



ESCALATE UK

The Exeter Data Analytics Skills Escalator



1. INTRODUCTION

This Report describes the role that the University of Exeter has taken, together with its regional partners, in creating a 'data analytics skills escalator' for the Exeter City region. It looks at how and why a university, working with other skills providers and economic development bodies, decided that 'data analytics' should be a regional skills priority and at the steps taken to deliver the skills we agreed were needed.

Being part the ESCALATE project, the purpose of this Country Report is to promote discussion, particularly within the ESCALATE partners, around the challenges and success factors that we faced in delivering this initiative and around the replicability of our efforts. Conclusions drawn from these discussions will inform the content of the Escalate project training programme and the partner pilots.

2. CONTEXT

2.1 Smart Specialisation

The UK Government and European Union (EU) are both asking regions to differentiate themselves: not to compete with neighbouring or multiple other EU regions at becoming the best at exactly the same thing. Regions have been instructed to consider their assets (natural, industrial or intellectual); to be clear about where the presence of such assets provides them with comparative advantage; and then to build on these assets to become world class in a few specific sectors, industries or technologies. This policy, known as 'Smart Specialisation' by the European Commission, drives the targeting of EU Structural and Investment Funds (ESIF). Although not often referred to as Smart Specialisation in the UK, the same rationale is increasing driving or focusing UK Government investment.

2.2 The move to Challenge Funding

Following its election in the wake of the 2008 Financial Crash, the newly elected Conservative Government disbanded England's Regional Development Agencies. They cut the funding available for local economic development by over 50% and centralised the remaining budget, putting it into a series of 'challenge funds'. Regions had much less direct control over their own funding, but were invited instead to bid for money from these central pots, competing against each other on the basis that investment of this funding in their area would deliver greatest benefit.

In the place of Regional Development Agencies, Government set up Local Enterprise Partnerships (LEPs): employer-led boards tasked with agreeing an economic strategy for their area. These economic strategies were supported by subsidiary strategies focused on

productivity & innovation, skills, sectors and similar. Equipped with these strategies, the public partners, also represented on the LEP board, such as local authorities, universities, colleges, third sector bodies, would bid for Challenge Funding pointing to these strategies to demonstrate the strategic importance of their proposal and its relationship to other investments designed to deliver the same strategic goal.

It is interesting to note that, as this may differ in other EU contexts, although their strategic backing has been important, no money has been given specifically for Escalator's development by any local authority or regional authority responsible for supporting economic growth in the area. They do not have direct access to resources to act in such a proactive and independent way.

2.3 The role of Universities in local economic development

There is a long-standing narrative in the UK which is that while our Universities have been extremely good at producing world-class research, they have too often failed to translate this research into world-class products and competitive advantage. In 2013, Sir Andrew Witty published his influential 'Review of Universities and Growth - Encouraging a British Invention Revolution' in which he argued that Universities needed to put greater emphasis on knowledge transfer and to assume a much greater responsibility for facilitating economic growth in their area. At the time of his report it was becoming apparent that EU 2014-2020 programmes (such as Horizon 2020 and ERDF) would be linked to the delivery of Smart Specialisation and that universities' ability to compete for both EU and UK research, development and innovation funding would increasingly depend on their ability to demonstrate how that investment would contribute to local economic growth.

Whereas, historically the University of Exeter may have argued that the very presence of a large world-class institution bringing well paid jobs and international students to a small city in the South West peninsular of England was itself a major contribution to the region's economy, from 2013/2014 the narrative changed. In 2014, the University established a new 'Regional Impact Team' to deliver this enhanced regional economic role, forged through the re-deployment of staff from the Marchmont Observatory¹.

¹ While Marchmont, funded by the South West Regional Development Agency, had fifteen years' experience of working on regional economic and skills strategies, it had always done so as an independent self-financing research centre. Arguably, this independence brought with it a certain peripherality that was valued because it enabled Marchmont to discharge much of University's local economic development responsibilities while simultaneously allowing the institution to continue to focus, undistracted, on its key responsibilities: world class research and teaching. The idea that such world-class activity should simultaneously improve local economic fortunes was anathema to most. It remains so to many. However, the tide of politics, policy and funding had by 2014 changed, such that a concerted focus and strategy in this area had become necessary.

2.4 The Heart of the South West Local Enterprise Partnership

In our area, it is the 'Heart of the South West' (HotSW) LEP that is responsible for agreeing economic strategies with Government. While Exeter sits at its centre, HotSW is a large, predominantly rural, geography. It includes a city larger than Exeter (Plymouth) and four Upper Tier local authorities², each with its own particular characteristics and strategic interests. As a consequence, the process of agreeing HotSW LEP's economic, industrial and Smart Specialisation strategies always involves combining a series of sub-regional interests into something resembling a coherent whole. While it is an economic driver for the region (see Section 3), Exeter is not in itself an Upper Tier Authority, but the largest city within a rural county, it has therefore to work carefully to ensure that it's interests are not lost when competing with other regional developments, such as:

- The building of Hinkley Point C - UK's first new nuclear power station for 40 years and one of Europe's largest construction projects
- Plymouth – a marine hub and major naval base; host to the UK's nuclear submarine fleet and Princess Yachts (a world-leading brand of pleasure craft)
- Yeovil – where 2,800 people are employed making helicopters (Leonardo).
- The rural economy, including land-based activity (e.g. agri-tech) and tourism.

Figure 1: Heart of the South West Local Enterprise Partnership



² The four Upper Tier local authorities in HotSW are Plymouth, Torbay, Devon & Somerset.

2.5 The Exeter economy

Exeter is a successful University City and something of a hub for knowledge-intensive employment in one of England's most peripheral and least productive areas (HotSW ranks 32nd out of 39 LEPs for productivity). According to the Centre for Cities 2020 Report, out of the UK's 63 largest cities, Exeter was the 3rd fastest growing; had the 3rd lowest unemployment; the 2nd lowest proportion of its population with no qualifications and the 17th highest with high qualifications; the 7th fastest growing wages; and the 14th largest number of patents per capita. Output per full-time employee in the city is nearly 25% higher than across the LEP area as a whole. Exeter's travel-to-work area is also growing. Each day 37,000 people (equivalent to 45% of all employees in Exeter) commute to the city to take advantage of employment opportunities.

This position enabled advocates of investment in Exeter to point to signs of agglomeration in and around the city: to knowledge-intensive companies being drawn to Exeter as a location where they could benefit from the exchange of goods, ideas and people. These arguments were well suited to the economic moment.

This, however, is only part of the Exeter story. Like all cities, Exeter faces a number of inclusion and area-specific challenges / opportunities it would wish a major skills initiative to address. Chief among these are, the fact that:

- The proportion of 18 and 19 year olds from the area who progress into higher education is much lower than expected (taking account of factors such as educational attainment). Ensuring that young people are able to benefit from the growth in graduate-level employment opportunities is a key goal.
- The University draws large numbers of talented young people to Devon; people whose knowledge and skills could be a powerful force for driving local growth. Yet, only 13% of Exeter University students identify the South West as the preferred location for their first job on graduation. Large numbers of young people who were born or brought up in the region also leave to build their careers in other parts of the country. While this is a complex issue, increasing the number of young people who build relationships with local companies and have the opportunity to apply their skills in the local economy is an important objective for the region and for the Escalator.
- There attractiveness of the region and lifestyle opportunities it offers, draws a number of people and organisations to relocate to Exeter and Devon, particularly in their mid to late-careers. While the ability to attract experienced employees is a factor behind the area's success, this dynamic also increases competition for well-paid / knowledge-intensive jobs for local people. Again, enabling local people to benefit from the local growth, is a key objective for the Escalator.

2.5 UK Economic Context & Policy

Between 2010 and 2016, the UK's recovery from the financial crisis was entirely employment-led. Total economic output (GDP) started rising in 2010, but it wasn't until late

2016 that productivity (output per head) recovered to its pre-recession level. To that point, the growth within the economy had been entirely attributable to an increase in the volume of people in, what was often low skilled and low waged employment.

In 2015, with the employment rate (74%) above its pre-recession highs (73%) but productivity 20% below the average for the other G7 advanced economies (the widest productivity gap since 1991), the UK Government produced a 15 point plan ('Fixing the foundations: Creating a more prosperous nation', July 2015) putting productivity growth at the heart of the national economic policy.

A year later in June 2016, the UK voted to leave the EU, resulting in an even greater focus on how to secure the UK's competitive position in a global economy and, in 2017, a new UK Industrial Strategy. Abandoning the 'default' Conservative Party position of allowing the fortunes of industry to be determined almost exclusively by the 'free-market', the Industrial Strategy sought to set out '*a path to improved productivity*' through investment in Ideas, People, Infrastructure, Business Environment and Place across four Grand Challenge areas where '*Britain can lead the global technological revolution*'. The four Grand Challenges were artificial intelligence and big data; clean growth; the future of mobility; and meeting the needs of an ageing society.

3. EXETER'S STRATEGIC PRIORITIES

Exeter was in an excellent position to respond to these agendas. With a highly educated population, a new science park, expanding knowledge-intensive employment and a research-intensive University, it was able to position itself as exactly the sort of location to deliver this agenda for Government. Using comparisons with other successful small cities as evidence – such as the City of Cambridge. Its case for investment was further supported given its position within a peripheral region with problematic low productivity.

While investing in Exeter can be argued as a logical attempt to assist a 'lagging' region when viewed from outside, remoter Districts across the LEP geography could equally view this as further concentrating resources in the region's most successful area – whereas they themselves continue to struggle with seasonal unemployment and low wages. These geographies' preference for economic strategy and investment was therefore to remain driven by inclusion and cohesion - i.e. the levelling up of their lagging areas, rather than on creating technology-led clusters in parts of the LEP area that were already relatively booming.

This local policy context was an important consideration in the development of the Data Analytics Skills Escalator. Political acceptance required not just alignment with the national agenda, but to the ability to simultaneously address a range of local concerns expressed across multiple strategies focused on productivity, industry/innovation, inclusion and cohesion. Ensuring that the Escalator was inclusive, geographically and socially, was key to securing backing from the LEP, as was its presentation as a 'model,' rather than as a replicable 'solution' for the LEP.

3.2 Exeter's Smart Specialisation Priorities

Recognising the direction of travel described above, in 2014 key players³ involved in Exeter's economic development came together, under the leadership of Exeter City Council and the University of Exeter, to debate how to realise the vision of establishing Exeter as a leading knowledge economy in the UK. At their first meeting, a dinner hosted by the University's Vice Chancellor, the group agreed to forge a new partnership, 'Innovation Exeter', focused on defining and delivering a smart-specialisation strategy for the city.

The group's review of its local assets resulted in a decision to focus on building Exeter as a nationally recognised centre for data analytics and data exploitation, with a particular focus on environmental data science. Members of the partnership agreed to focus their economic development efforts on establishing an active and supportive infrastructure, including: a science park; enhanced innovation / knowledge exchange capability; business support services; and a Data Analytics Skills Escalator.

³ Exeter City, East Devon, and Teignbridge District Councils, Devon County Council, the Met Office, the University of Exeter, Exeter College and the Royal Devon and Exeter Hospital Foundation Trust

Central to this decision was the move to Exeter in 2003 of the UK's Meteorological Office, a world-leader in climate and weather science. With over 2,000 employees, the presence of the Met Office added a vital flagship to the region's already considerable environmental science knowledge base, which included: environmental science research clusters at Exeter and Plymouth Universities; the UK Hydrographic Office in Somerset; an arm of the UK's leading agricultural research station (Rothamsted Research) in West Devon; and Plymouth Marine Laboratory. As Government was simultaneously pushing national laboratories (such as the Met Office) to become better drivers of local economic growth, Exeter and the wider HotSW LEP area had a huge asset around which to build messages and bids for funding back to Government.

In 2015, HotSW LEP identified 'Environmental Futures' and 'Big Data' as two of its eight Smart Specialisation priorities⁴, recognising that the Met Office provided *"a nucleus for world-leading business innovation and impact in the environmental sector, [and for] attracting specialist units from larger companies as well as high-growth SMEs."*⁵ The LEP's 2018 Productivity Plan further prioritised Exeter's emergence *"as a cutting edge place for enviro-technology, agri-tech and data analytics"* due to *"an exceptionally high concentration of climate and environmental science experts, and Europe's most powerful supercomputer"*.

More locally, the 2019 Exeter Local Industrial Strategy established the vision that *"Exeter will be the global leader for addressing the challenges of climate change and urbanisation, and the world-leading location for applied environmental science, health and data analytics."* This vision is underpinned by prioritising the development of *'the skills and capabilities to harness and interpret data to ensure value generation globally and locally'* through the development of the Data Analytics Skills Escalator.

3.4 Data Analytics or Environmental Data Analytics?

As previously stated, the Escalator's inclusivity - its ability to accommodate the skills concerns of different social interest groups and geographies - has been central to its success. A further flexibility that has enabled it to gather broad support is that up to levels 4 or 5 it is 'sector blind', generating statistical and data science skills that are a priority for enterprises across the economy. Above Level 4/5, however, it starts to play into the very specific Smart Specialisation Strategy set out above. So, while the Escalator is mainly focused on skills it links or extends into a range of aligned initiatives focused on innovation, knowledge transfer, business support, and infrastructure initiatives, all of which are geared to the same goal.

These initiatives can be seen on the right hand side of the Escalator diagram in Annex.1. Whether an Environmental Futures Campus on a Science Park or a new Centre for Doctoral Training in Environmental Intelligence should or shouldn't be shown on a diagram of a skills

⁴ The fact that the LEP had eight Smart Specialisation, arguably too many, is indicative of its wide geography and need to accommodate a wide range of local interest. While getting Exeter's specific interests included as Smart Specialisation sectors was not problematic, competition for priority relative to other LEP Smart Specialisation sectors remains ongoing.

⁵ <https://heartofswlep.co.uk/wp-content/uploads/2016/09/Appendix-3-Smart-Specialisation-Approach.pdf>

escalator’ is not particularly important. It is, however, useful when seeking to understand the content of these aligned investments.

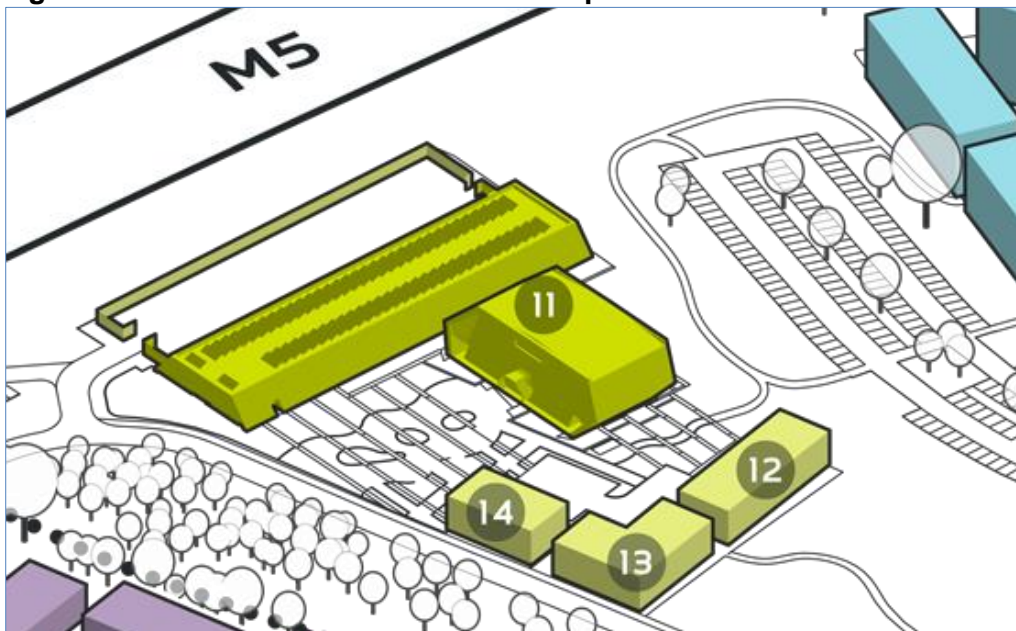
4. ALIGNED INVESTMENTS

Here we look at the scale and focus of some of the principal innovation, infrastructure and business initiatives with which the Escalator concepts is aligned. The Escalator is, after all, just one part of an integrated strategy. Our ability to point to these other complementary investments has also been a crucial factor in winning funding and support for the Escalator itself.

4.1 Environmental Futures Campus

The Exeter Science Park, which opened its first building in 2015, includes land set aside for an Environmental Futures Campus, designed to accommodate 375 new environmental jobs. The site currently houses the Met Office Supercomputer (the long rectangular building on the left of Figure 1.) and the Collaboration Zone (No. 11), a landmark building that houses the Environmental Futures Impact Lab. The construction of two new Environmental Futures ‘Grow on’ buildings (No. 12 and 13) commenced in 2020. A developer is being sought for a further 8,000 square feet building (No. 14).

Figure 1. The Environmental Futures Campus at the Exeter Science Park



4.2 Environmental Futures and Big Data ‘Impact Lab’

The Environmental Futures and Big Data Impact Lab is HotSW’s largest (£6.4m) ERDF investment. Led by the University of Exeter, it brings the region’s environmental intelligence assets⁶ together to deliver an integrated innovation and new product support service to SMEs in Devon. Based in the Collaboration Zone building on the Environmental Futures Campus (No. 11 on Figure 1.) it provides data science expertise via teams of Industrial Research Fellows and draws deep technical know-how from across the partner organisations to help innovators to create new products and services.

4.3 Enhanced University of Exeter Research Capability

The University of Exeter is simultaneously investing to transformation its capability in data science, high performance computing and artificial intelligence. A new Institute for Data Science and Artificial Intelligence (IDSAI) has been created to deliver: world-class research; support for collaborative projects with academics from other disciplines (particularly environmental science); industrial collaboration; and a step change in the contribution to the digital skills agenda.

The University is also proposing an investment of up to £100m in a new Global Systems Institute (GSI) to position Exeter as a world-leading university in solving global challenges by bringing academics from different disciplines together (including from IDSAI) to more accurately predict global changes, taking into account interactions between the physical climate, natural ecosystems, and human social systems; to identify transformative solutions; to train a new generation of change agents; and to work with global partners from business, the public and third sectors, to translate research into solutions.

4.4 Centre for Doctoral Training in Environmental Intelligence

In 2019, the University of Exeter was awarded £5.2m to create a new Centre for Doctoral Training in Environmental Intelligence: Data Science and AI for Sustainable Futures. The centre will fund 72 PhD students to develop skills to help create a better understanding of the complex interactions between the natural world and climate change, with human social, health, and economic systems.

4.5 The University of Exeter Enterprise Zone

Also in 2019, the Exeter Science Park was awarded ‘University Enterprise Zone’ status and funding, to create new co-working and collaboration spaces and deliver enhanced business incubation and support services to enterprises in the area. This £1m initiative which has been supported by a further £1m of ERDF funding has a particular focus on supporting the growth of data-driven and environmental businesses.

⁶ The partnership includes The Met Office, University of Exeter, Rothamsted Research, Plymouth Marine Laboratory, Exeter City Futures, University of Plymouth and Plymouth College of Art

5. SKILLS PRIORITIES FOR THE ESCALATOR

The rising need for skills in data analytics, data science and artificial intelligence across industry is well documented in labour market research. Advances in computer memory, processing power and algorithms have made it possible to store and analyse the huge quantities of data generated by the everyday use of digital technologies, while imaging and sensing technologies now enable scientists to study the environment and other phenomena with unprecedented precision.

Corporate capacity to understand data, about consumer behaviour or process efficiency is becoming central to competitive advantage, to the extent that big data has been termed *‘the new oil’ that will fuel our economy in the coming decades*⁷. Public bodies are similarly focused on working out how they can use this data to improve service delivery and quality of life. Yet, all this data is useless unless we have the skills and creativity to turn it into insight and action.

During the early stages of the Escalator development it became clear that the employment opportunities open to those with data science skills were immense, and it remains the case today, particularly following Covid-19. e-skills UK, the responsible sector body, produced evidence to show that demand for skills in big data analytics was rising at an almost exponential rate and four in five data-intensive businesses struggling to find the skills they need⁸. These recruitment difficulties were also reflected in the average salaries for data scientists which were 30% above the average for all UK managerial / professional salaries and 80% above the average salary for all UK workers⁹.

To supplement the national research, understand any possible local nuances in demand and to secure early buy-in and support for the initiative, the University of Exeter ran a series of employer consultation events (business breakfasts / workshops) through 2016 and 2017.

Employers pointed to a need to raise awareness, interest and excitement about careers involving the application of mathematics and computing. This, they argued, should be done by engaging employers in curriculum enrichment activities that enabled pupils to think creatively and which led them to enjoy addressing real-world challenges using real-world data. They were very clear that developing analytical thinking capability, i.e. supporting pupils, students or other trainees such as business leaders to think creatively about the challenges and opportunities they face and the role that data can play in resolving these, was just as important as the technical and scientific training. The two should go together. There was a need to provide young people with mathematics and coding skills the opportunity to apply their skills through work experience and internships, in situations where they also acquired business acumen and employability skills and to focus on problem-

⁷ e-skills, Big Data Analytics, Assessment of Demand for Labour and Skills 2013–2020, October 2014

⁸ *Model Workers – How leading companies are recruiting and managing their data talent*, NESTA, Royal Society of Statisticians, UCKES, July 2014

⁹ *Big Data Analytics, An assessment of demand for labour and skills, 2012-2017*, e-skills 2013.

centred learning in which learners could work in teams, reflect on their findings, relate these to real-world concerns and develop communication skills through feedback exercises.

6. ESCALATOR PARTNERS

In Sections 2 and 3 above, we have described the role of economic development bodies at various levels in supporting the Escalator's development while also pointing out that the work of finding the funding and putting it together was left to the educational institutions that would deliver it.

The key institutions that both provided the foundations for the escalator and which committed to its further development included:

- **The Ted Wragg Multi-Academy Trust** – a management body which brings together three of the area's largest secondary schools, one all-age school campus and a large primary school to innovate and forge partnerships with organisations such as Sparx, a scientifically driven educational technology company that is using big data to transform the way young people learn.
- The new **Cranbrook Education Campus**, adjacent to the science park, which is committed to becoming a centre of excellence for mathematics by implementing cutting edge technology across the curriculum.
- The **Exeter Mathematics School (EMS)**, opened in 2014, one of only two free specialist maths schools and a regional centre of excellence offering live-in facilities to attract talented 16 to 19 year old mathematicians to Exeter, cited in the national Industrial Strategy as an exemplar to be rolled out elsewhere in the country.
- **Exeter College**, the first college in Devon and Cornwall to be rated as 'Outstanding' by Ofsted¹⁰ using the new enhanced framework and BTEC College of the Year in 2014.
- **University of Exeter**, ranked 21st in the UK for Computer Science and 14th for Mathematics in 2017 (Complete University Guide, Times Good University Guide). Its undergraduate computer science programme has doubled in numbers in recent years and it is also one of the only 15 universities in the UK to host a Q-Step Centre, a £19.5 million programme to provide social science students with proficiency in applied data analytics.

¹⁰ Ofsted = Office for Standards in Education, the inspection body responsible for setting and reviewing standards in further education

7. ESCALATOR PRIORITIES

7.1 Objective 1 - Raise young peoples' awareness, interest and attainment in data analytics study and careers

Learning identities and our perceptions of different academic subjects are formed at an early age. Whilst data analytics employers will recruit talent from across the country, a priority for local policymakers is to build a model that engages young people from their geography. This should seek to engage the young learners in understanding how data can be applied to gain insights about the real world - from an early age. The need is encourage those growing up in and around Exeter to take an interest in the well paid and rewarding jobs the Escalator partners and local industry are creating.

Working with employers and public bodies, the escalator aims aim to raise awareness of the central role that data now plays across a wide range of careers by educating teachers and guidance professionals, generating opportunities for employer visits and placements, engaging parents, delivering master-classes and sand-pit sessions, and by recruiting young people as role-models and ambassadors.

The partners are finding ways of enriching the mathematics and ICT curriculum, extending initiatives such as summer schools, to build on the existing Met Office Ambassadors scheme and to find ways of making learning fun through techniques such as gamification.

The escalator is also very much concerned with inclusion; to address the fact that women remain seriously under-represented in this area of study and work, accounting for only 15% of Computer Science undergraduates and 18% of the IT workforce (HESA data 2015, e-Skills 2012).

Getting young people with mathematics and coding skills into business through work experience, placements and internships through which they can acquire business acumen and employability skills is another important task.

Progress to date

SPIDAS

In Sept 2017, a consortium of four local schools, the Met Office, University of Exeter and Exeter College, were awarded an ERASMUS+ grant to establish a 'Strategic Partnership for Innovation in Data Analytics Skills' (SPIDAS). Alongside Universities and networks of schools in Spain and Turkey, SPIDAS explored new ways of teaching of data analytics through student-centred, problem-based learning, focusing on the impacts of weather and climate change. Young people analysed factors such as the correlation between wind speeds in their locality and frequency of playground accidents, reporting their findings back through multi-media / filmed presentations. Common success factors and lessons, e.g. around impact on learning identity, enjoyment of maths and likelihood of continuing maths

education, are being drawn together into a structured SPIDAS Toolkit that other schools, locally and nationally, can use to replicate or build on our experience. See <http://blogs.exeter.ac.uk/spidasatexeter/> for more information.

Met Office Ambassadors

Met Office Ambassadors work with schools and colleges across the region, delivering a wide range of education and outreach activities aimed at young people and the general public to encourage interest in STEM careers. Their activities include delivering interactive workshops and talks at schools; running code clubs, running interactive sessions and stalls at festivals and attractions around the area; coaching, mentoring and supporting mock interviews.

Outreach and curriculum enrichment

In January 2018, the University of Exeter secured £200,000 of Catalyst funding to deliver an outreach, engagement and curriculum enrichment programme, raising understanding, aspiration and opportunities to progress into data science learning from schools and colleges across Devon, including PETROC, Exeter Maths School, Exeter College and South Devon University Technical College (UTC).

The programme builds on successful practice already established with the Exeter Maths School which includes activities such as 'Inspire Lectures', interview training and delivery of an 'Exeter Mathematics Certificate' on completion of projects, created by academics, delivered by teams of pupils, supported by student mentors and culminating in the delivery of pupil presentations to a large audience of academics, students, parents and friends in the University of Exeter's Alumni Auditorium.

Sparx

Sparx is a scientifically-driven and research-based local educational technology company that uses technology, data and real world classroom observation to investigate the way young people learn. Using technology, Sparx examines the learning process, exploring and analysing what works and what does not to deliver more personalised lessons that deliver results. The approach was extensively piloted with St James School, a large secondary school in the city where just 46% of students achieved five or more GCSEs including English and Maths in 2011, a figure 12 percentage points below the England average (58%). Today, Attainment in Maths (9.6) is well above the England average (9.0), the Progress indicator (+0.44) suggesting that students' attainment in mathematics is approaching half a grade above expectations.

The measures described above are good a start. However, too many are being delivered on a pilot basis or with short-term project funding. We also recognise a need to extend these activities across the sub-region, embedding them into the mainstream practice, though this is challenging as so much is dependent on national education policy.

7.2 Objective 2: Establish an Institute of Technology

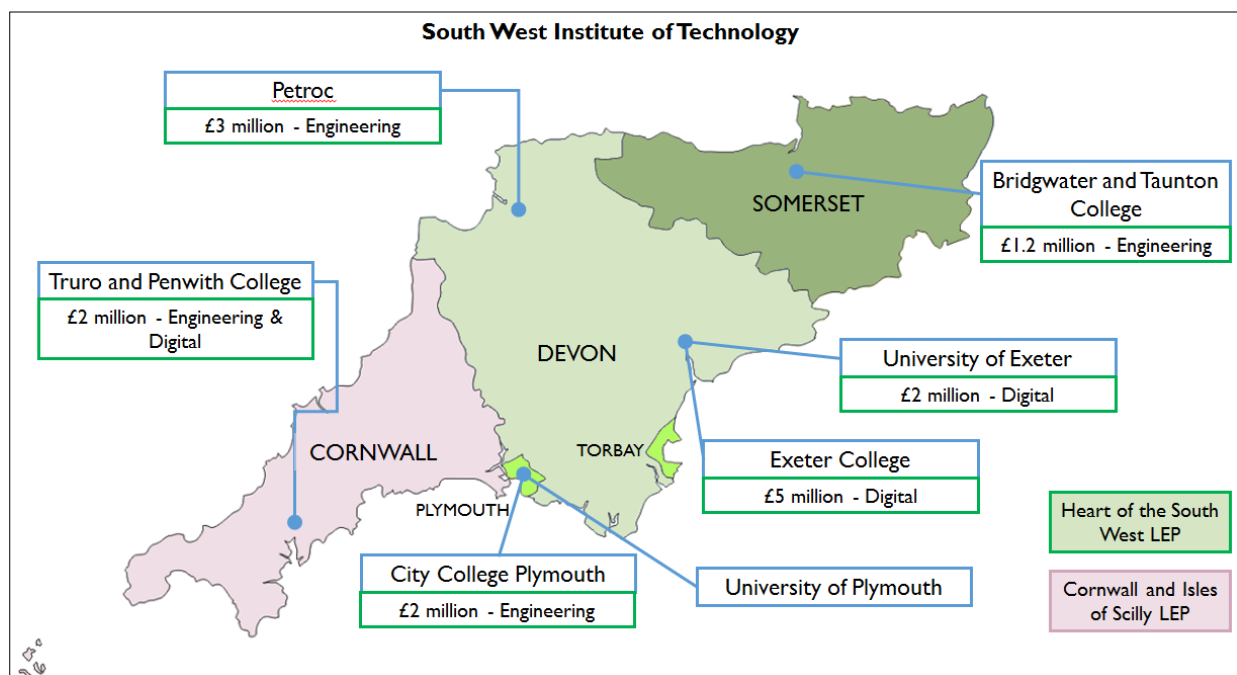
The Conservative Party's 2017 election manifesto announced that £180m would be made available to create around 12 institutes of technology (IoTs) across the UK. IoTs would be

new educational institutions, led by colleges, universities and employers within a geography providing the specialist higher-level professional and technical education, primarily at Level 4 and Level 5. The relative weakness of UK technical education (compared to countries operating the Dual / Apprenticeship System, for example) has been a long-standing concern of UK VET policy and employers. IoTs are designed to fill this gap by delivering intermediate and higher level technical skills required to deliver local industrial and growth strategies.

Partners in Exeter initially considered whether it would be possible to establish an IoT in Exeter focused on digital and data skills. However, the scale of the IoTs, particularly the requirement to have at least 1,500 new learners, meant that such a proposition was unlikely to be viable in a city as small as Exeter (with a population of 130,000). We were also aware that broad political support (from the LEP, members of parliament and other education providers) would be essential to the success an IoT bid. A proposal for an IoT distributed across multiple locations in the SW peninsular, focused on both Digital/Data and Advanced Manufacturing and Engineering skills, was developed instead.

Progress to date

In 2019, the University of Exeter was informed, as lead applicant, that the South West IoT consortium had been successful in its application for £15.2m of IoT funding. The additional funding from Government was capital, to build and / or equip a range of new IoT buildings across the South West, shown in the map below.



The SWIOT bid secured £7m to build two new buildings for digital and data analytics training in Exeter, a £10m facility at Exeter College and £3.65m facility at the University of Exeter, both designed with group desk clusters, to facilitate problem-based learning.

Allied to this, SWIoT will deliver an expanding range of courses in digital and data science from Level 4 to level 7, informed by:

- An Employer Leadership Group to ensure that provision is tailored to employers' needs and meets industry standards.
- An Observatory to ensure that SWIoT's curriculum is based on market intelligence, horizon scanning and a wide range of primary research into digital and data analytics skills needs.

As a footnote to this initiative, it should be noted that all education providers are concerned about difficulties in attracting talented staff with the skills and experience needed to teach data analytics. These recruitment difficulties are a potential constraint on the success of the Escalator. Teachers and tutors already in post experience difficulties with keeping up-to-date with the latest methods, technologies and industry standards.

The fact that the Escalator includes an emphasis on integration of curricula and progression of students across institutions suggests that it would be sensible to take a collaborative approach to staff development, involving mutual learning and the exchange of staff across institutions.

Building on the presence of the University of Exeter's leading Graduate School of Education, ranked 8th in the UK for research and 3rd for PGCE teaching, we are seeking to create a SWIoT Academy, focused on translating SWIoT Observatory findings into practical advances in teaching and learning by developing, piloting, evaluating and mainstreaming new approaches to teaching data analytics. Initiatives such as SPIDAS (described above) are the start of this process. Additional resources now need to be secured to mainstream this.

7.3 Objective 3: Develop an apprenticeship pathway in data analytics

A key aim of the Escalator is to create visible, coherent and uninterrupted pathways that provide a line of sight and direct route that young people from Exeter can follow into the knowledge-intensive jobs being created at the Science Park and across the City as a whole. To achieve this, Exeter College and Exeter University are committed to working together to build flexible apprenticeship pathways, for students who wish to remain in employment.

Progress to date

As part of its commitment to the Escalator, Exeter College is expanding its IT Practitioner apprenticeship provision, as well as introducing a new digital pathway to allow progression to higher apprenticeships across a wide range of job roles such as IT technical support, software developer, web developer, database administrator, telecoms engineer and network planner. In 2018, the College became one of the first colleges in the UK to introduce the

Data Analyst Higher Apprenticeship at Level 4¹¹, the launch of which was linked to the creation of an 'Exeter Data Information Science Collaborative' (E-DISC), an initiative in which leading city organisations¹² committed to recruiting one or more apprentices to be among the first cohort, so reducing the risk for this new initiative.

In September 2016, the University of Exeter became the first Russell Group University to offer the Digital and Technology Solutions (DTS) Degree Apprenticeship, aligning its curriculum to College's DTS Level 4 provision to facilitate progression along specialist pathways in: software engineer, IT business analyst, cyber security analyst and data analyst.

As part of SWIoT, the University of Exeter will be introducing the new specialist Level 7 (MSc) Apprenticeship in Digital and Technology Solutions, providing further progression opportunities for professionals and those who have completed undergraduate degrees in IT related fields. The University is also part of the Trailblazer developing the new Data Analyst Degree Apprenticeship at Level 7.

7.4 Objective 4: Expand graduate & post-graduate provision, bringing it closer to industry

The University of Exeter performs well in the undergraduate study of computer science and mathematics but recognises that it needs to expand and align the study of these subjects with the skills needs of the growing data analytics sector. There is also a need to enhance the data literacy skills of natural and social scientists as well as humanities graduates.

To achieve this, Exeter has established:

- a) The Exeter Institute for Data Science and Artificial Intelligence (EIDSAI).
- b) The Q-STEP centre, whose mission is to provide social science courses with career-enhancing training in quantitative research methods.

Progress to date

New BSc and MSci in Data Science

In January 2018, the University of Exeter secured Catalyst Funding to work with employers on the development of a new curriculum for an innovative MSci and BSc in Data Science, launched in September 2019. The curriculum has been designed to deliver skills that are most valued by employers, including the soft skills (team-work and presentation) that have been consistently emphasised during consultations about the focus for the escalator. Local employers, such as IBM, BT, Black Swan and Oxygen House have supported the development modules to address particular challenges faced by their company or industry

¹¹ <https://www.exe-coll.ac.uk/Course/data-analyst-higher-apprenticeship/>

¹² Under the E-DISC collaboration, organisations such as the Met Office, Exeter College, Exeter City Futures, Exeter City Council, University of Exeter and the Royal Devon & Exeter NHS Foundation Trust are taking part in a new Data Analytics Apprenticeship scheme.

using methods, platforms, software and data, to ensure that they are fully reflective of workplace practice. Both programmes will include industrial placement opportunities.

MSc Data Science Professional

In September 2017, the University launched its MSc Data Science Professional. Designed specifically for professionals already working with data, the programme allows companies and individuals to acquire the skills necessary to meet sophisticated demands of deep insight generation, across any dataset. The programme is delivered flexibly over 2 or 3 years, featuring intensive week-long residential¹³.

Proficiency in Applied Data Analytics

As part of a £19.5m response to a nationwide shortage of numerically-skilled social science graduates, the University of Exeter has been selected as one of fifteen universities to host a Q-Step centre. This centre enables students to gain degrees across a range of social science disciplines, with 'Proficiency in Applied Data Analytics'. In 2017, the University was awarded £350,000 of ESF funding, to extend the reach of the Q-Step centre beyond its original focus (limited to Sociology, Criminology, Politics, and International Relations students) and to create placements with local enterprises, enabling 50 ESF funded students per annum have the opportunity to apply their proficiency in data analytics to business-related problems.

7.5 Objective 5: Boost employability and graduate retention

Industry needs people who combine technical skills (such as coding and statistics) with good communication, team-working and business skills to create a workforce that can transform data into insight and commercial value. Enabling students and graduates to gain work experience within multi-disciplinary teams has enormous benefits. It improves individuals' employability and their understanding of the career opportunities available to them, whilst enabling enterprises who benefit from the students work to review potential employees with reduced cost and risk.

Large numbers of talented young people are attracted to Exeter to learn. This is an enormous potential resource and driver for growth. However, too often these bright students leave the city on graduating. The Escalator includes a focus on ensuring that graduates have opportunities to apply their skills to the benefit local companies and that local companies fully appreciate the depth of skill being generated through the escalator. To achieve this, we are working to extend the range and depth of support we can provide for internships, student placements and graduate business partnerships.

Progress to date

The University of Exeter is creating a wide range of new opportunities for students with skills in data science and analytics to demonstrate the impact that these can have on enterprises' efficiency and profitability. Further:

¹³ <http://www.exeter.ac.uk/postgraduate/taught/datascience/msc-data-science/>

- The new University of Exeter's new BSc and MSci in Data Science programmes will both feature industrial placement opportunities, undertaken either via a year in industry or two summer placements.
- From summer 2018, a new ESF funded Pathway to Data Analytics, delivered by the Q-Step office, will offer 40 social science students the opportunity to undertake placements with local companies.
- Working with the University of Plymouth, the University of Exeter has secured for £0.5m of ERDF funding for 'Linking Graduates to Business', a programme that will generate 100 further placement opportunities focused locally on digital and data oriented businesses.

7.6 Objective 6: Raise business awareness of the value of data

Information is the lifeblood of business. Companies that manage information effectively can improve efficiency, be more responsive to market opportunities, achieve competitive advantage and operate more sustainably. Many companies are already gathering data but a critical next step is to build information systems and data analytics capabilities to translate this into actionable insights. This enables companies to more effectively identify which actions are achieving their goals, detect risk or opportunity early, evaluate possible outcomes, allocate resources to achieve greatest returns; and measure the true impact of their activities.

Our escalator needs to engage small enterprises from all sectors, not just those for whom data analytics is core business. It needs to reach out to business managers and leaders, helping them better understand, explore and exploit the potential of their data and to find the right solution going forwards, be that participation in an accredited short course, graduate placements or apprentices.

Progress to date

Practical Insights into Data and Analytics

The University of Exeter has developed a 4 day MBA module on 'Practical Insights into Data Analytics'. Available one stand-alone basis, this module helps understand tools for analysing numbers and text and to apply concepts in data analytics to real examples drawn from their business.

Strategic Employer Engagement in Devon (SEED)

In 2017, the University of Exeter secured £120,000 of ESF via the SEED funding project to reach out and better understand local SMEs' data analytics skills needs and to develop a suite of tasters (free to SMEs) leading on to further provision, including CPD modules, developed in response to that demand.

The MSc Business Analytics

In September 2020, the University of Exeter will be launching a new MSC Business Analytics. Focused on learning how to utilise and leverage data to solve business problems, the programme includes modules on Marketing Analytics, Strategic & HR Analytics, Operations Analytics, and Environmental Analytics as well as an optional internship and

semester abroad. The scope of offering modules as stand-alone units, as part of CPD programme is being explored.

7.7 Objective 7: Deliver training to data professionals:

Data analytics is an industry in which knowledge and skills can quickly fall out-of-date. The escalator needs to offer short-courses and flexible programmes that allow professionals to up-skill and re-skill in response to changes in technology and methods.

Progress to date

The University has developed the MSci Data Science Professional and, on an experimental basis, is currently offering data professionals the opportunity to take up places on single modules of its MSc Data Science programme.

Supported by the SEED ESF programme is undertaking market research which will lead to the development of a suite of tasters leading to condensed masters modules, delivered in short periods over consecutive days, in the most promising areas of data science. The Q-STEP centre and EIDSAI are involved in the delivery of this.

As part of its commitment to SWIOT, the University is seeking to expand its CPD offer. To ensure financial viability this will need to attract both national and local enterprises.

7.8 Objective 8: Provide high-end analytical talent and support to business

At the top end of the Escalator, there is a need to provide high-end analytical talent, to transfer skills into businesses and support them in solving technical challenges that may be hindering innovation and the development of new products and services. EIDSAI was set up to include a focus for doctoral training and the development of a cohort of analysts with high-level specialist skills and to take a wider responsibility for supporting the development of a data analytics cluster within the City and Science Park.

Progress to date

Centre for Doctoral Training in Environmental Intelligence and AI

In February 2019, the University of Exeter was awarded £5.2m to establish a new Centre for Doctoral Training in Environmental Intelligence: Data Science and AI for Sustainable Futures. The Centre, funded 60% funded via UKRI, 20% by the University and 20% by industry, proposed to deliver 50 PhDs over seven years, delivering a step-change in the high end analytical talent available in the region.

Environmental Futures and Big Data Impact Lab

The University of Exeter, via EIDSAI, has led the development of this £6.4m project which brings the region's environmental data assets¹⁴ together to assist SMEs from across Devon that are developing new products and services in the LEP's Big Data and Environmental

¹⁴ Impact Lab partners are Plymouth Marine Laboratory, Rothamsted Research, University of Plymouth, the Met Office, Exeter City Futures, University of Plymouth and Plymouth College of Art.

Futures Smart Specialisation sectors. Operating as part of the wider business support innovation support ecosystem, the Impact Lab partnership employs 11 Industrial Research Fellows to provide deep data science capability. The programme also includes: provision of a collaborative workspace on the Environmental Futures Campus on Exeter Science Park (pictured below); a £0.9m fund to leverage academic expertise from outside the core team; and a £0.75m SME grant fund¹⁵.

Environmental Intelligence Accelerator

While the Impact Lab represents an excellent start, its ERDF funding constrains it to supporting industrial research, collaboration and new product development with SMEs from Devon. Our ambition is to establish our region as an internationally recognised centre of excellence for data analytics, with a particular focus on the practical application of environmental intelligence. The challenge posed by Brexit forces us to think globally. Lagging regions like the South West Peninsula will not transform their economic fortunes by looking internally. We have therefore, working in collaboration with business and the Impact Lab partnership, submitted a bid to the UKRI 'Strength In Places Fund' for £25m to create and Environmental Intelligence Accelerator. The Accelerator will build on the Impact Lab approach, extending its innovation capability to industrial collaborations with small and large enterprises nationally and internationally.

Our proposal has been approved at Stage 1 and is not being reviewed at Stage 2, which remains a competitive part of the process. The new Strength In Places Fund is specifically focused on supporting innovation capability and driving regional economic growth in Smart Specialisation priorities. It provides a very clear example of how new UK research, development and innovation fund streams are being linked to the delivery of local industrial strategies as well the rationale for the University's new focus on local growth.

¹⁵ See <https://impactlab.org.uk/>

8. SUCCESS FACTORS

This section of the UK Escalate Country Report considers the factors that enabled the Data Analytics Skills Escalator in the Exeter city region to succeed.

8.1 Breadth of concept

The Data Analytics Skills Escalator was relatively broadly defined. It encompasses topics such as:

- statistical understanding
- digital and programming skills
- use of AI and high end algorithm development for the analysis of 'big data'
- the translation of environmental intelligence into new products and services and local growth.

There is a coherent rationale for creating a pipeline of skills, or perhaps more accurately a funnel of skills, into a specific smart specialisation sector. The fact that a significant proportion of individuals may apply these skills usefully outside the prioritised smart specialisation sector is not problematic. Having a relatively broad, and some might say flexible focus (in which the 'environmental' focus can be picked up or dropped, as convenient) enables engagement across a wide range of educational and other partner organisations and access to a wider range of opportunities.

8.2 Clarity of focus and purpose

The success of the escalator owes much to the fact that the Exeter city-region has adopted a very clear focus for smart specialisation. The amount of energy required, across multiple institutions, to bid for and build the range of initiatives set out above is very considerable. It has been suggested that Exeter should have similar 'escalators' for construction, health and some other sectors. While seeking to identify and fill gaps in skills provision in those sectors is undoubtedly useful, the extent to which this level of concentration and resource can be matched across multiple sectors simultaneously is questionable. Clarity of focus and purpose as well as consistency of effort has, in the author's opinion, been an important factor behind the Escalator's success.

8.3 Integration into wider growth strategy

The Escalator forms just one element of a much wider strategy for fostering knowledge intensive within our region. Other pillars of this strategy include the development of Exeter Science Park's and it's Environmental Futures Campus; development of business support services, including securing University Enterprise Zone incubation funding for the area; as well as the strategy for research concentration, on environmental and life sciences, at a major University. This integration delivers a weight of support across a wide range of agencies, all of whom have a role in delivering the over-arching vision and all of which are

able to lend political support for the initiative at LEP and national level. It also enables the Escalator to play into and receive emphasis strategies covering economic growth, innovation, business support and inclusion.

8.4 Build a high trust partnership

It is interesting to note that the review of the region's assets and decision to focus on Data and Environmental Data Analytics was largely forged over an informal dinner hosted by University of Exeter's Vice Chancellor. With the right partners in the room, a set of contextual factors that compels (or at least incentivises) collective action (e.g. access to Challenge Funding) and a concept that is flexible and broad enough to accommodate varying institutional interests (e.g. includes a health data analytics concern for the NHS trust) agreement to align behind the initiative was not difficult for partners in Exeter.

8.5 Build political support

More difficult was building wider political support for the local priority at the LEP Level, where it could sit in competition for resources or strategic emphasis with the priorities of other localities. Partners in Exeter sought to do this in a number of ways, including by recruiting backing from District Authorities in the wider Exeter travel-to-work area; by taking the city's case directly to Government; and by compromising where necessary, e.g. by broadening the coverage and focus of the South West Institute of Technology. They had varying degrees of success, but perhaps the central lesson and success factor was the region's determination to carry on and deliver the initiative regardless of the extent of formal backing achieved. Success breeds success in the world of competitive bids for Challenge Funding, as bidders are able to point to the measures already being put in place. Ultimately, the initiative and its success became compelling and something that others wished to associate with and take some credit for. This can be accepted and welcomed in an open-spirited way.

8.6 Accept the knock-backs and carry on

Success has not been simple or straight-forward. The UK Government has had a policy of increasing and devolving control of funding to English regions if local authorities have been prepared to relinquish their economic development functions & budgets to the control of directly elected Mayor. HotSW LEP's upper tier local authorities have been reluctant to follow this route - despite the promise of additional regional funding.

Exeter City Council, which is not an upper tier authority made direct approaches to Government regarding the development of a City Local Industrial Strategy while discussing options for establishing a Mayoral region that did not fit the LEP geography. Senior civil servants were initially receptive, inviting the submission of a fully worked up City Industrial Strategy including a series of financial asks for the Escalator and other initiatives. Much work went into this before politicians, seeing a potential risk to the LEP area, informed Exeter partners that the city's industrial strategy should be subsumed into in the LEP's Industrial Strategy. These set-backs are normal. The effort put into working up the initiative presented

to government was not wasted as a number of the initiatives (e.g. the Doctoral Training Centre) have been taken forward subsequently.

8.7 The right initiative in the right place at the right time

The Escalator was developed at a time of high, possibly nearly full, employment in the UK; when the focus was on productivity and how 'global Britain' could compete and export in the post-Brexit world. Exeter, pointing to the role that other University town such as Cambridge have had in driving productivity-led growth in their regions, was in an excellent position to relay a compelling narrative back to Government focused around how it could pick up and deliver the Government's objectives for it. The extent to which such a narrative will chime with Government as the economy recovers from the Covid-19 crisis is much less clear. The focus may shift to inclusion and job creation, rather than on productivity and innovation. It may be necessary to focus on elements of the escalator focused around more digital user and home-worker skills. Choosing a focus that fits the economic moment and concerns of the day, but which can also potentially evolve to meet new circumstances, and will enable the continuity of emphasis and effort.

8.8 Achieve high-level institutional backing

Arising from being the right initiative in the right place at the right time, is the need to ensure that you achieve high level institutional backing, including human resources, to see delivery through. The University of Exeter has been a key driver of the Data Analytics Skills Escalator from its inception. The drivers may be diverse and sometimes extraneous, such as the desire to win research funding linked to local growth from national challenge funds. This is not a draw-back and may even be useful. It is important to seek to embed the priority within an institutional strategy. To provide an example, in 2018, the University of Exeter produced, for the first time, its own Regional Skills Strategy, setting out its responsibilities to the region's skills development. The Escalator was a central pillar in the strategy.

ANNEX 1. THE DATA ANALYTICS SKILLS ESCALATOR

The diagram below shows the various actors involved in creating and delivering the Escalator, the different initiatives that we have taken over the last few years (in yellow) at the various different levels of education (in blue). The initiatives also fall under a series of broader objectives.

