll-out of smart agriculture tools, as outlined in Box 7 below. These projects also cross into neighbouring local authority areas, most significantly Dumfries and Galloway and Northumbria. Further integration with Midlothian, in particular the world-leading Roslin/Easter Bush agri-tech cluster, is encouraged. The latter already offer consultancy services in the region and work with several individual farms and businesses in research projects and technology pilots.

7 DDI in agritech and forestry – SRUC and natural capital innovation zone

of which the Scottish Borders are part, will provide a vehicle to develop integrated, place-based and locally-led strategy and environment plans. One of the work streams, "Borderlands Smart Countryside" is relevant to DDI as it utilises digitised mapping of the Borderlands natural capital assets and demonstrating use of smart technologies. Two Innovation Centres being proposed and developed in the South of Scotland under the Borderlands Growth Deal exemplify new DDI opportunities.

Dairy Innovation Centre is to be based in Dumfries and Galloway, promoting precision agriculture and the IoT. Scottish Borders can perhaps benefit from a series of relevant projects within these initiatives, even though they have so far not been directly involved. For instance, the Dairy Nexus, aiming to develop infrastructure (digital twin dairy farms, biorefinery, milk technology unit) for co-innovation (with farmers and supply industries) can help renew dairying as a natural circular economy in the Borderlands by creating new income streams, faster productivity growth. Digital Dairy Value-chain is another area DDI will provide future opportunities. Scottish Rural University College (SRUC) and Centre for Excellence in Sensing Imaging and Internet of Things (CENSIS), are collaborating in this area. Getting Scottish Borders partners involved could yield significant benefits to the region.

Forestry Innovation Centre focuses on the forestry and wood sector, aspiring for a future data-driven forestry and wood processing. This will have a significant impact on the Scottish Borders. SRUC is going to deliver a new course "Agriculture Technology" focusing on precision farming system and promoting innovation in agriculture system.
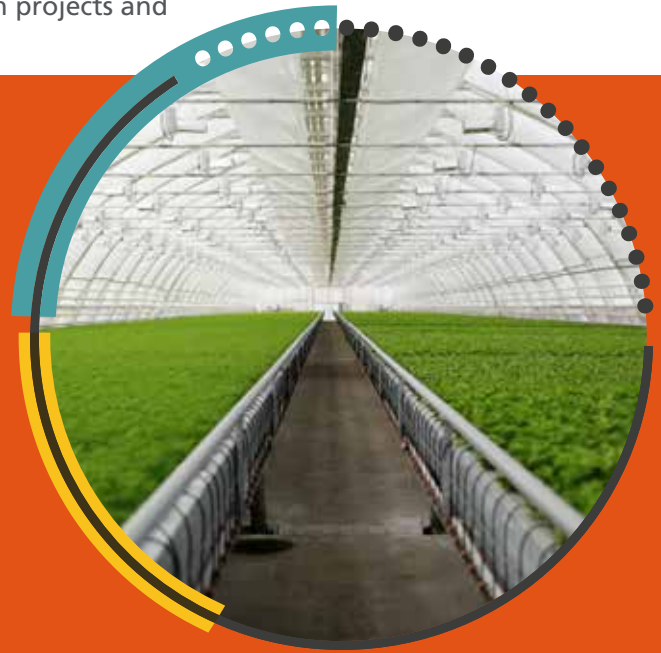
Recommendations for next steps

The main objectives of this study were to:

- Understand current innovation and entrepreneurial ecosystems in the Scottish Borders to evaluate options and identify opportunities and gaps; and,

- Outline the alignment of existing and emerging interests and perceived gaps between the key private and public sector organisations in the Scottish Borders and the DDI Programme.

Our recommendations are to nurture and support the entrepreneurial and innovation ecosystem in the region by developing bespoke initiatives along the lines of the overarching policy agenda to:

- Identify 'place-based needs' with businesses and communities

- Support growth of entrepreneurial businesses in the Scottish Borders through more integrated support such as incubator services and mentoring, to help businesses between access resources such as knowledge, finance and human capital.

- Better networking and connectivity across existing businesses and enterprises

These recommendations can be supported by the SBC, SoSE, and other partners in the region working together to create a clear strategy to develop DDI activities aligned with 'place-based needs' and key priority sectors. Given the dispersed nature of the geography and distance to urban centres, it is imperative to improve physical infrastructure and connectivity by utilising existing hubs in the region, connecting entrepreneurial networks and coordinating resources and training opportunities available elsewhere in Scotland. This is also vital to support the inclusive growth agenda, and to ensure that young people are supported in training and employment.

At regional level, it is important to work with all relevant regional partners to align goals for policy support for the development of entrepreneurial and innovation ecosystems.[36] However, while this is important, it is also potentially challenging given the potentially competing objectives of different bodies, the complexity of the interactions of different multiple policy levels (i.e. the local authority, regional economic development agency, the Scottish Government, the UK Government), and the varying longevity of the time-scales involved.

The formation of SoSE, and the participation of Scottish Borders in both the City Region and Borderlands growth deals provides an ideal opportunity to convene these conversations, to collaborate with other partners in the City Region and the Borderlands by fine-tuning the ways to work together for the economic recovery and regional growth by improving such infrastructure, connectivity and networks. We encourage the formation of a standing Working Group on DDI for Scottish Borders Economic Development (DDI-SBED), where the opportunities identified in this report can be explored further and a stable collaboration framework established.

36 Feldman, M., Siegel, D.S., Wright, M (2019) New developments in innovation and entrepreneurial ecosystems, Industrial and Corporate Change, Volume 28, Issue 4, August 2019, Pages 817–826, https://doi.org/10.1093/icc/dtz031

In order to realise the DDI related development for the inclusive growth agenda, we noted the following avenues for the partners to pursue jointly:

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• Pursue existing opportunities relating to local infrastructure and assets in the Scottish Borders, for example through the Workforce Mobility Project in the ESES CRD, or the green energy agenda or addressing digital skills gaps through the Borderlands Inclusive Deal. (See Box 8 for example.)

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• Supporting data sharing between organisations supporting education, skills and training including Skills Development Scotland (SDS), Borders College and the HEIs to support widening participation, increase retention of students after graduation, and support diversity and inclusion in apprenticeships and other training opportunities in communities.

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• The University and partners in the ESES CRD could encourage smarter use of procurement data for regional economic impact and innovation.

8 Potential for a ground-breaking circular economy partnership

Through discussions with Bayes Centre, we have unearthed an opportunity to work with Scottish Borders partners, our proposed Circular Economy Centre at UoE, and industrial partners (including, for example, Cisco) to explore the application of Digital Technologies for addressing issues of sustainability and inclusive economic growth in the Scottish Borders. In particular, this could focus on the following specific areas of development, listed below:

1. Sustainable textiles and fashion: Building on existing capacity in light advanced manufacturing in Textiles & Fashion in the Borders, a number of projects could be established with the Centre of Excellence in Textiles, local partners, and design experts in UoE's College of Art. UoE's proposed Circular Economy Centre could facilitate a public-private sector partnership to advance regional circular economy for the Border's textile sector, creating a centre of excellence and innovation to explore the role of data in value chain management and logistics in this sector. Discussions are planned for early 2021 to explore this concept further, as per the Smart High-Added-Value Manufacturing opportunity area.

2. Local mobility and infrastructure: Critical challenges in the local ecosystem related to mobility and energy efficiency have also been explored in preliminary conversations with key stakeholders, including ScotRail (Borders Railway train operators, with specific interest to develop new IT systems and extend the use of physical infrastructure). Projects here could seek to develop integrated mobility solutions (on-demand services, use of data for capacity planning, etc.), in conjunction with zero-carbon local housing development and local energy generation schemes, aligned to the Workforce Mobility project, the

emerging Energy Masterplan, within the context of the identified Energy-Efficient Infrastructure opportunity area. Additionally, developing such community-enabling infrastructure enables the ability to create and advance regional circularity, for example through localising supply chains, manufacturing and skills. Furthermore, the improvement of regional infrastructure and mobility would provide a post Covid-19 recovery for the region, enabling greater levels of tourism and economic activity. Again, the proposed Circular Economy Centre would be well positioned to facilitate public-private partnerships to explore these opportunities.

3. Regional jobs and upskilling for a just transition: working with the regional colleges, UoE's Circular Economy Centre could play a key role in provision of education and skills training for emerging 'green' jobs and jobs in the circular economy. This new, high growth area, is essential to Scotland's green recovery and requires new skill-sets and roles, including the use of data and use of digital technologies. This could provide a sustainable model for economy growth and recovery in the Borders.

4. Agritech and agriculture: efficient use of land and resources is essential to creating a circular economy and this sector is critical to the Borders. UoE's experts in biotechnology and other related fields, facilitated through the Circular Economy Centre, could develop projects with regional stakeholders to develop methods for the use of digital technologies in agriculture to create a plan for the sustainable growth of this crucial sector in the Borders.

The partnership emerging on the back of these development themes could be transformative for the framework of engagement with rural entrepreneurship, where Scottish Borders can be recognised as a pilot "living laboratory" area for other rural communities in Scotland and wider.

We further recommend the university increases its direct contacts, visibility and physical presence in the Scottish Borders, by utilising existing networks (e.g. Interface) and building on the work of sector leads and business development managers to work on raising awareness to local businesses and organisations about wider DDI opportunities in collaboration with local partners. In line with the DDI Programme objectives, there are existing projects in talent development through training and skills provisions in collaboration with Borders College, in particular. The focus is on data skills and digital up-skilling for both traditionally dominant economic sectors and emerging sectors. This needs to be extended to research, adoption and entrepreneurship activities, building on the opportunities identified in this report.

As this is a preliminary feasibility study, the conclusions and recommendations are limited in terms of the scope and level of details. Such a study needs to be supplemented with further research to define and detail the possible pathways for the exploitation of opportunities presented. We need to consider the wider 'social impacts' of the identified DDI opportunity areas in the Scottish Borders by collecting evidence over time. Data and evidence on the City Region needs to be built as part of the long-term development of the DDI Programme.

Appendix A: Sources of Data and Analysis

Data sources

Primary Data Sources and Informants

Interviewees in Scottish Borders

Nine businesses located in the Scottish Borders

Scottish Borders Council

Borders College

SB Cares

Live Borders

Eyemouth Harbour Trust

Others

Borderlands Growth Deal

South of Scotland Enterprise

Scottish Enterprise

Mountain Bike Centre of Scotland (MTBCOS)

Mountain Bike Innovation Centre (business case manager)

Visit Scotland

South of Scotland Destination Alliance (Midlothian and Borders Tourism Action Group)

Whereverly

ScotRail

SRUC

Scottish Edge

Interface

University of Edinburgh

DDI Programme team, Hub Leads

DDI related BDMs and academics at Bayes Centre, EFI, Usher Institute, Easter Bush

Edinburgh Innovations

School of Engineering

Procurement Office

Student recruitment and admissions

Corporate Services Group

Edinburgh Centre for Carbon Innovation

The Advanced Care Research Centre

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