A Final Report
16 September 2021

Department for Digital, Culture, Media & Sport: Assessing the UK's Regional Digital Ecosystems

steer economic development

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List of Acronyms

Acronym	Definition
ABS	Annual Business Survey
APS	Annual Population Survey
BRES	Business Register and Employment Survey
DCMS	Department for Digital, Culture, Media & Sport
ESF	European Social Fund (ESF)
FTE	Full Time Equivalent job
GVA	Gross Value Added - a measure of the value of goods and services produced in an area, industry or sector of an economy. It is calculated as the value of outputs minus the value of intermediate consumption
HE	Higher Education
HESA	Higher Education Statistics Agency
IDBR	Inter-Departmental Business Register
KPI	Key Performance Indicator
LQ	Location Quotient - an analytical statistic that measures a region's industrial specialisation relative to a larger geographic unit (usually the nation)
NUTS	Nomenclature of Territorial Units for Statistics - a geocode standard for referencing the subdivisions of countries for statistical purposes
ONS	Office for National Statistics
REF	Research Excellence Framework
STER	Scottish Technology Ecosystem Review
SIC	Standard Industrial Classification - a system for classifying industries by a four-digit code
SOC	Standard Occupational Classification - a coding framework used to classify occupations, enabling comparisons of occupations across different datasets
VC	Venture Capital

Executive Summary

Overview

1. This report summarises the findings of research into the digital ecosystems of the UK's nations and regions, commissioned by the Department for Digital, Culture, Media and Sport (DCMS).
2. The study has developed a framework for characterising digital ecosystem performance across five 'enabling domains':
   - Digital Tech Businesses, Employment and GVA;
   - Place and Infrastructure;
   - Ideas and Innovation;
   - Investment and Business Environment; and
   - People, Skills and Inclusion.
3. Within each of these domains, various metrics have been selected and gathered, to present as full a view as possible at each of three geographic levels (NUTS1, NUTS2, and NUTS3). The metrics have been normalised (e.g. for population size) and presented in a way that shows each area's performance relative to all other UK areas at that level of geography. This approach was chosen to avoid comparing regional performance against a 'UK average', which is in practice skewed highly by London and the South East.
4. The quantitative analysis for the study has been complemented with a series of roundtable discussions with stakeholders in each of the 12 NUTS1 regions, discussing the digital ecosystems of each nation and region.

Findings

5. The digital sector[1] represents a substantial share of the UK economy. It employed around 1.66 million people (between October 2019 – September 2020), accounting for 4.9% of all employment. In terms of Gross Value Added (GVA), the sector contributed £148 billion to the UK economy in 2019[2] (constant prices), which was 7.6% of the UK total.
6. This research confirms that every nation and region of the UK is seeing vibrant growth in their digital ecosystems. Growth is particularly strong in larger cities, which benefit from agglomeration economies and cluster effects. Larger cities offer people a wide range of job opportunities, providing firms with a large addressable labour market and stronger networks of industry contacts.

[1] See Figure 2-1 for how the 'digital sector' and 'digital occupations' have been defined for the purpose of this study

[2] DCMS Sectors Economic Estimates 2019 (provisional): Gross Value Added

7. By continuing to support and strengthen digital ecosystems throughout the UK, indicative modelling projects that the UK's digital sector annual GVA could grow by an additional £41.5 billion by 2025, creating a further 678,000 jobs[3].
8. Drawing on a variety of indicators, this report paints a nuanced picture in which each nation and region has a different mix of strengths and challenges in their digital ecosystem.
9. The study highlights that there is much commonality between regions in the specific parts of the digital economy where stakeholders consider there to be good prospects for future growth. FinTech, Cyber Security, HealthTech, Big Data, Artificial Intelligence and the digital transformation of traditional industries (including Advanced Manufacturing) were each explicitly highlighted as promising areas, and the study's assessment of the data on high growth companies confirms that these are of key importance to almost all regions.
10. Beyond the tech hotspots of London and the South East, there are clusters of specific specialisms, for example: FinTech (e.g. Scotland and Wales), Cyber Security (e.g. Northern Ireland and South West), HealthTech (e.g. East Midlands and Scotland), e-Commerce and AdTech (e.g. North West and Northern Ireland), Big Data (East of England and Wales), EdTech (West Midlands and North West), AgriTech (e.g. East of England and Yorkshire and the Humber), Internet of Things (e.g. South West and Wales), Space Tech (e.g. Yorkshire and the Humber), the digitisation of advanced manufacturing (e.g. West Midlands and North East), and the digital delivery of public services (e.g. North East and Scotland).
11. However, it should also be stressed that each of the nations and regions has extensive digital activities beyond the specific examples cited above. As a result, ensuring that there are the right enabling conditions in which all parts of the digital ecosystem can flourish must be a key imperative for economic development policy.
12. The shift to remote working practices enforced by COVID-19 is likely to endure, to a significant extent, post-pandemic. This has the potential to work to the advantage of the digital ecosystems beyond London, since it could reduce geographical barriers and widen the pool of experienced talent available to firms across the UK.
13. However, the study also found that the increased willingness of London-based firms, and even Silicon Valley firms, to employ remote workers was leading to wage inflation for experienced talent in other regions. This is making it somewhat harder for non-London based businesses to recruit locally in some regions, as they are increasingly competing with London-based firms for talent living in their areas.
14. Access to talent was consistently highlighted as the most important barrier to growth for regional digital ecosystems. More could be done to encourage school

[3] Methodology described in paragraph 2.35

leavers to gain competencies in programming, data science and computer science, promote computing-related pathways at university, and inspire more UK-based students to set up their own tech businesses after university. Industry, educators and Government should work together to upskill more people (both our current and future workforce) into digital occupations so they can share in the prosperity of the digital sector..

15. For companies located outside London and the South East, it can be very difficult to attract experienced talent from elsewhere in the UK or from overseas – especially mid-career programmers and senior executives with experience in successfully scaling tech businesses. This is because digital ecosystems beyond London and the South East are yet to reach a 'critical mass' of activity which makes it relatively easier to attract and retain talent.
16. The availability of growth capital is also heavily skewed geographically. Data from Beauhurst[4] shows that out of the £15.5 billion of private funding raised in the digital sector[5] between 2016 and 2020, 73% (£11.3 billion) went to London-based businesses. In the roundtable discussions several people expressed the view that it is difficult to persuade some venture capitalists (VCs) to make digital sector investments beyond London and the South East, due to the large number of investment opportunities that already exist in those regions.
17. Agglomeration effects are at work here too, i.e. if a region has relatively few investment opportunities at an appropriate scale, quality and stage, then venture capitalists may consider the region to be too small to be worth exploring, and/or too small to sustain a scale-up.
18. All of the UK's nations and regions have key assets which are essential for supporting thriving digital ecosystems, albeit to differing degrees between the regions. These key assets include:
    - Universities, with world-class excellence in digital-related research, and with substantial numbers of students enrolled on computing courses;
    - Digital-focused incubator facilities, and accelerator programmes for start-up and scale-up;
    - Industry-led tech cluster organisations, acting as catalysts for networking and knowledge exchange;
    - Tech-focused networks/events, including large annual conferences, which help bring people together, raise the profile of the region's digital sector, and create the virtuous circles of collaboration; and
    - Emerging clusters of some particular industrial specialisms (e.g. cyber security, FinTech, HealthTech), providing foundations for further growth..
19. In London, and increasingly in some of the UK's other major cities such as Birmingham, Edinburgh, Leeds, and Manchester, there is also a further critical

[4] Search conducted and data downloaded on 28 April 2021

[5] Defined by DCMS Digital Sector SIC codes as listed in Appendix A

ingredient for world-class digital ecosystems: scale. With a diverse mix of employers, an extensive labour market, and large numbers of job opportunities at every level of seniority, London's scale is a key factor in driving its unrivalled growth.

Going Forward

20. In the light of these findings, this study proposes that the following should be considered by DCMS and other Government departments when developing policy in this area:

- Careful consideration should be applied to the scope of economic activity that policy interventions are trying to support. There are various ways of defining the digital economy, and the current DCMS definition of the 'Digital Sector' is very broad. For example, it includes publishing, TV broadcast activities and motion picture projection activities, as well as telecommunications and computer programming. While this may be appropriate for statistical reporting purposes, it could hinder the development of world-class interventions that address the diverse needs of such a broadly defined sector. An alternative approach could focus on software engineering-intensive businesses, irrespective of domain, that operate under 'internet economy' principles.
- A sustained and long-term cross-government approach is required to address the skills and talent issues highlighted. Fundamental to this would be to increase the capacity of schools to teach computer science, and to improve computer science participation in schools throughout the UK - especially amongst girls and other under-represented groups.
- Although it is a much broader issue, the problems of digital poverty have been brought into sharp focus by COVID-19 restrictions. Consideration should be given to the options for ensuring that young people from disadvantaged backgrounds are not de facto excluded from experimenting with computers and seeking digital occupations in the future, as a result of them lacking appropriate devices and broadband at home.
- Adult education can provide opportunities for people at various life-stages and from diverse backgrounds to direct their careers towards digital industries, recognising that a large majority of the people who will make up the UK's workforce in 2030 are already in the workplace. This should be a well-funded and enduring feature of policy, building on initiatives such as CodeClan in Scotland and DCMS' Local Digital Skills Partnerships and digital skills bootcamps delivered in many of England's main cities.
- The issue of university key performance indicators (KPIs) and incentives to improve innovation development and entrepreneurship emerged in some of the roundtable discussions. We propose that this area should be considered within the policy development process, seeking to ensure that universities are appropriately encouraged to grow the local base of skilled personnel, to increase spin-outs and industry collaborations, and to ensure that students are exposed to entrepreneurship education.
- Grassroots industry-led cluster organisations play a critical role in developing local tech communities. Government might consider how best to provide practical support for such initiatives, for example in their core funding,

business support programmes, locations for meetings, and remote participation facilities.

- Support might also be considered for the various tech events and conferences held throughout the country – helping with speakers, facilitating remote participation, and ensuring that these events expose local tech communities to international contacts for business opportunities and international best practice in growing tech businesses.
- While all Nations and regions in the UK have some digital incubators, they vary considerably in terms of capacity and local/national profile, and hence in their ability to act as a flagship physical hub for the local digital ecosystem. The Government should consider how it can ensure that every major city has sufficient incubator capacity of an appropriate type, with the financial support necessary to offer low rents to start-up tenants, easy-in/easy-out terms, and with the ability to provide founders with support and education in managing growth. Facilitating networks of relevant incubators at regional or even national levels may be helpful in strengthening connections within the tech community.
- Insufficient access to growth finance is clearly a challenge to the development of digital ecosystems outside London and the South East. The Government should work with venture capitalists and local tech cluster groups to consider how best to address this critical issue.
- The capacity of public sector leadership organisations to develop high performing digital ecosystems varies significantly between different places. DCMS should consider how best to ensure a joined up and adequately resourced approach is taken by the public sector to enable growth based on the different circumstances across the UK's regions.

1 Introduction

Purpose of the Study

1.1 In March 2021, the Department for Digital, Culture, Media and Sport (DCMS) commissioned Steer Economic Development (Steer-ED) and its subcontractors[6] to assess the ecosystems operating across the UK to support the digital economy.

For the purpose of this report, the **'digital economy'** is defined as businesses and organisations producing products and services in digital sectors, plus those job roles in sectors not classified as digital but which require digital skills and activity (such as a software developer working for, for example, a logistics company).

1.2 DCMS' objective in commissioning the study was to better understand the factors that are shaping and enabling these ecosystems and, informed by this, to provide a 'snapshot review' of the capacities of these ecosystems. The work was envisaged to have two outcomes:

- **Stage 1:** Developing a comprehensive framework for analysing regional digital economy ecosystems, which could be used to assess
  - The performance of the digital ecosystem in differing regions;
  - Regions' ability to support digital economy growth; and
  - Existing inter-and intra-regional disparities in the way the digital economy ecosystem works in different places.
- **Stage 2**: Undertaking a comprehensive review of regions' strengths, specificities, and institutions, assessing specifically:
  - Digital specialisms and assets within regions that support the digital economy; and
  - Regions' abilities to optimise digital economy prosperity.

[6] DMS Research Consulting, John Holden from The University of Manchester, and Geek Talent Ltd

1.3 The work was undertaken at the level of the UK's 12 NUTS1 regions[7]. For the ecosystem in each NUTS1 region, the study sought to identify the strengths, opportunities, digital technology specialisms, and the barriers to digital economy growth on a consistent and systemic basis, drawing on the latest data (both quantitative and qualitative) from national datasets, specialist data providers, reports/literature, and regional consultees.

1.4 This report sets out the findings of this work, which was undertaken between March and August 2021.

Context for the Study

1.5 DCMS has a long-standing commitment to driving better outcomes for places and communities. Reflecting its more recent policy responsibilities for the digital economy, the DCMS Secretary of State's 10 Tech Priorities[8] sets out a series of commitments through which the Department *'will deploy digital tech to 'build back better', safer, and stronger from COVID[-19], and shape a new golden age for tech in the UK'*. Of these 10 priorities, Priority 9 was the highly influential driver for this study:

DCMS Tech Priority 9: Levelling up digital prosperity across the UK

'As we turbocharge our tech sector, we will ensure long-term digital prosperity is evenly spread across the entire country. Many of our most exciting tech companies are already based outside of London, and we will continue to support these hubs by building on regional innovation, regional strengths and regional specialisms, while enabling businesses in every UK postcode to seize the opportunities of the digital economy'.

1.6 Against this background, in commissioning the study, DCMS wished to develop a stronger evidence base to assess on a consistent basis the breadth and depth of NUTS1 regional ecosystems in support of their digital economies. This work seeks to identify how regions can develop their strengths and level-up further to those areas of existing ecosystem strength, and how and where 'areas for development' might be progressed. Whilst the data on the digital economy are wide and extensive, using a well-developed framework of analysis this work sought to provide a systemic, replicable, and importantly holistic view of how and why digital ecosystems across the UK are performing

[7] Nomenclature of Territorial Units for Statistics (NUTS) is a hierarchical classification of administrative areas, used for statistical purposes. In the UK, there are 12 such areas - Northern Ireland, Scotland, and Wales, and the nine statistical regions in England - East of England, East Midlands, London, North East, North West, South East, South West, West Midlands, and Yorkshire and The Humber. Note that ONS has recently adopted the new UK classification of International Territorial Levels (ITL) in place of the NUTS classification. This transition has not changed the names of regions, or the areas covered by them; it is simply a change to the codes used.

[8] **Our Ten Tech Priorities, 2021, DCMS**

Structure of this Report

1.7 This remainder of this report is structured with the following sections:

- **Section 2: Approach and Methodology** – describes how the study was designed and framed, and the work which was undertaken practically;
- **Section 3: The Digital Economy in a UK Context** – discusses the characteristics of the UK digital sector, providing the UK-wide backdrop against which individual NUTS1 region ecosystems for the digital economy are working;
- **Section 4: Summary Dashboards –** This Section, the core of the report, sets out, using standard profiles for each of the UK's 12 NUTS1 regions, a summary assessment of Strengths, Opportunities and Specialisms, Barriers to Growth, and how the 'Prosperity Prize' offered by the digital economy can be seized; and
- **Section 5**: **Conclusions** – this final Section draws the study's findings together and provides thoughts on ways forward for the Government.

1.8 The Main Report is supported by four technical appendices, as follows:

- A: SIC and SOC Codes for the 'Digital Economy' used by the Study;
- B: Sources for the longlisted metrics considered for characterising the enabling domains of the digital economy ecosystem;
- C: Summary Dashboards for each of the UK's NUTS2 regions; and
- D: A write-up of the Rapid Evidence Review which informed the study's approach and method.

2 Approach and Methodology

Purpose

2.1 This Section sets out the approach adopted by the study, and then introduces the streams of work which it progressed. It explains how the 'digital economy' was defined, the data sources and metrics used, and how these are presented in this report. The Section also outlines the process used to engage with stakeholders across the UK's 12 NUTS1 regions.

Approach

Three Phases

2.2 From the outset, this was recognised as a high-profile and challenging study, with 12 UK NUTS1 regions in view, and a large amount of data – both qualitative and quantitative - relating to the digital economy, be this in terms of 'sector' or 'occupations'.

2.3 Reflecting this complexity and the need to draw-out messages and themes of value to DCMS' policy makers and partners in the NUTS1 regions, the approach to the study was designed to comprise three stages of work:

- **Phase A:** developing an analytical framework with which to assess the ecosystem for the digital economy in each of UK's 12 NUTS1 regions;
- **Phase B:** informed by the above, developing and designing metrics and an analytical tool with which to report coherently, communicably, and with as much comprehensiveness as possible how the digital economy ecosystem in each of the NUTS1 region was performing; and
- **Phase C:** undertaking a detailed ecosystem assessment for each of the UK NUTS1 regions using the tool developed under Phase B. This was then augmented with qualitative inputs from regional consultation, resulting in a blended (i.e. quantitative and qualitative) assessment of each UK NUTS1 region's digital economy ecosystem.

Method

2.4 Informed by the approach above, the practical work done to deliver the study comprised the following elements:

1. Rapid Evidence Review

2.5 Much work has been undertaken over the last 35 years to understand the concept of the 'economic ecosystem', and the role this plays in the development of sectors, clusters, and agglomeration. The launch point for much of this thinking

was Michael Porter's path-finding study in 1989, The Competitiveness of Nations, with much research work done since, including by DCMS itself[9].

Figure 2-1: Definitions of digital sector and digital occupations used in this report

Definitions of 'Digital' – Economy, Sector, and Occupations

For the purpose of this report, the **'digital economy'** was defined as businesses and organisations producing products and services in digital sectors, plus those job roles in sectors not classified as digital but which require digital skills and activity (e.g. a software developer working for a logistics company). Thus, when looking at the digital economy, the study considered both the 'digital sector' and 'digital occupations', which is in line with DCMS' definition of the digital economy[10].

The 'digital sector', in terms of constituent firms, was defined according to DCMS' published four-digit Standard Industrial Classification (SIC) Code definition. This definition includes 43 sub-sectors across the broad sections of Information and Communication, Manufacturing, and Wholesale and Retail Trades. Additionally, for datasets where only two-digit SIC Codes were available, the study used SIC Codes 58-63. In-scope SIC Codes are given in Appendix A.

For **'digital occupation'** or job roles, the digital sector was defined using DCMS' published digital sector Standard Occupational Classification (SOC) Codes. A full list of these SOC Codes is presented in Appendix A.

To give an overall picture of the extent of digital economy employment in each region, SIC-based and SOC-based data have been combined, showing both the employment in digital sector firms (using SIC Codes) and the digital occupation employment (using SOC Codes) – while taking account of the overlaps between these two (i.e. digital occupations within digital sector firms).

2.6 Accordingly, a key first activity for the study was to undertake a Rapid Evidence Review to unearth the range of analytical approaches taken in national and regional reports (or related studies) to characterise, define and then measure the digital economy and assess its potential for growth and prosperity.

2.7 A set of more than twenty papers and presentations were identified as potentially relevant. Of these, 10 were selected for further detailed review; these papers

[9] This includes in-house desk research on the role of economic agglomeration and clustering, Smart Specialisation, and the role of Higher Education-driven innovation in regional ecosystems, and what this might mean for the Digital Economy at the regional level.

[10] DCMS, 2019, DCMS economic estimates: employment. The digital economy was defined as "all those employed in the Digital Sector as well as those in Digital Occupations outside the Digital Sector."

were chosen based on public standing and their potential to provide insight into the essential components of a successful digital economy ecosystem, including the range of factors, enablers, and indicators used to assess it. The papers comprised the following:

- National-level
  - The future UK tech built (2021)[11];
  - Places of Innovation: The role of Districts, Quarters, Corridors and other venues of the COVID-19-adjusted innovation economy (2021)[12];
  - Digital Industries in the UK (2016)[13];
  - The prospects for regional disparities in the UK in the times of Brexit and COVID (2020)[14]; and
  - Blueprint for cities and regions as launch pads for digital transformation (2016)[15].
- Regional-level:
  - Matrix Digital's ICT Report (2016)[16];
  - Lancashire's Digital Landscape (2019)[17];
  - Scotland's Digital Technologies (2019)[18] ;
  - Sheffield City Region Digital, Digital Action Plan (2018)[19]; and
  - West Midlands Digital Roadmap (2021)[20].

2.8 In addition, helpful wider framing was provided by the review undertaken by Mark Logan (formerly COO of Skyscanner) in 2020 for the Scottish Government to undertake the Scottish Technology Ecosystem Review (the 'STER'). With a focus on software engineering-intensive start-ups and scale-ups that exhibit – or aspire to exhibit - characteristics common to successful tech start-ups internationally, it

[11] **The Future UK Tech Built, 2021, Tech Nation**

[12] **Places of Innovation: The role of Districts, Quarters, Corridors and other venues of the Covid-adjusted innovation economy, 2021, Catapult**

[13] **Digital Industries in the UK, 2016, Tech Partnership**

[14] **The prospects for regional disparities in the UK in times of Brexit and Covid-19, 2020, Arnab Bhattacharjee, David Nguyen, and Tony Venables**

[15] **Blueprint for cities and regions as launch pads for digital transformation, 2016, Strategic Policy Forum on Digital Entrepreneurship**

[16] **Matrix Digital's ICT Report, 2016, Matrix Digital ICT Panel**

[17] **Lancashire's Digital Landscape, 2019, Lancashire Enterprise Partnership**

[18] **Scotland's Digital Technologies: Research & Analysis Report, 2019, Digital Scotland Business Excellence Partnership**

[19] **Sheffield City Region (SCR) Digital Action Plan, 2018, SCR LEP**

[20] **West Midlands Digital Roadmap, 2021, West Midlands Combined Authority**

proposes a set of 34 recommendations across three areas: Education and Talent; Infrastructure; and Funding.

2.9 A comprehensive overview of the findings from each report reviewed is set out at Appendix D**.** The key summary findings from the Rapid Evidence Review were as follows:

- According to a report from the Strategic Policy Forum on Digital Entrepreneurship[21], the key dimensions which trigger the digital transformation of an area include: Governance and Leadership; Communication and Collaboration; Entrepreneurs and businesses; Talent Pools; Finance; Infrastructure; Support Structures; and Digital Technology;
- Another paper conceptualises the four core dimensions needed for a regional ecosystem to thrive and generate a critical mass of start-ups and high-growth companies as the following: Economic Demand drivers; the Enabling Infrastructure; the Skills Base; and the Framework Conditions for business and investment;
- Studies most frequently made use of well-known administrative data sources, principally the: Interdepartmental business register (IDBR), Annual Population Survey (APS) and Annual Business Survey (ABS). Other public sources cited included the Higher Education Statistics Authority (HESA) and Ofcom's statistical publications. In addition, some 'non-standard' data sources were referenced, such as Dealroom, Streetbees, and Geek Talent;
- Skills Demand and Supply were assessed as vital factors for assessing the digital economy; and
- Regional specialisms and sub-sectors (such as HealthTech, FinTech etc.) had an important role to play in regional development. Measures which captured these should be sought, although the appropriate measure may vary between regions.

2. Framework Development

2.10 Informed by the Rapid Evidence Review and extended iterative dialogue between the Consultancy Team and the Study Steering Group, a framework with which to analyse the performance of regional ecosystem for the digital economy was developed progressively. Summarised in Figure 2-2, this envisages five 'enabling domains', which individually and jointly help to create the conditions to enable digital economy growth and resilience. The five domains, and their importance are set out below:

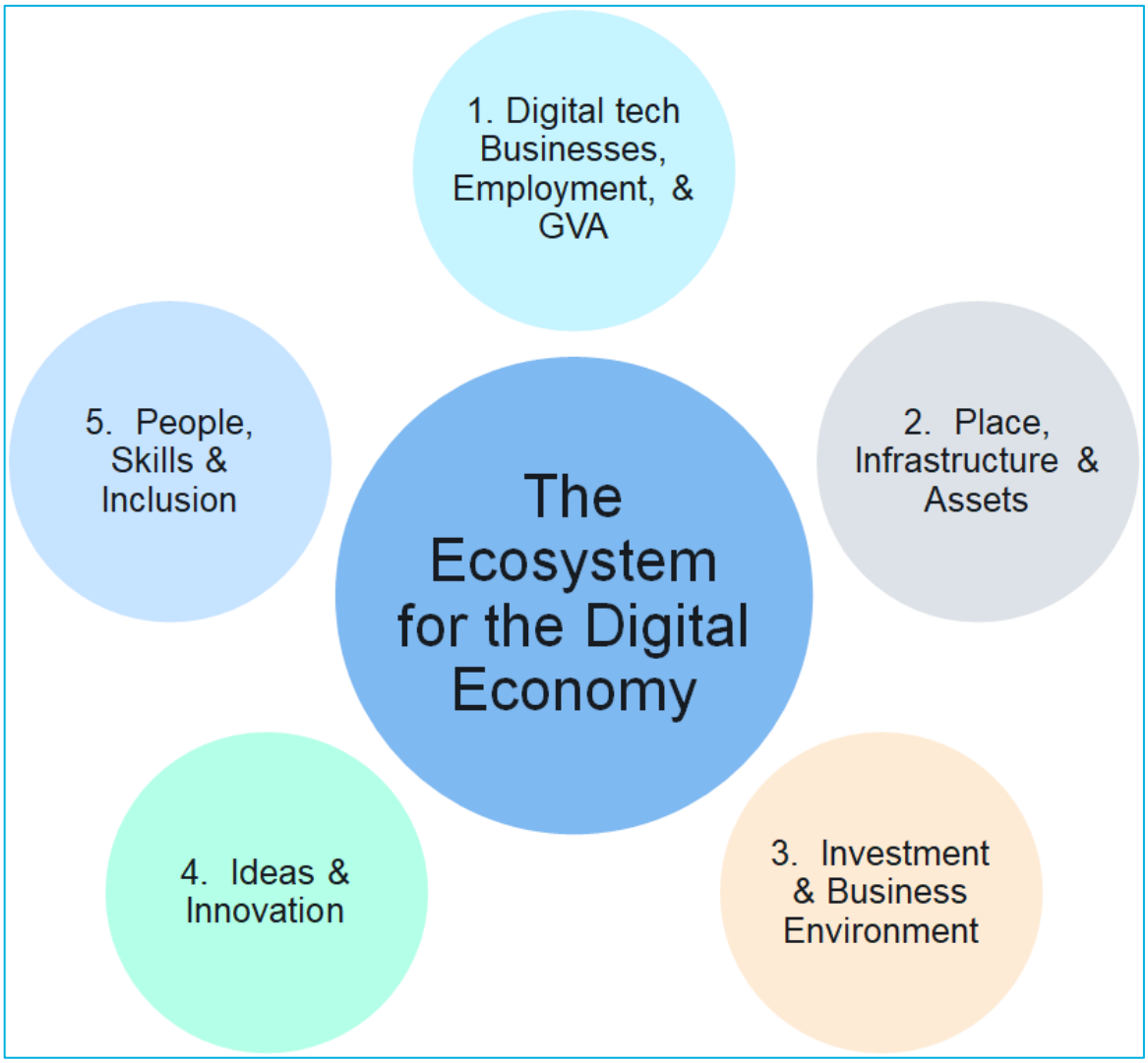
Enabling Domain 1: – digital technology businesses, their employment, and the value creation

2.11 Key to any functional digital economy ecosystem is a viable stock of digital economy businesses, which provide the products/services and employment opportunities to create value and wealth. Without this key enabling domain, the

[21] Blueprint for cities and regions as launch pads for digital transformation, 2016

wealth-creating heart of the ecosystem is missing, and growth cannot happen effectively. Key considerations in characterising this domain include the mix of businesses (business numbers, specialisms, survival rates, productivity, growth potential etc), the share of the digital sector as a proportion for the wider economy, and the export orientation of the business base.

Figure 2-2: A framework for assessing regional ecosystems for the digital economy



Source: Steer-ED, 2021

Enabling Domain 2: – Place, Infrastructure, and Assets

2.12 Despite the increasing virtualisation of business activity, much still happens physically in places, premises, and facilities. These places, their infrastructures, and the support assets which accompany them all have a key influence on the wealth-creating process which good businesses embody. So, for example, are premises of the right type, in the right places, and at the right price point, and are wider assets that businesses need (for example lab and testing facilities, incubators, and accelerators etc) in place. An additional critical consideration here is how well-served these aspects are by connectivity (both physical and digital to allow the easy movement of products and services, and to allow firms to access seamlessly talent pools and supply chains.

Enabling Domain 3: Investment and Business Environment

2.13 This domain recognises that many firms often need factors external to the business to help them and achieve and maintain their optimum growth. This includes the access that businesses have to knowledge and expertise (to help with strategic and operational development), finance and investment capital (to help drive investment, scaling, and growth), and access to networks of peers (where experiences can be shared, business relationships built, and collaborations taken forward).

Enabling Domain 4: Ideas and Innovation

2.14 The fourth enabling domain recognises that, increasingly, UK businesses must compete on the basis of content and quality, not simply price alone where lower cost locations will always have the 'whip hand'. Accordingly, this domain recognises the critical necessity of the generation, commercialisation, and spinning-out of new ideas, approaches, and knowledge (from both academia and/or established larger businesses), which firms in the ecosystem can embrace and deploy to improve the innovation and content of their own products. A strong flow of ideas and innovation is critical to the performance of any competitive ecosystem.

Finally, Enabling Domain 5: People, Skills, and Inclusion

2.15 This final domain recognises the importance of talents, skills, and opportunity in the functioning of a resilient and high-performance ecosystem. Without workers with the right qualifications, talents and mindsets, business cannot grow and expand. By the same token, without economic growth and expansion, people and their communities cannot benefit from the employment and learning opportunities that inclusive growth can deliver into the ecosystem.

3. Defining metrics for NUTS1 regions' digital economy ecosystems

2.16 Following the Rapid Evidence Review and collective agreement on the resulting five enabling domains driving the digital ecosystem, work was undertaken to agree metrics and indicators for the domains in the framework. These indicators could then be used to drive assessment dashboards of the digital ecosystems presenting in each of the 12 UK NUTS1 regions.

2.17 The principles used to select for metrics for the five enabling domains were as follows:

- Data sources should be public where possible, giving the greatest transparency and the optimum flexibility for future updates;
- Data sources should be sufficiently recent to give meaningful results, ideally updated within the last two-to-three years, and with historic data available for trend analysis;
- Full UK geographic coverage at the NUTS1, NUTS2 and NUTS3 levels was sought where possible, so that data analyses could be built up and disaggregated, although inevitably there were some coverage gaps; and
- In general, metrics were sought which permitted comparison between regions of different sizes – therefore, percentages or ratios were preferred over absolute numbers, although the latter also needed to be included to some

extent because of their importance for identifying 'threshold effects' and measurements of 'critical mass'.

2.18 In progressing this activity:

- Steer-ED Undertook a detailed review of relevant publicly available data sets from sources such as ONS, NOMIS, Ofcom, HESA, and similar;
- For each dataset, data availability, frequency of update, level of sector disaggregation and geographical coverage were probed to ensure indicators were meeting the principles above. The frequency of update meant that many of the indicators in the national Census could not be shortlisted; and
- Where publicly available data were limited or lacking, for example numbers and locations of high-growth companies, and details of occupation types being advertised, Steer-ED worked to access databases provided by used Beauhurst, Tech Nation and Geek Talent (the latter being a subcontractor to the Steer-ED team for this purpose).

2.19 The metrics were grouped by the appropriate enabling domain they help to characterise, and are set out in Table 2-1. These are the metrics which drive the UK NUTS1 Summary Dashboards presented at Section 4.

Table 2-1: Final list of metrics used to characterise enabling domains of regional digital ecosystems

Enabling Domain	Metric
Digital Tech Businesses, Employment & GVA	• Digital sector % share of total enterprises • Digital sector % share of employees • Digital occupations % share of employment • Digital sector % share of enterprise births • Average annual growth in digital sector employees (% p.a.) • Average growth in digital occupations over 5 years (% p.a.) • Digital sector % share of GVA • Average real growth in digital sector GVA - 5 years (% p.a.) • Digital sector GVA per hour worked (£/hour) • Balance of international trade in digital sector services as % of GVA
Place, Infrastructure & Assets	• Earnings p.a. as % of house prices • Average business floorspace per £1k rateable value (sq. m) • Superfast broadband coverage (% of premises) • Full fibre coverage (% of premises) • Gigabit-capable coverage (% of premises)
Investment & Business Environment	• 3yr survival rate of digital sector firms (%) • % of digital sector firms identified as 'high growth' • Digital sector firms raising Angel Network funds • VC investment in digital sector firms per capita (£)
Ideas & Innovation	• Computer Science FTEs in REF2014 • Average % Computer Science research rated 4* in REF2014 • Digital sector R&D tax credit expenditure per enterprise (£k pa) • Innovate UK grants in "AI & Data Economy" sector (£m) • Digital sector university spin-outs per 1m pop • HE postgrad computing students per 1k pop

Enabling Domain	Metric
People, Skills & Inclusion	• Digital sector median gross annual pay (£k) • Median gross annual pay for IT and telecoms professionals (£k) • Proportion of people aged 16-64 with NVQ4+ (%) • Proportion of people aged 16+ using the internet (%) • Proportion of households with internet access (%) • Proportion of internet users finding info online for work/study (%) • % of first degree graduates that remain in the region • Higher Education computing students per 1k pop

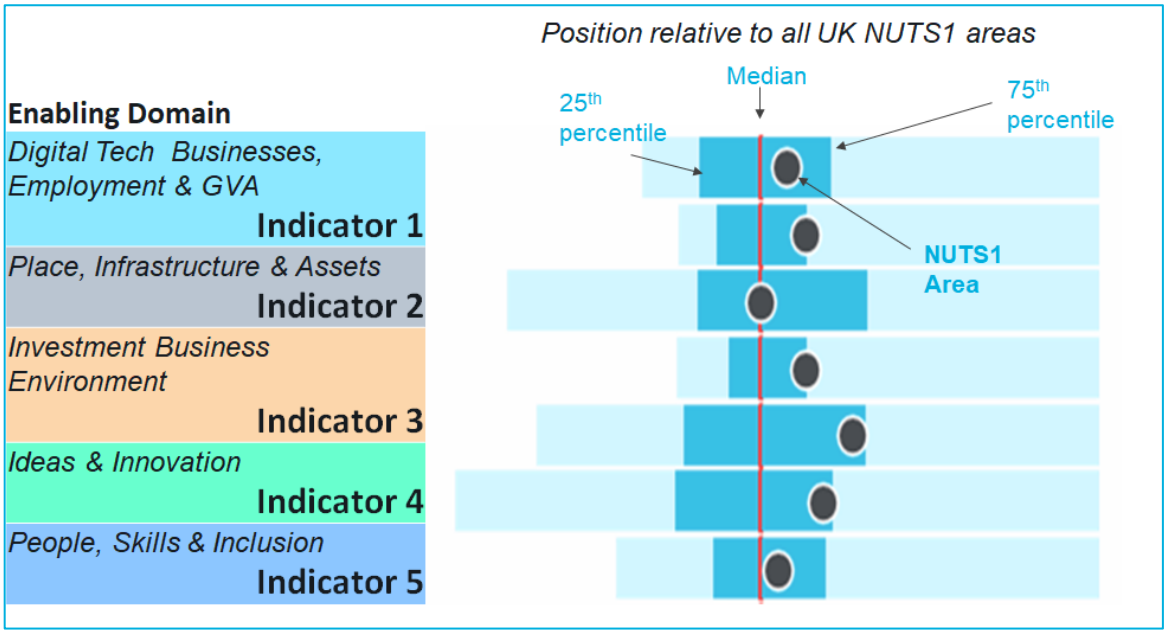
Source: Steer-ED, 2021

4. Visualisation Approach for Comparing Areas

2.20 Under this activity, the metrics presented in Table 2-1 were collated in a single Excel workbook containing information at the NUTS1, 2 and 3 levels. The spreadsheet tool enables rapid comparison between NUTS1, 2 and 3 regions on a standardised scale, so that variations between regions can easily be identified and investigated further.

2.21 The tool produced a series of 'box plot' style outputs positioning the selected NUTS area relative to all other UK NUTS geographies at that level. Figure 2-3 provides a snapshot of how the box-plot was visualised.

Figure 2-3: Example of the visualisation of the metrics provided by the Indicator Tool Spreadsheet



Source: Steer-ED, 2021

2.22 Figure 2-3 shows where a chosen area within the NUTS1, 2 or 3 area sits relative to all the other areas in its NUTS' category. The scales are normalised across the indicators, so that it is easier to understand a place's relative performance against other areas in the NUTS geographies.

2.23 The median score for each indicator is represented by the red line and is shown consistently in the middle of the chart. The horizontal bars display data in quartiles; the first quartile of scores (light blue), the second quartile (dark blue to the left of the median), third quartile (dark blue to the right of the median), and fourth quartile (light blue). Lastly, the black dot indicates where the chosen area within a particular NUTS geography sits in relation to all the other UK areas at that level of geography. This helps to give a perspective on an area's performance with metrics where there may be extreme outliers.

2.24 For ease of interpretation, the metrics were organised such that the lowest performing geography is consistently on the left of the chart, with highest performance to the right.

2.25 Additional graphical representations of data are used throughout this report to highlight movements, trends, and geographical distributions, where appropriate.

5. Stakeholder Roundtable Discussions

2.26 To complement the data analysis and gather qualitative insights, a series of NUTS1 region roundtable discussions were held with stakeholders. In total, 12 stakeholder roundtable discussions were held with the three nations of Northern Ireland, Scotland, and Wales, and the nine English regions.

2.27 Drawing on DCMS', TechNation's, and Steer-ED's national/regional contacts, these took in a total of more than 160 people, with stakeholders drawn from the following broad groups:

- Accelerators;
- Businesses;
- Local government authorities;
- Skills providers; and
- Universities;

2.28 The roundtable discussions were delivered virtually, using MS Teams, with each session led by a pair of Steer-ED consultants. These roundtable discussions had a broad mix of stakeholders, and provided very helpful qualitative insights into the local digital ecosystems. It should be noted, though, that it was not feasible for every relevant stakeholder organisation to be represented, so there will inevitably be some aspects of the local digital ecosystems which will not have been covered in the discussions.

2.29 It was not possible, given the number of variables in play, for roundtable discussions to be structured as robust and statistically representative samples of the stakeholder populations of their nation or region. As such, the sampling approach was purposive and pragmatic; given the numbers involved, formal allowance for bias arising from non-response to the invitation to participate in the roundtable discussion could not be undertaken.

2.30 The main purpose of the roundtable discussions was to explore the study's emerging data set, and share quantitative insight on the performance of the digital ecosystem in the NUTS1 region in view. The roundtable discussions focused on the following areas of discussion:

- '**The Past'** - The digital economy's success stories, challenges and supporting factors relating to the NUTS1 region, up until this point;
- '**The Present'**- a discussion of what the current factors enabling the digital ecosystem in the relative NUTS1 region; and
- '**Future Opportunities'** – what is needed to spur future growth of the digital ecosystem and economy across the NUTS1 region, and how this might be advanced for the future.

2.31 Findings from the roundtable discussions were collated and synthesised, and were then used to supplement the metrics data captured at the level of the five enabling domains of the ecosystem, providing a comprehensive assessment of

each NUTS1 region's strengths, weaknesses, opportunities, and challenges. These are presented as Summary Assessments at Section 4.

Assembly of database of accelerators, incubators, and wider assets

2.32 The penultimate activity involved assembling a database of accelerators, incubators, and wider assets in support of the digital economy, grouped by NUTS1 region. These data were drawn from a range of sources, including the following:

- Business incubators and accelerators: the national picture[22]
- The Beauhurst Data Platform[23];
- 153 Business incubators for UK for start-ups and entrepreneurs[24];
- The Complete List of Unicorn Companies[25];
- The Higher Education Statistics Agency[26], drawing-down data on all UK universities delivering Computer Studies courses;
- References made to accelerators, incubators or wider assets made in the stakeholder roundtable discussions (at activity '5' above)
- Steer-ED's wider professional knowledge of science and technology assets at regional level.

2.33 Following assembly, these data were screened and de-duplicated. These data were subsequently used to provide insights into the provision of accelerators, incubators, and wider enabling assets at the level of each of the UK's NUTS1 regions.

Indicative projections of future growth for NUTS1 regions

2.34 Detailed modelling of future growth in the digital economy's GVA and employment was beyond the scope of this study. However, Steer-ED did provide *indicative* estimates of the extent to which each NUTS1 region's digital sector could increase by 2025, and these are included in the 'Achieving Prosperity' section for each of the NUTS1 Summary Dashboards in Section 4.

2.35 Steer-ED's *indicative* estimates were derived as follows:

- The focus of estimation was on the two sub-sectors which have shown a clear pattern of growth in GVA over the last few years (both at the UK level and at the regional level): 'Computer programming and consultancy' (SIC division 62)

[22] Business incubators and accelerators: the national picture - GOV.UK (www.gov.uk)

[23] Beauhurst

[24] 153 Business incubators for UK for startups & entrepreneurs, 2021, Entrepreneur Handbook

[25] The Complete List Of Unicorn Companies, CB Insights

[26] HESA

and 'Information service activities' (SIC division 63). For the purposes of *indicative* estimates, it was assumed that these software- and data-intensive sub-sectors will be the primary drivers of regional growth in the digital sector[27];

- Combining ONS' regional GVA data for these sub-sectors up to the year 2019, growth rates were assumed for 2020 in line with the region's annual average for the period 2014 to 2019 (these varied from 5.1% p.a. in the South West to 13.9% p.a. in Northern Ireland). It was then assumed that each region's annual growth in these combined sub-sectors' GVA could converge to 8.5% p.a. by 2025 (this being the UK average for the period 2014 to 2019), with a linear interpolation being used to calculate annual GVA growth rates for the years between 2020 and 2025; and
- The associated employment uplifts by 2025 were estimated by dividing the region's GVA uplift by the region's GVA per employee for these combined sub-sectors (averaged over the period 2015 to 2019).

Limitations

2.36 Data availability was a key limitation for this study. Overall, data were collated at NUTS3 level wherever possible. Where different geographic boundaries were used in a dataset (for example, for data which is released by local authority or postcodes), these were aggregated and organised appropriately to the NUTS3 level. NUTS2 and NUTS1 data were also collected where possible, or where NUTS3 data was not available for the metric or geography. The availability of like-for-like data on school-level qualifications was also limited due differences in the education systems across the four nations.

2.37 Some metrics had more extensive time-series coverage than others (both in frequency of measurement and overall time covered), which makes comparison between some metrics challenging.

2.38 SIC Code classifications have limitations, because they are rigid and may only partially account for emerging sectors, such as Fintech, EdTech etc. To account for this, Steer-ED used additional sources, such as Beauhurst's tracked growth business database and data from Geek Talent, which classifies sectors and occupations in ways which fit more closely to emerging sectors and roles. However, these data were not available for all metrics.

2.39 Overall, the metrics give good insight into national/regional digital ecosystems in the UK, but the data availability and time period limitations must be considered when assessing the Summary Assessments in Section 4.

[27] In London, the GVA of the 'Motion picture, video and TV programme production' (SIC division 59) sub-sector has also been growing strongly, but this pattern is not common across the regions.

3 The Digital Economy in a UK Context

Purpose

3.1 This Section presents a brief contextual summary of the UK's digital economy to illustrate its importance to the UK's long-term growth and competitiveness.

The Digital Sector

3.2 The digital sector[28] represents a substantial share of the UK economy. It employed around 1.66 million people in 2020, accounting for 4.9% of all employment. In terms of Gross Value Added (GVA), the sector contributed £151 billion to the UK economy in 2019[29], which was 7.6% of the UK total. In its economic contribution, the digital sector is therefore larger than, for example, the construction sector (£130 billion) or the financial services sector (£126 billion)[30].

3.3 Furthermore, the digital sector is rapidly growing, as shown in Figure 3-1. Since 2010, its GVA has grown by 26.5% in real terms, compared to total UK GVA growth of 17.7%.

3.4 The primary driver of this growth, especially over the last five years, has been 'Computer programming, consultancy and related activities', which is also the largest sub-sector, as shown in Figure 3-2.

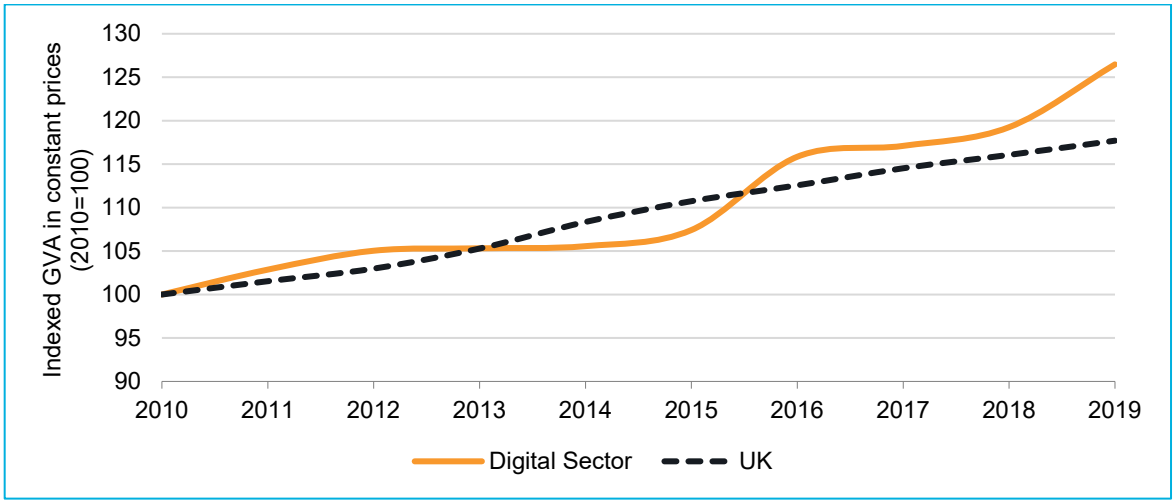
3.5 In terms of the spatial distribution of digital sector activity, Figure 3-3 illustrates the digital sector's share of total employees by NUTS3 area. The sector's average share of employees ranges from 2.1% in Wales to 8.4% in London, and its share of GVA ranges from 3.4% in Wales to 12.3% in London (see the Summary Dashboards in Section 3 for further information on these metrics).

[28] The 'digital sector' refers to those businesses in digital industries, based on Standard Industrial Classification definitions. 'Digital occupations' refers to digital job roles, in whatever industry, based on Standard Occupational Classification definitions. See Figure 2-1 for further information on the definitions of the 'digital sector' and 'digital occupations' used for this report.

[29] DCMS Sectors Economic Estimates 2019 (provisional): Gross Value Added

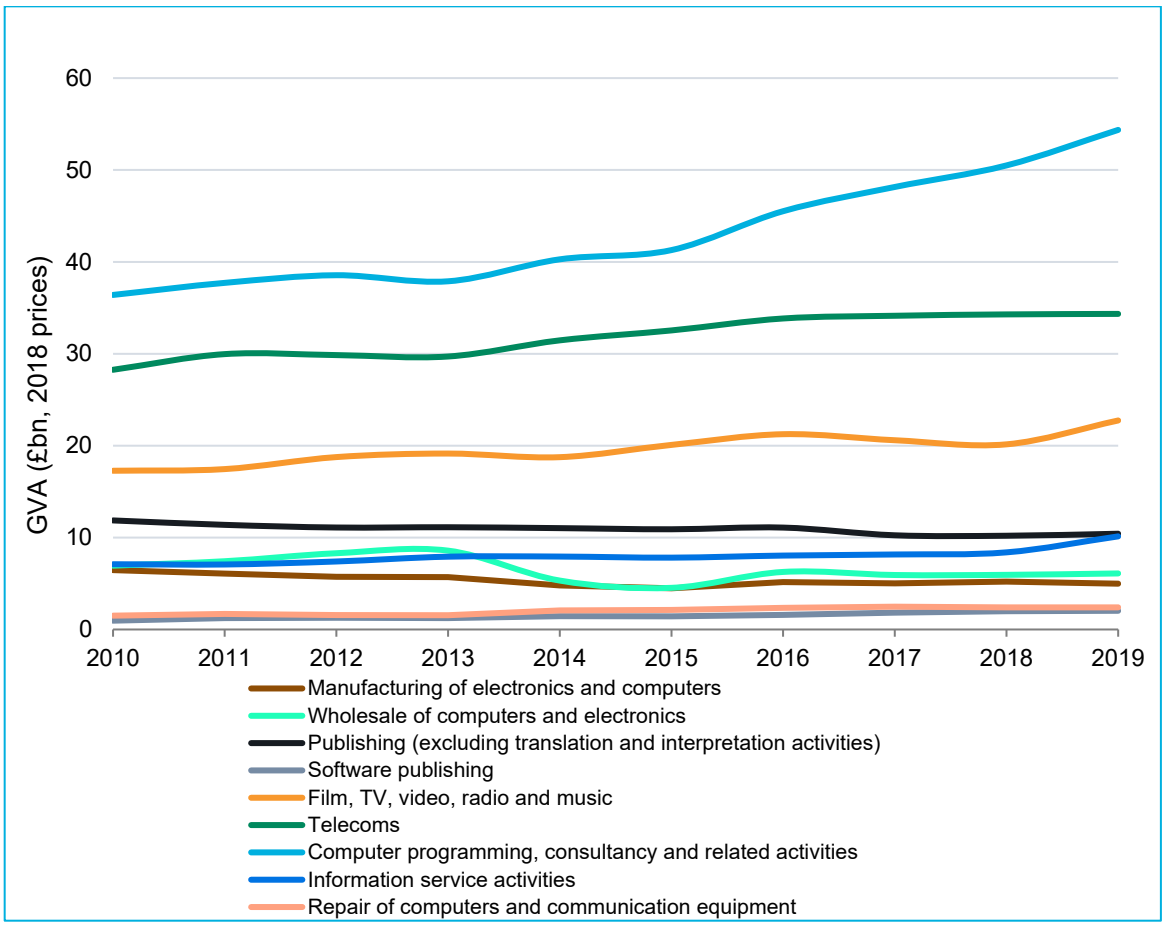
[30] Regional Gross Value Added (balanced) by industry (ONS), 2021

Figure 3-1: Indexed GVA for the digital sector, and for the UK



Source: DCMS Sectors Economic Estimates[31]

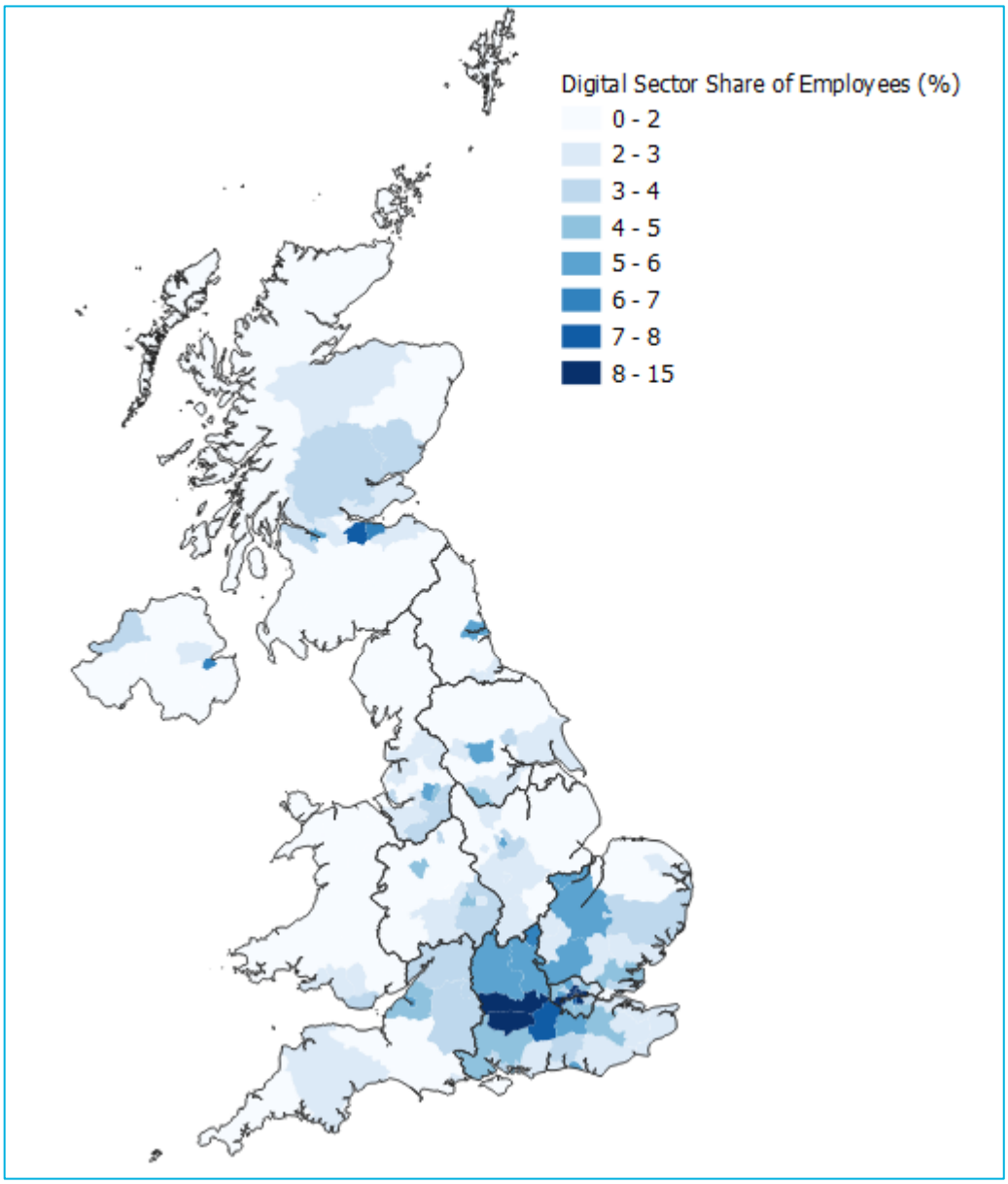
Figure 3-2: Digital sector GVA by sub-sector, since 2010



Source: DCMS Sectors Economic Estimates

[31] 2019 GVA figures here and throughout the report are provisional

Figure 3-3: Digital sector share of employees by NUTS3 region, 2019



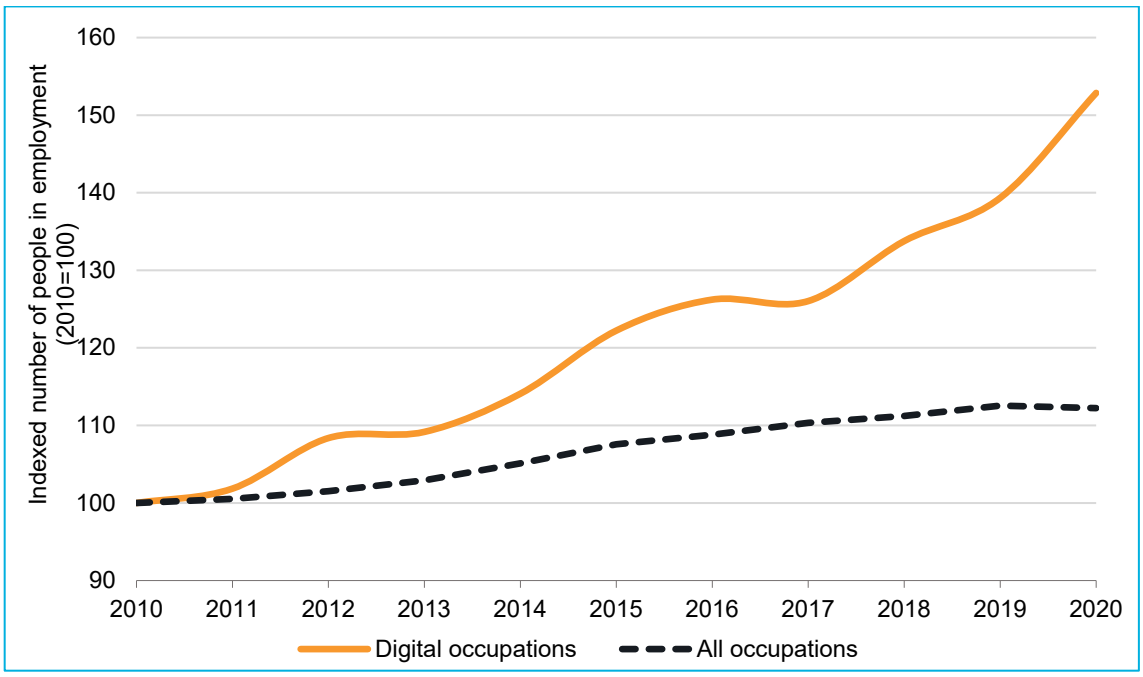
Sources: ONS Business Register and Employment Survey and Northern Ireland BRES

Digital Occupations

3.6 There were 1.63 million people in digital occupations[32] in the UK in 2019. Since 2010, employment in digital occupations has increased by 53%, far outstripping the overall UK employment growth of 12%. This shows how important the digital economy is to the prosperity and economic outlook of the UK.

[32] Telecommunications engineers, IT engineers, IT Technicians, IT & telecommunications directors, and IT & Telecommunication Professionals

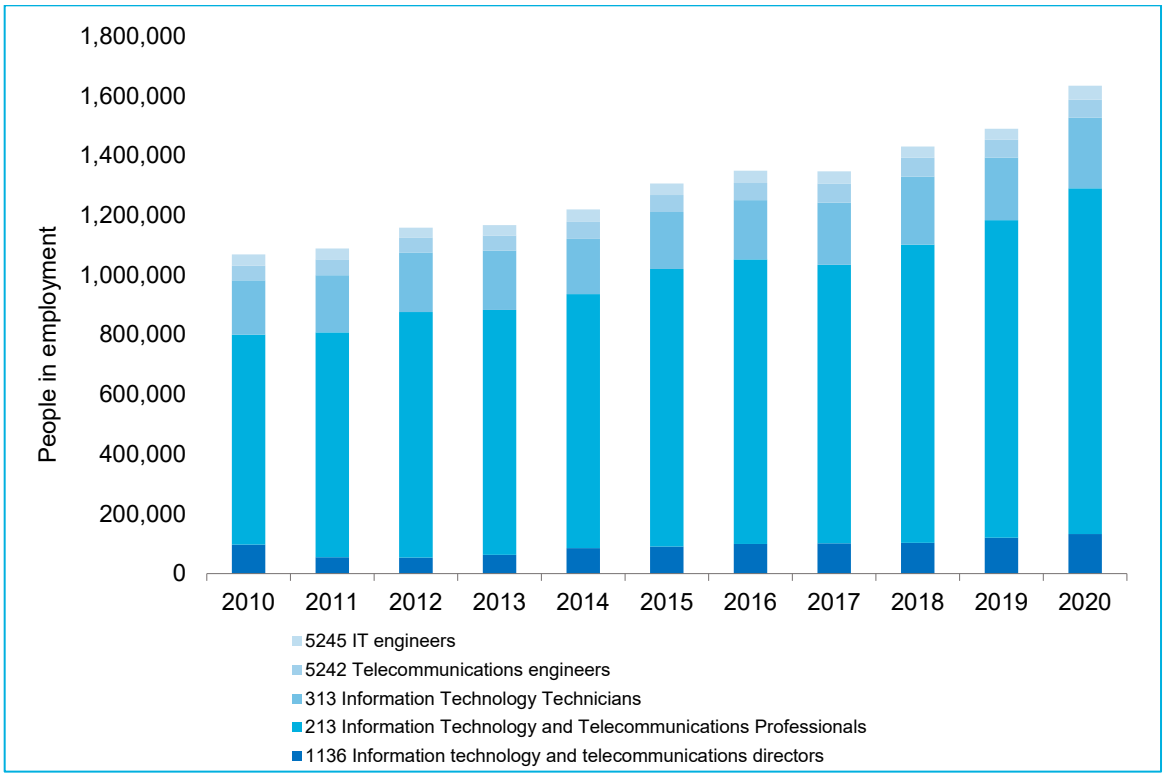
Figure 3-4: Indexed employment in digital occupations and all occupations, since 2010



Source: ONS Annual Population Survey

3.7 The vast majority (80%) of this growth has been in IT & telecommunications professional occupations, such as programmers, web designers and IT business analysts (Figure 3-5).

Figure 3-5: Number of UK digital occupations, by occupation category since 2010 (legend includes the specific SOC codes)



Source: ONS Annual Population Survey

3.8 The geographic distribution of digital occupations is more evenly spread than digital sector employment, ranging from 3.0% of all employment in Wales, to 7.2% in London. This more even distribution reflects the fact that *all* sectors of the economy require digitally-skilled people, and the UK's geographic distribution of all economic activity is less skewed towards London and the South East than that of the digital sector. Over the last five years, the growth in digital occupations has been particularly strong in Northern Ireland (57%), and least rapid in the South East region (9%).

Table 3-1: Total digital occupations and occupations growth by nation and region, 2020

NUTS1 region or nation	Total digital occupations 2020	Digital occupations share of all employment	Digital occupation growth 2015-2020
East of England	161,200	5.2%	21%
East Midlands	98,600	4.2%	13%
London	340,700	7.2%	34%
North East	44,200	3.7%	36%
North West	146,800	4.3%	22%
Northern Ireland	33,200	3.9%	57%
Scotland	111,100	4.2%	34%
South East	295,900	6.4%	9%
South West	129,700	4.7%	25%
Wales	43,000	3.0%	29%
West Midlands	123,400	4.5%	40%
Yorkshire and The Humber	106,200	4.1%	38%

Source: ONS Annual Population Survey

Regional Digital Ecosystems

3.9 As seen above, there are currently wide disparities in the extent to which the digital economy is contributing to the prosperity of the UK's nations and regions, and there are also considerable differences in growth rates.

3.10 The adoption of digital technologies across all industry sectors and markets is increasing, and will continue to transform the way people, businesses and places work in the UK, making a critical contribution to innovation and productivity growth[33].

[33] See, for example, Information and communication technology intensity and productivity, ONS, 2018

3.11 Improving digital skills capability is a major focus for regional stakeholders. Key findings from a recent evaluation[34] of the DCMS-funded Local Digital Skills Partnerships show that when there is greater collaboration, and joined-up activity between regional stakeholders, national organisations and central government, digital skills interventions are more impactful.

3.12 Furthermore, as a sector, digital is also one of our most promising growth areas, and it is one in which the UK has a competitive international position[35].

3.13 If the UK is to maximise the benefits of the digital economy – both as a driver of productivity growth and as a substantial and fast-growing contributor to jobs and economic output in its own right - it is increasingly important that these benefits are extended more fully across the country. This requires concerted and ambitious development of the digital ecosystems in every part of the UK, building on existing strengths and addressing the key barriers to progress.

[34] The Local Digital Skills Partnership evaluation report is due to be published in the Autumn 2021

[35] For information on the UK's international position see, for example, the **UK Tech Competitiveness Study**

4 Summary Dashboards

4.1 With the study background, approach and methodology, and wider context established, this Section presents 'Summary Dashboards' characterising the present status of the digital economy ecosystem in each of the 12 UK NUTS1 regions.

4.2 To aid readability and consistency, each Dashboard is structured with six logical parts:

- The first provides a positioning overview of the NUTS1 region in view, setting out headline statistics for the region, a summary of the economy overall (including GVA growth) and the size of the digital economy in particular, and a perspective on the demand for digital economy occupations.
  - Data driving this part of the dashboard are drawn from ONS' Regional GVA tables, the Business Register and Employment Survey (BRES)[36], the Annual Population Survey and specially-commissioned data from Geek Talent[37];
- The second part then provides information on how the region in view performs against the identified metrics for each of the five enabling domains being used to characterise the digital ecosystem (see Table 2-1). These data are presented in tabular form with a 'box plot' chart, with the latter enabling specialisms and weaknesses to be identified easily.
  - The data driving this section of the dashboard are drawn from an extensive list of sources, fully reported in Appendix B.
- Part Three then focuses on the digital economy's spatial distribution within and across the region in view. Maps present digital economy employment, digital sector assets (including incubators, accelerators and such), and digital

[36] The totals for digital sector employment and digital occupations in the year 2019 have been sourced via NOMIS from the Business Register & Employment Survey and the Annual Population Survey respectively. In the absence of sufficiently detailed recent data on the overlap between these two, an assumption has been used that 42% of the digital sector employment is in digital occupations – drawn from an analysis of the detailed occupations by industry data available from the England & Wales Census 2011

[37] Location quotients (LQ) have been used on some of this data to draw out regional differentiation more clearly (for example, on occupations data, the LQ is calculated by the following process: an occupation's share of total ads in the region divided by this occupation's share of total ads in the UK). The UK average is, therefore 1.0. Only the top 10 occupations by job adverts are shown here, ranked by LQ.

sector high-growth businesses to help identify clusters of activity and potential in the region.

  - Data driving this part of the dashboard are drawn from the BRES, Beauhurst's Leading High-Growth Platform[38], stakeholder roundtable discussions held with regional partners, and the database assembled by the study on digital economy relevant accelerators, incubators, and wider assets;

- Part Four moves on to provide perspectives on sub-regional potential, disaggregating the overall NUTS1 position down to NUTS2 and 3 levels to show the relative output (GVA) of the digital sector. This material highlights where the region's NUTS2 and NUTS3 regions are in relation to the top and bottom performers in the UK. Charts provided include the five-year (2014-2019) growth rate for the digital sector's GVA, Higher Education Computing Students per 100k population, and VC investment per capita.
  - The data driving this section of the dashboard are drawn from an extensive list of sources, which are fully reported in Appendix B.
- Part Five focus on the area's digital economy potential and high-growth business specialisms, providing an analysis of growth potential, looking at the annual GVA output (over the 2010-2019 period) produced by digital sector sub-sectors. This Part also includes two 'Word Clouds' drawn from an analysis of Beauhurst's Leading High-Growth Platform dataset, setting out the frequency of sub-sectors to which high growth forms associate themselves, and the 'buzzwords' used to define their services;
  - Data driving this part of the dashboard are drawn from ONS's Regional GVA tables and Beauhurst's Leading High-Growth Platform.
- Finally, Part Six draws the material into a short summary, focusing on the strengths of the digital ecosystem in the region, the opportunities/specialisms that present, the barriers to be faced, and how the 'prosperity prize' that the digital economy potentially presents can be best achieved for the region.

4.3 Summary Dashboards are presented for 12 UK NUTS1 regions in the following order.

- East Midlands;
- East of England;
- London;
- North East;
- North West;
- Northern Ireland;
- Scotland;
- South East;

[38] 10% or 20% year on year growth in headcount or turnover, over a three-year period – Beauhurst/OECD definition

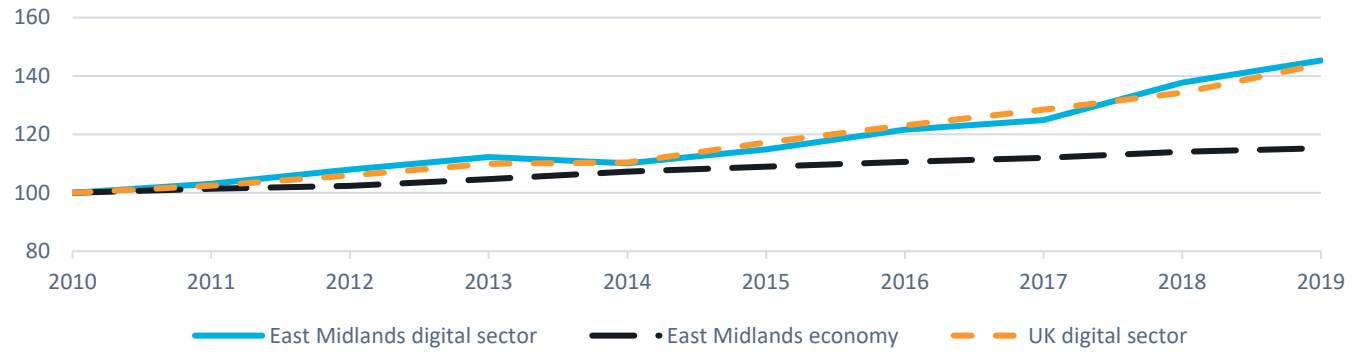
- South West;
- Wales;
- West Midlands; and
- Yorkshire and The Humber.

East Midlands – Summary Dashboard

Region

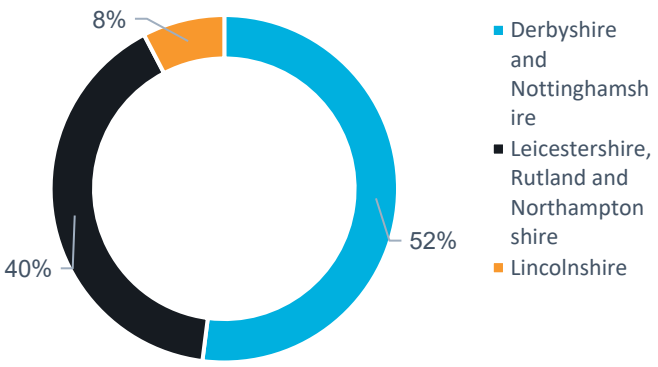
- **Component NUTS2 regions:** Derbyshire and Nottinghamshire, Leicestershire, Rutland and Northamptonshire and Lincolnshire.
- **Key Statistics:** 15,627km^2, 4.9m population, £110bn total GVA (2019), 1.5% total annual GVA growth (2014-2019)
- The East Midlands' economic activity is concentrated in Nottingham and Leicester, but it also has main population centres in Derby, Mansfield, Lincoln, and Northampton.
- This region continues to perform strongly relative to the UK in manufacturing, particularly in Food, Textiles, Leather Products, Manufacture of other Non-Metallic Mineral Products, and Wearing Apparel.
- The digital sector is relatively small as a percentage of total output for the region (3.6%), but it is showing strong growth in economic output (5.7%, 2014-2019), marginally faster than the UK's Digital Sector, and much faster than the East Midlands' economy as a whole.
- Total digital employment (estimated at 125k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector; this is indicative of the high demand for digital skills in non-digital sector industries, such as Transport and Storage (which link to the region's transport infrastructure).
- Demand for digital occupations is dominated by both Derbyshire and Nottinghamshire and Leicestershire, Rutland and Northamptonshire, with 52% and 40% of the area's digital occupation online job postings in 2019-2020, respectively. This is followed by Lincolnshire, which has a small proportion at 8%.
- There is relatively high demand for Web Developers, Field Service Engineers and IT Support Analyst (location quotient above 1.0, the UK average) although the largest absolute demand for occupations is Software Developers, accounting for 25% of digital occupation job adverts in the 2019-2020 period, indicating increasing demand for innovative software and accelerating growth in technology.

Digital Sector GVA growth 2010-2019 (indexed to 2010), East Midlands NUTS1 Region



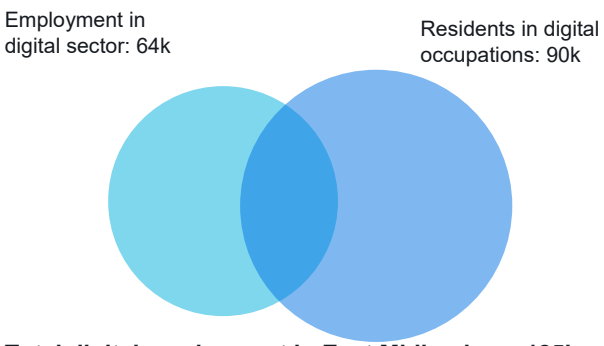
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in the East Midlands (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), East Midlands NUTS1 Region



Total digital employment in East Midlands: c. 125k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations (2019-2020), East Midlands NUTS1 Region

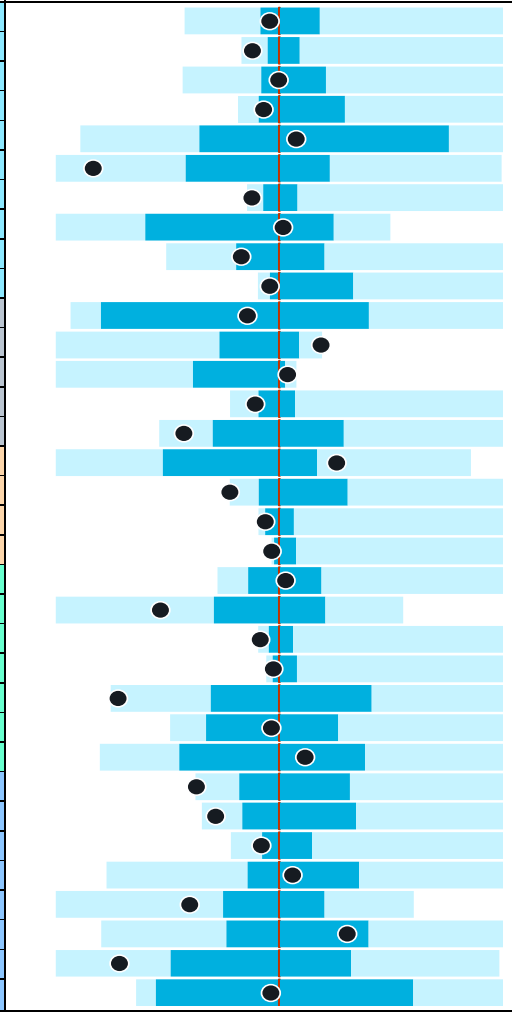
- This table shows digital occupations by demand for the East Midlands. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, Data Engineers, and IT Support Analyst, but comparative demand is highest for Web Developers, Field Service Engineers and IT Support Analysts. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Web Developer	7,097	6.4%	1.46
Field Service Engineer	3,157	2.8%	1.40
IT Support Analyst	7,952	7.1%	1.39
Software Developer	27,342	24.5%	1.22
IT Service Manager	2,425	2.2%	1.21
Database Administrator	1,710	1.5%	1.20
Test Analyst	3,341	3.0%	1.11
IT Manager	5,347	4.8%	1.09
System Administrator	1,573	1.4%	1.07
Business Development Executive	1,556	1.4%	0.98

Source: Geek Talent, 2021

East Midlands - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for the East Midlands and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where the East Midlands (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, the East Midlands is above the median value on this indicator.

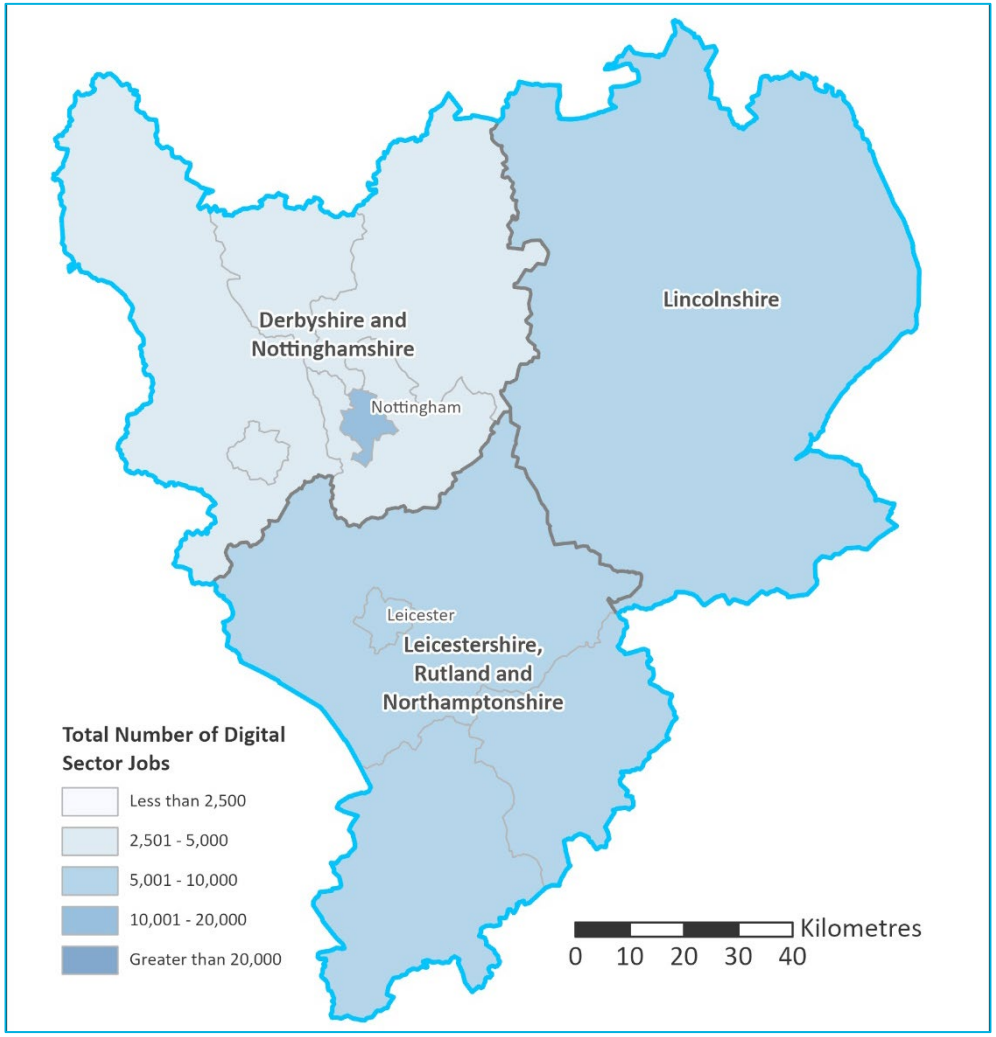
Indicator name	Period	EM	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**5.9**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**2.4**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**4.2**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**5.5**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**3.2**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**2.4**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**3.6**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**5.7**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**37.1**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.1**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**13.8**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**19.2**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**95.8**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**15.1**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**15.1**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**62.7**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**0.9**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**5.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**5.8**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**145.5**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**17.1**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**14.2**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**9.0**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**1.2**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.4**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**1.2**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**30.2**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**35.8**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**37.2**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**91.4**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**92.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**50.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**56.9**		51.7	61.1	69.9	75.7	87.8
HE computing students per 1k pop	2019/20	**1.8**		1.3	1.4	1.8	2.3	2.6

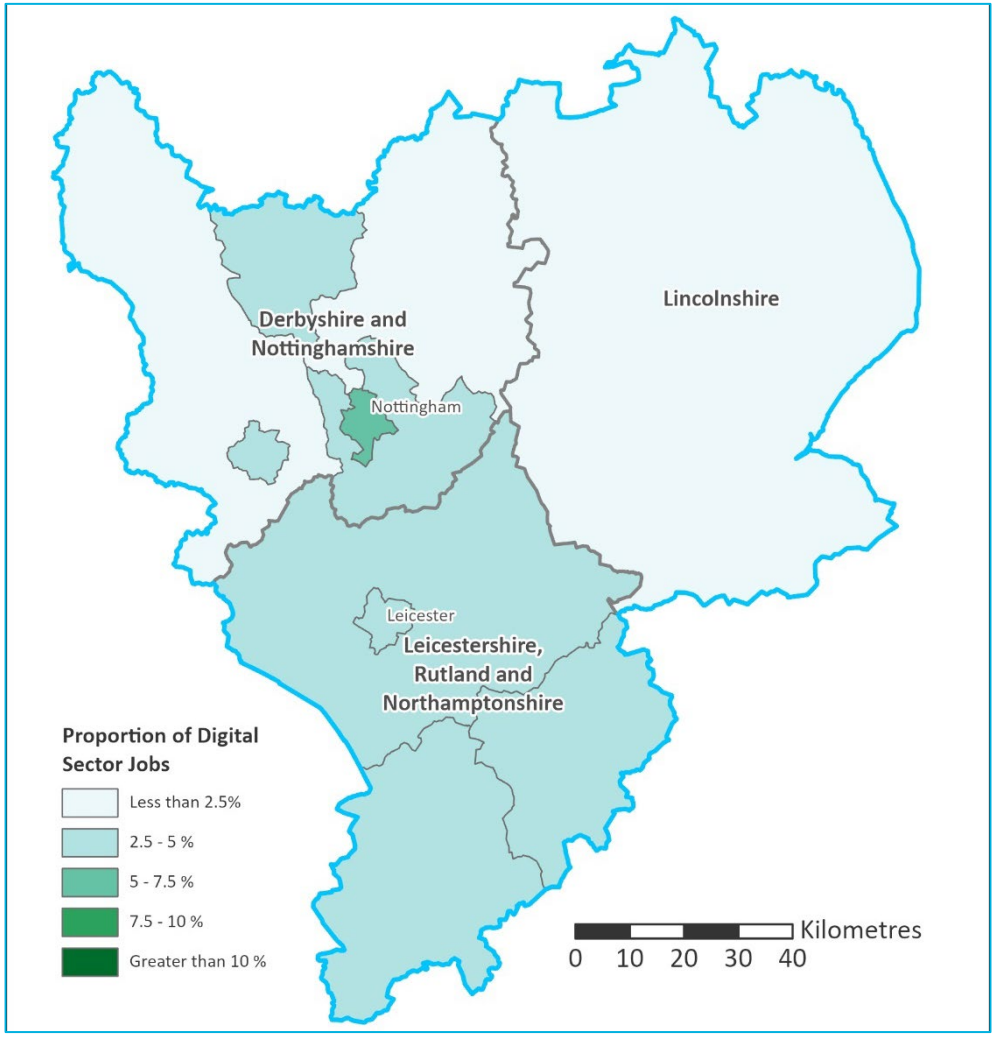
Source: Steer-ED and various datasets – See Appendix B

East Midlands - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

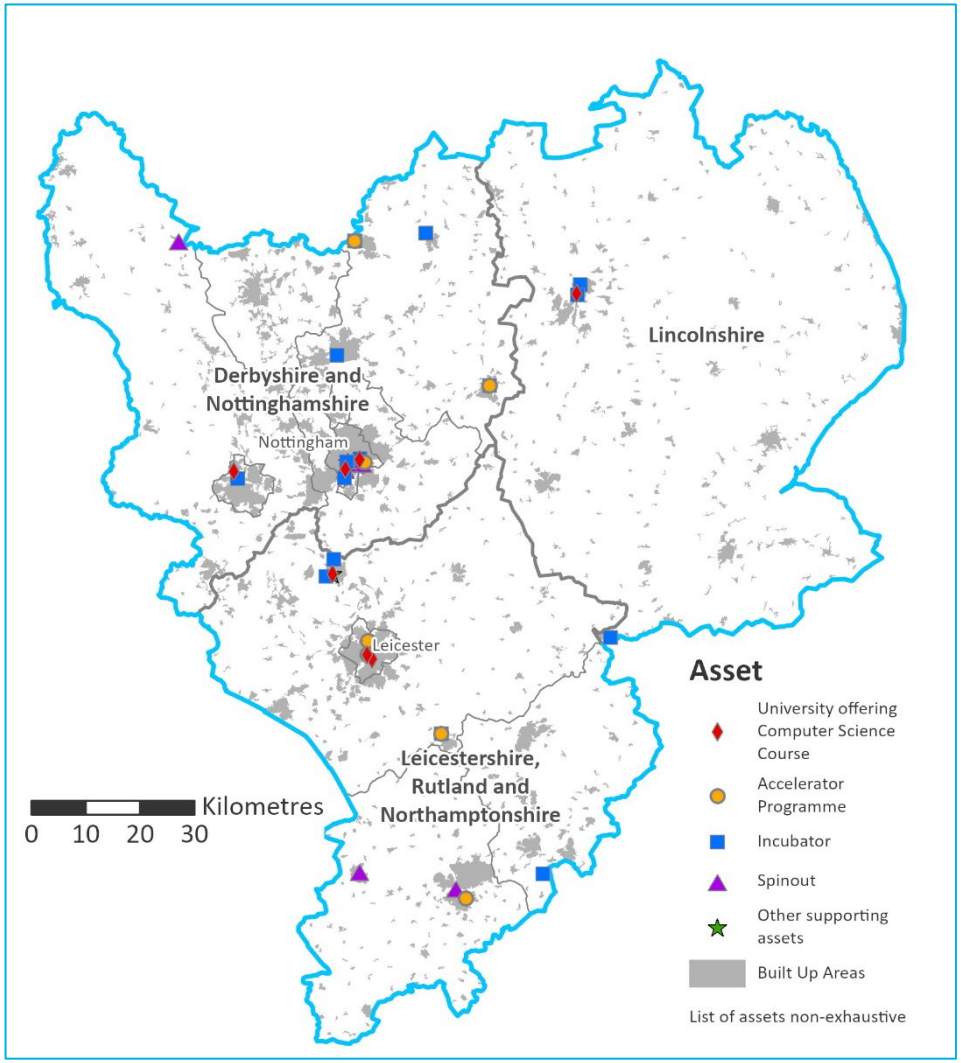
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

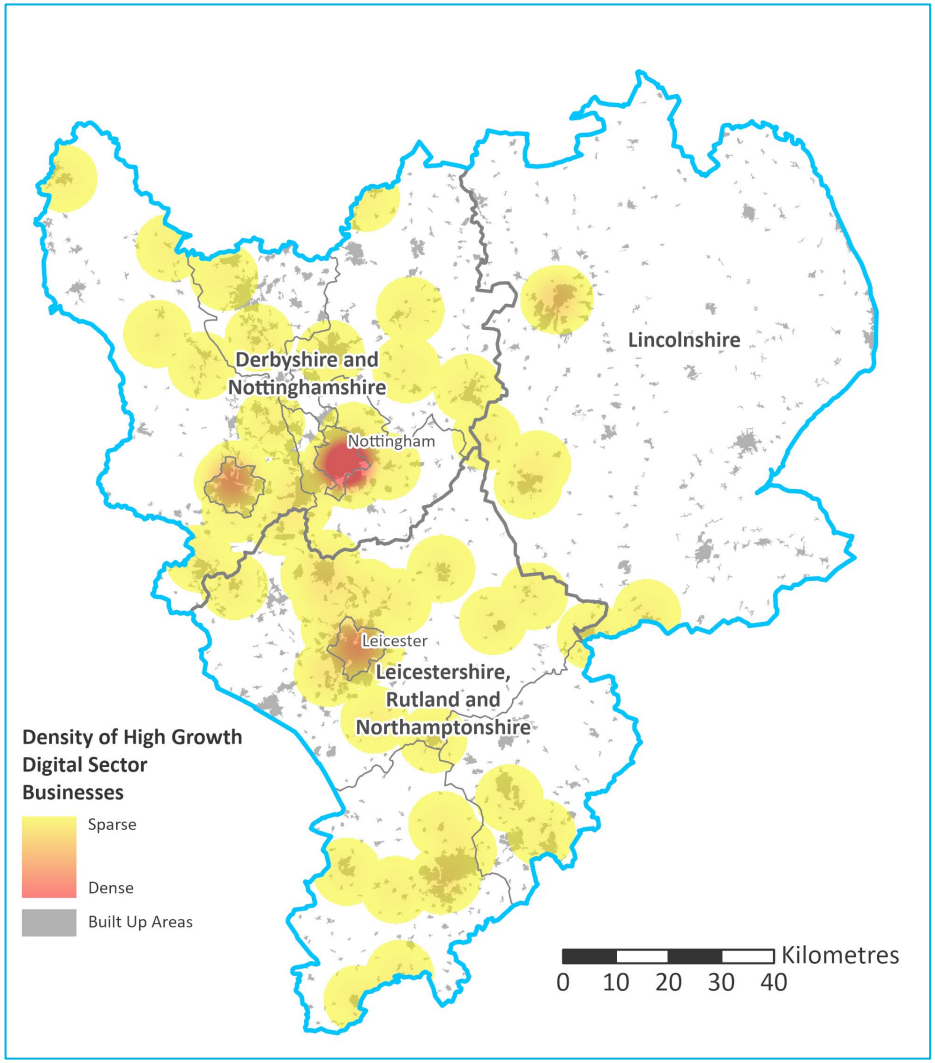




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in the East Midlands, including accelerators, incubators, universities with computer science courses, university spinouts, and additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in the East Midlands. It highlights how high growth businesses are concentrated in larger urban areas.



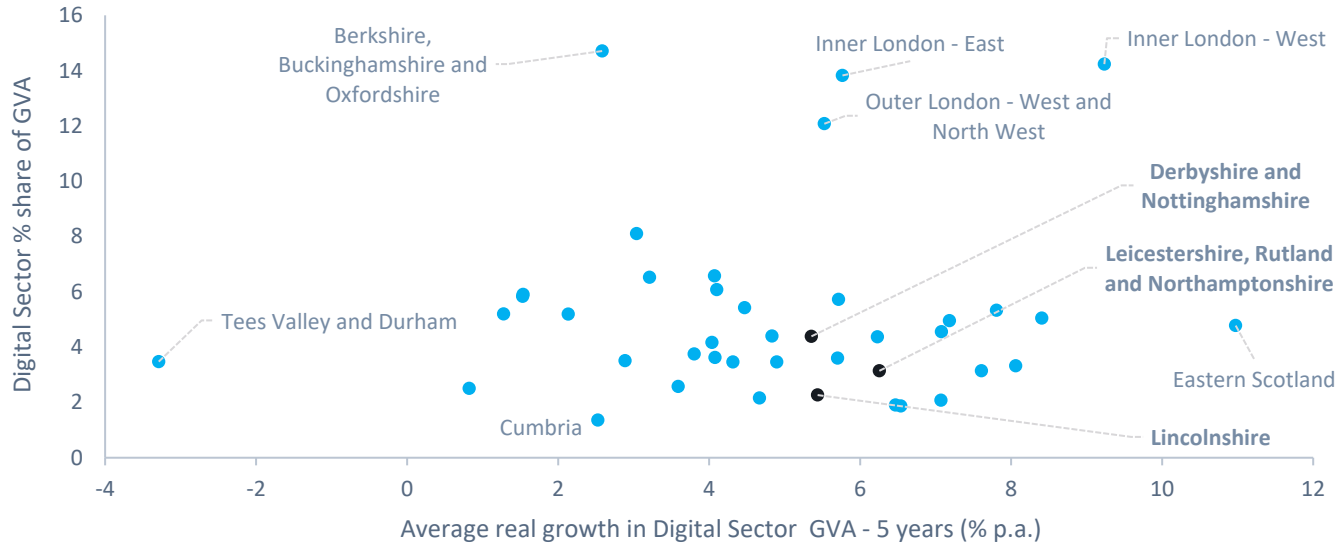


East Midlands – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in the East Midlands, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. The East Midlands are indicated in black. Key outliers outside the East Midlands are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in the East Midlands.

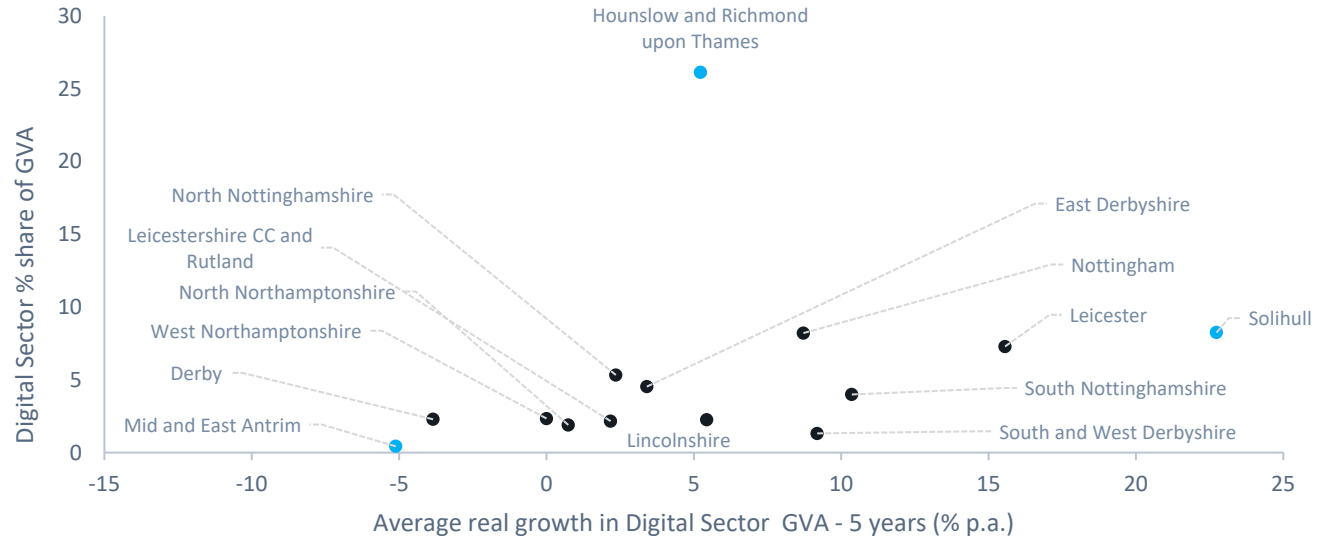
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

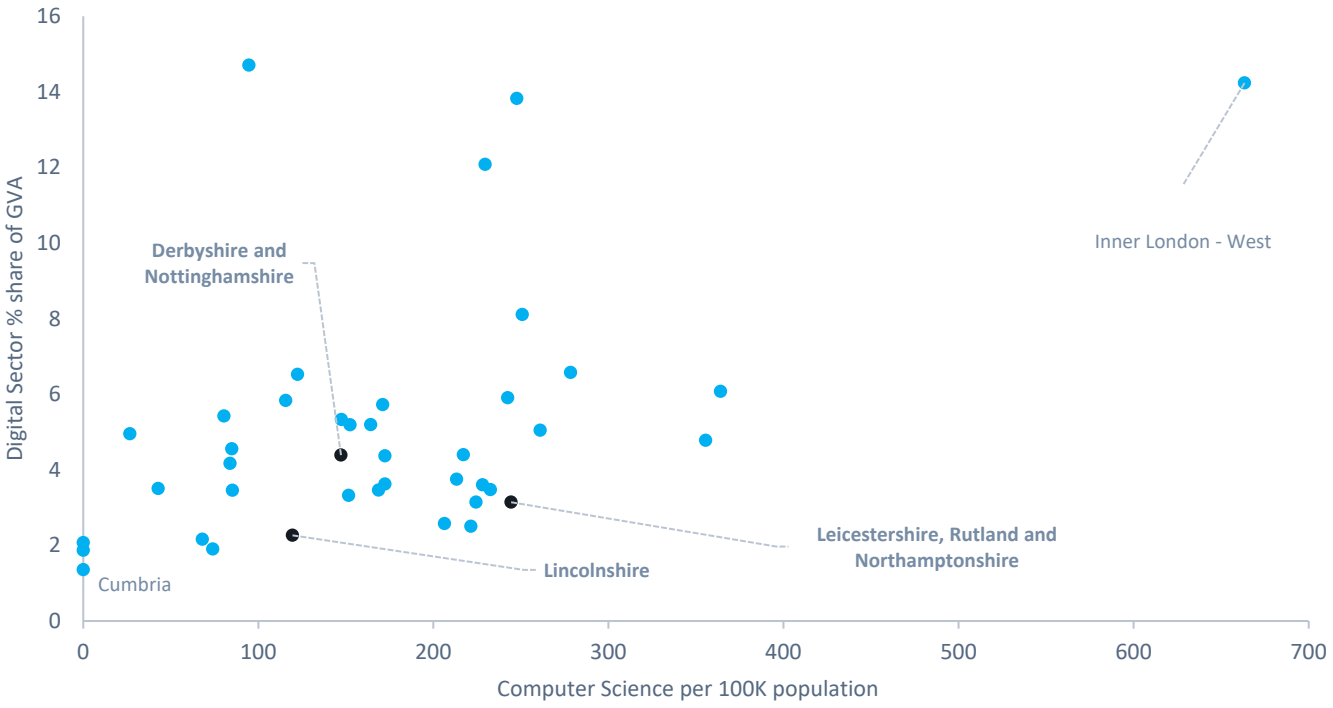
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – East Midlands NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in the East Midlands' NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

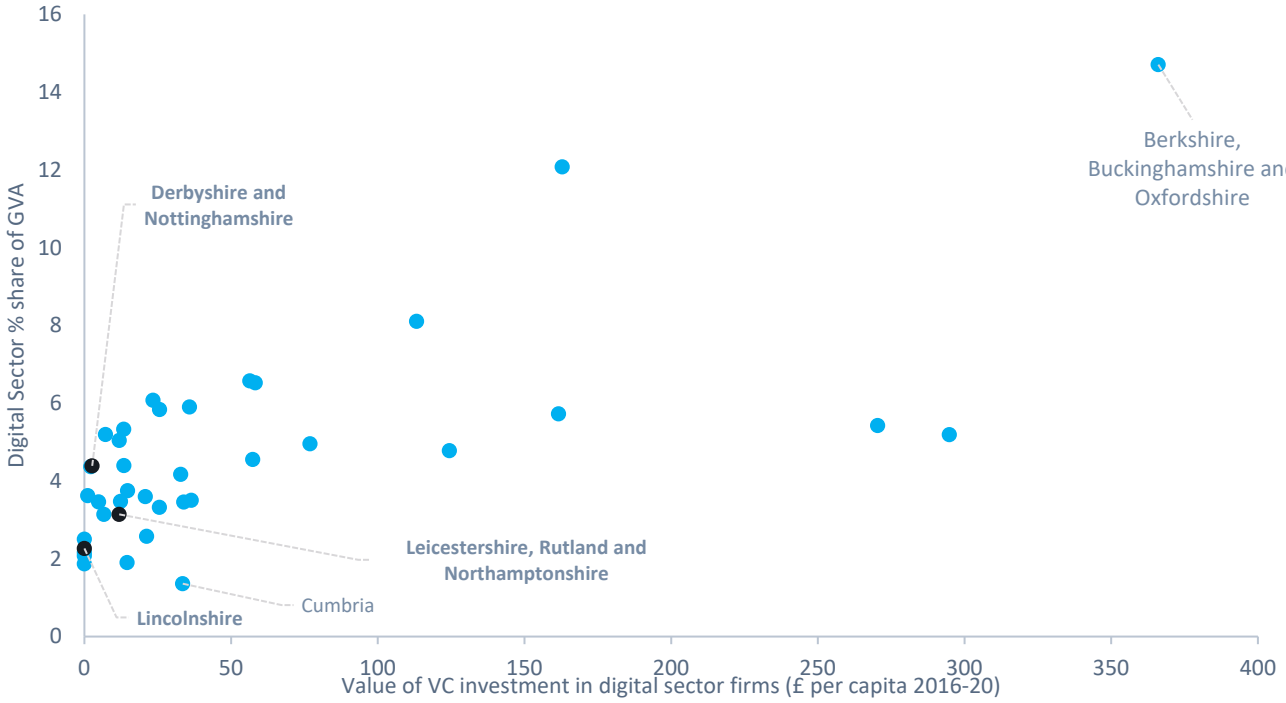
Digital Sector GVA % plotted against HE Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019 Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

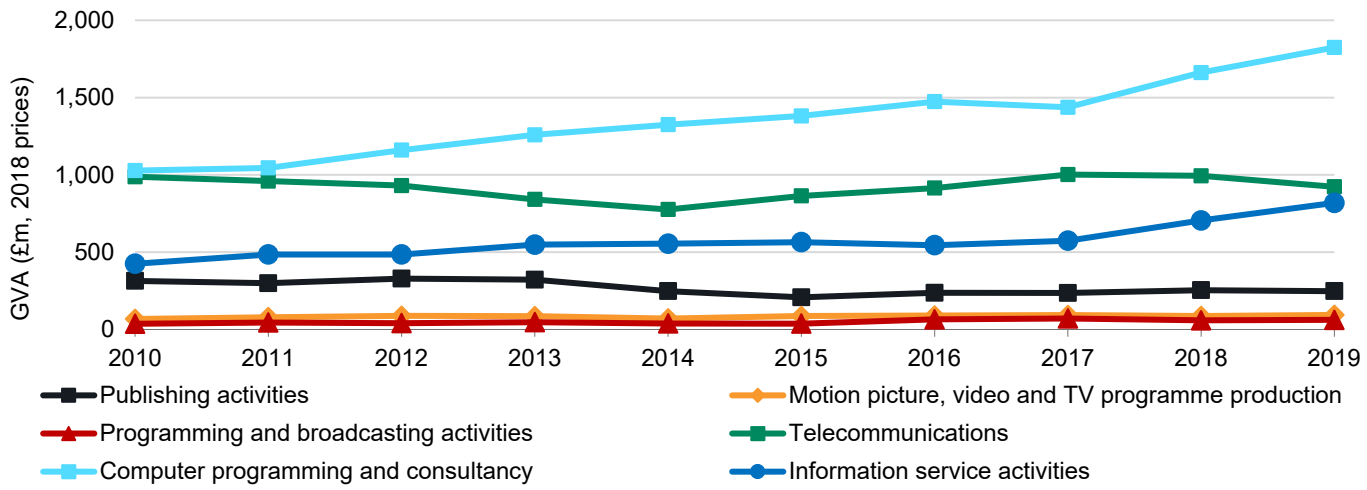
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector at a NUTS2 level.

East Midlands – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of the East Midlands, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

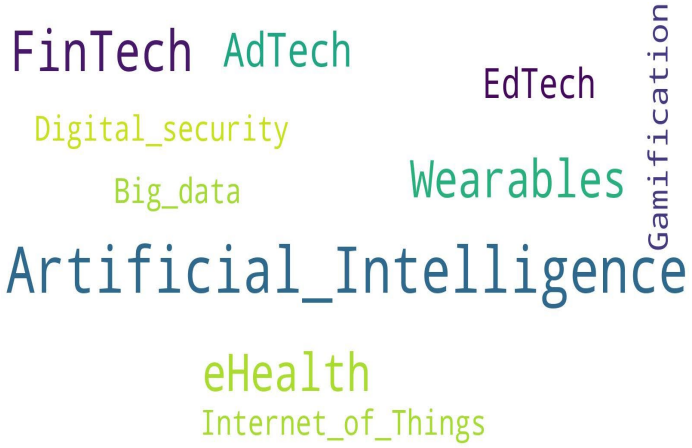
- The chart above shows that there has been significant growth in Computer programming and consultancy (CAGR of 6.6%), it is also the largest sub-sector. Information service activities has grown steadily since 2010, and most recently, since 2017, at a fast pace. The sector grew at a CAGR of 8.09% between 2014-2019. These sub-sectors are where the growth potential for the East Midlands lies.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which the East Midlands' potential for further economic growth lie. There were 99 high growth businesses in the digital sector in the East Midlands as at 2021, equating to 0.9% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms which these high growth businesses operate in are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which East Midlands high growth firms operate in, and "buzzwords" that relate to their business operations. It shows significant expertise in providing software as a service, the development of mobile apps, internet platforms, analytics insight tools, with specialisms in Artificial Intelligence, eHealth, FinTech and Wearables.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

East Midlands Digital Ecosystem in Summary

Strengths

- In recent years, the East Midlands has grown above the median in terms of both digital sector employees (3.2% per annum) and digital sector GVA (5.7% per annum).
- These regional averages do not do justice, however, to the two East Midlands cities in which the digital sector is particularly strong. Nottingham features in the top quartile of UK NUTS3 areas for the digital sector share of employees (5.1%), recent growth in digital sector employees (5.7% per annum) and recent growth in digital sector GVA (8.7% per annum). Leicester is in the top quartile of NUTS3 areas for recent growth in digital sector employees (6.5% per annum) and recent growth in digital sector GVA (15.6% per annum).
- Such growth has reflected the region's success in recently attracting large employers (e.g. IBM's Client Innovation Centre at Leicester), as well as the development of substantial home-grown digital businesses such as Experian, UNiDAYS (online student community), Lockwood Publishing (mobile games), and ENSEK (energy sector software).
- Vibrant tech communities have been established over the last ten years, particularly in Nottingham (Tech Nottingham) and Leicester (Create Leicester and Leicester Tech Startups). Tech Nottingham is the largest of these, and now has around 3,000 members. By providing networking and collaboration opportunities these grassroots organisations have strengthened the connections within the East Midlands tech community, making it much easier to seek advice and support from peers.
- Survival rates for digital sector businesses are relatively high in the East Midlands: 63% of such firms survive into their third year, which is in the top quartile of UK regions for this metric.
- Although the region appears to have a relatively low average performance in REF2014 in terms of the proportion of computer science and informatics research judged to be world-class (at 17%), this regional average again hides a strong centre of excellence in the University of Nottingham, which had 37% of its submitted research in this area judged to be 4*. Through its Horizon Digital Economy Research Institute, the University has funded four cohorts (15 years) of PhDs and has helped position Nottingham and the East Midlands in digital research, particularly in data privacy and ethics. The Ingenuity Programme hosted by the University of Nottingham is an example of the University's support for entrepreneurship and the creation of impact-led businesses.

Opportunities/Specialisms

- Amongst the region's 99 digital sector companies identified as high growth, prominent sub-sectors include **Software-as-a-Service** (31% of firms), **mobile apps** (24% of firms), **analytics, insight, tools** (15%) and **internet platform** (14%). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are **Artificial Intelligence** (8% of firms), **FinTech** (6%), **wearables** (5%), and **eHealth** (5%).
- The East Midlands has a diverse range of digital businesses. However, there are some cluster specialisms, for example in Health Tech in Nottingham (e.g. Imosphere, Pharmaseal, Boditrax), Agri-Tech in Lincolnshire (supported by the University of Lincoln's Institute for Agri-food Technology), and Creative Tech in Leicester (e.g. Anicca, Bulb Studios, Herdl).
- With the COVID-19 lockdowns, the East Midlands has seen a number of digital professionals re-locating to the region from London, while still working remotely for London-based firms – considering it to offer better housing affordability and a higher quality of life. This presents an opportunity to integrate these (often highly skilled) people into the East Midlands tech community, sharing contacts and expertise, and potentially creating a wider base of experienced digital professionals from which East Midlands tech businesses can recruit.

Barriers to Growth

- Access to talent is a pressing concern and is a critical constraint on the growth of the region's digital ecosystem.
- The East Midlands currently has the second lowest median gross annual pay in the digital sector of all UK regions (£30.2k), and also appears in the lowest quartile for median gross annual pay of IT and telecoms professionals (£35.8k). This is likely to be a contributory factor to the difficulties in attracting and retaining digital talent and reflects the fact that the digital sector as yet only accounts for a relatively modest – albeit growing – share of the region's economy (3.6% of GVA).
- More widely, the East Midlands is also in the lowest quartile for the proportion of working age people with any degree-level qualifications (37%).
- The numbers of active East Midlands-based digital sector spinouts from universities currently appears to be low, according to the data tracked by Beauhurst: 1.2 per million population, which is in the lowest quartile of UK regions. Of more concern, however, is that the broader R&D intensity of digital sector firms in the East Midlands is relatively low: with an average digital sector R&D tax credit expenditure of £14.2k per annum per enterprise, this is in the bottom quartile of UK regions.
- Looking at international trade data, the East Midlands' balance of trade in digital sector services as a proportion of GVA is +0.1%, which is below the 25th percentile of +0.2% and well behind the West Midlands (+1.4%) and London (+3.5%).
- Issues of digital poverty have been brought into sharp focus by the COVID-19 lockdowns, and where households lack access to sufficient devices and/or connectivity this constrains the extent to which children and adults can access education and training resources. This presents very practical barriers to people from more disadvantaged households acquiring new digital skills and developing an interest in the area (reported by programme managers to have been a

problem in some of the region's European Structural Fund, ESF, funded skills-development programmes). The region currently appears in the bottom quartile for the proportion of households with internet access (92% having internet access).

- Digital connectivity is also still a problem in some parts of the region. Though there is now a very high coverage of superfast broadband (96%), the East Midlands is currently in the lowest quartile for full fibre and gigabit-capable coverage.
- Relatively little external capital is being invested in the region's digital sector, and this presents a further barrier to maximising its growth potential. Normalised to the population size, the East Midlands has had the least venture capital funding into its digital sector of any UK region over recent years (in the period 2016 to 2020, funds raised by East Midlands digital companies amounted to just 0.2% of the UK total, according to Beauhurst data, compared to the region's UK population share of 7%).

Achieving Prosperity

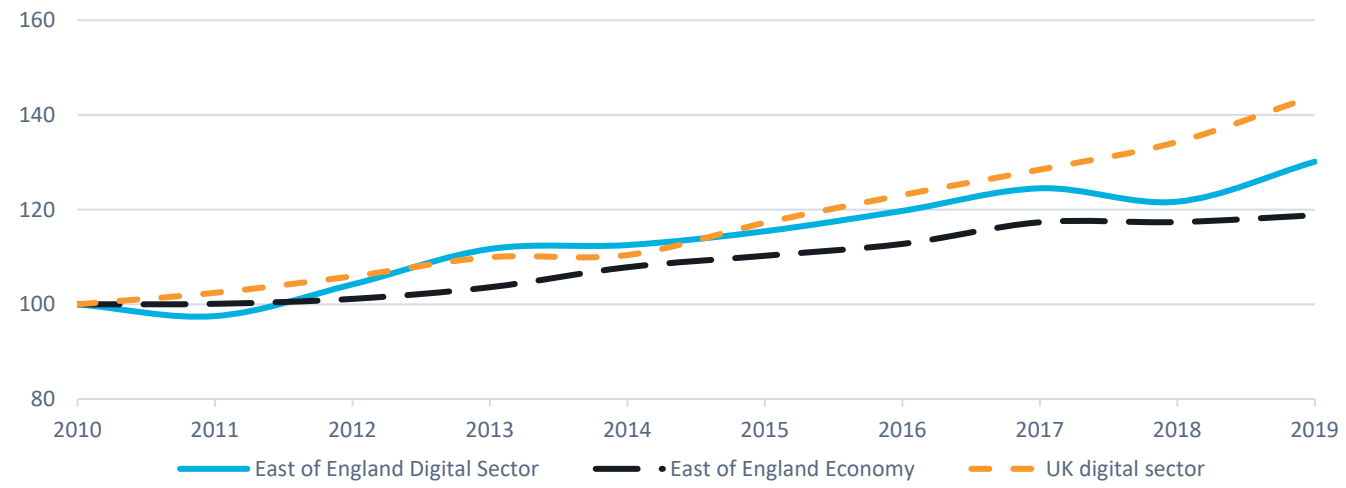
- On the basis of Steer-ED's indicative modelling (see Section 2), the digital sector in the East Midlands has the potential to grow by **at least £1.5 billion in annual GVA by 2025** (an increase of 38% on the 2019 value), creating an additional 36,500 jobs (an increase of 49% on the employment in 2019).
- Recent growth in the region's digital economy has largely been down to the software and data-intensive Computer Programming and Consultancy and Information Services segments. These are vital bedrock sectors for the region, going forward, work is needed to both consolidate the good progress made and accelerate and extend this.
- In realising the 'prosperity prize', there are constraints on the availability of funding, especially around Angel and venture finance, which are both necessary to lubricate the virtuous circle of start-up and scaling. Availability of talent is also an issue, in terms of both volume and experience. These constraints must be tackled if the full economic potential of the region's digital economy is to be realised.
- Whilst focusing on the above issues is key to enabling prosperity, the region can look already to the digital economies in Nottingham and Leicester to see what can be achieved in a relatively short space of time.

East of England – Summary Dashboard

Region

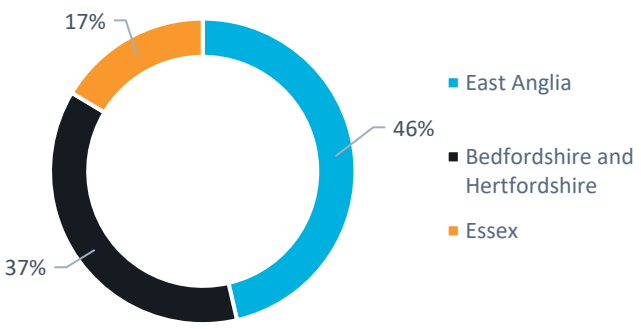
- **Component NUTS2 regions:** East Anglia (Norfolk, Suffolk & Cambridgeshire), Bedfordshire and Hertfordshire, and Essex.
- **Key Statistics:** 19,120km^2, 6.3m population, £165bn total GVA (2019), 2% total annual GVA growth (2014-2019).
- The East of England is a region of low-lying counties featuring many rural and coastal towns, many of which have low population densities. The main population centre for the East of England is Essex.
- This region performs strongly, relative to the UK, in Agriculture, Manufacturing, Construction, and Civil Engineering.
- The Digital Sector accounts for a significant percentage of total output for the region (5.1%), and the regional sector is comparatively larger in terms of economic output than for the UK as a whole. The growth of economic output from the digital sector (3%, 2014-2019) is slower than the UK's Digital Sector, but faster than the regional economy as a whole.
- Digital employment (estimated at 235k in 2019) is weighted towards digital occupations in businesses not traditionally in the digital sector. This is indicative of the high demand for digital skills in non-digital sector industries such as Recruitment, Retail, Technology, Construction, Pharmaceuticals/Life Sciences.
- Demand for digital occupations is highest in East Anglia, which includes Cambridgeshire (46% of digital occupation online job postings 2019-2020), followed by Bedfordshire and Hertfordshire (37%) and then Essex (17%).
- There is relatively high demand for Software Engineers, Field Service Engineers and System Administrators (location quotient above 1.0, the UK average), although the largest absolute demand for occupations is Software Developers, making up 19% of digital occupation job adverts 2019-2020.

Digital Sector GVA growth 2010-2019 (indexed to 2010), East of England NUTS1 Region



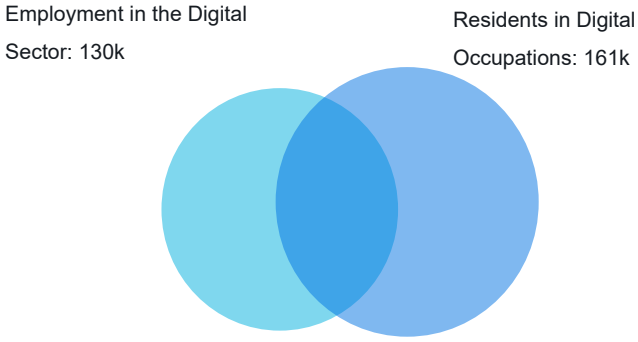
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in the East of England (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), East of England NUTS1 Region



Total digital employment in the East of England: c. 235k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations (2019-2020), East of England NUTS1 Region

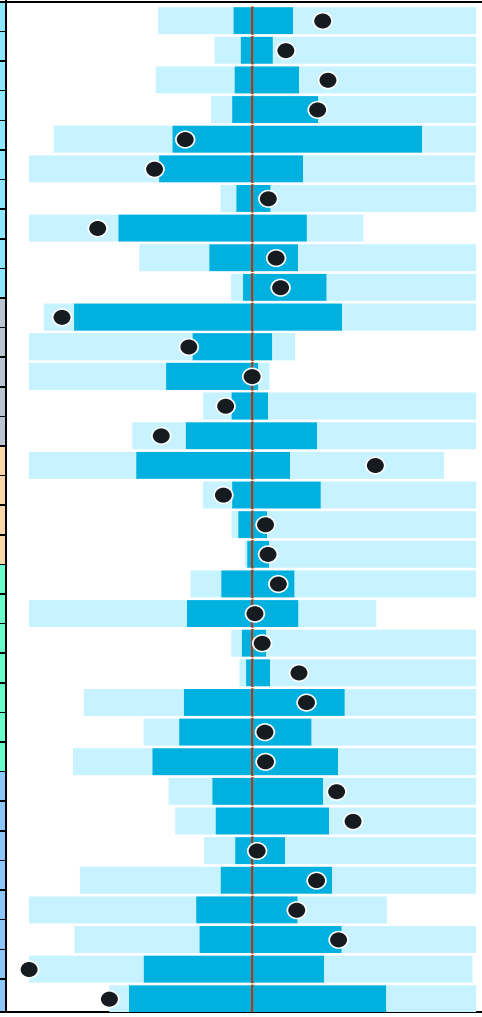
- This table shows digital occupations by demand for the East of England. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers and Data Engineers, but comparative demand is highest for Embedded Software Engineers, Field Service Engineers and System Administrators. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Embedded Software Engineer	13,390	7.5%	1.55
Field Service Engineer	5,421	3.0%	1.49
System Administrator	3,079	1.7%	1.30
IT Support Analyst	11,412	6.4%	1.25
Network Engineer	4,397	2.5%	1.14
IT Manager	8,728	4.9%	1.11
Test Automation Engineer	3,241	1.8%	1.11
Data Engineer	18,641	10.4%	1.07
IT Service Manager	3,380	1.9%	1.05
Web Developer	7,850	4.4%	1.01

Source: Geek Talent, 2021

East of England - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for the East of England and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where the East of England (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, the East of England is above the median value on this indicator.

Indicator name	Period	EE	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**8.7**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**3.8**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**5.2**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**8.0**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**1.2**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**3.9**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**5.1**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**3.0**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**43.1**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.7**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**9.8**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**13.2**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**95.6**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**14.6**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**15.9**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**63.8**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**1.3**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**17.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**131.0**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**169.7**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**25.3**		10.0	20.7	25.1	28.2	33.4
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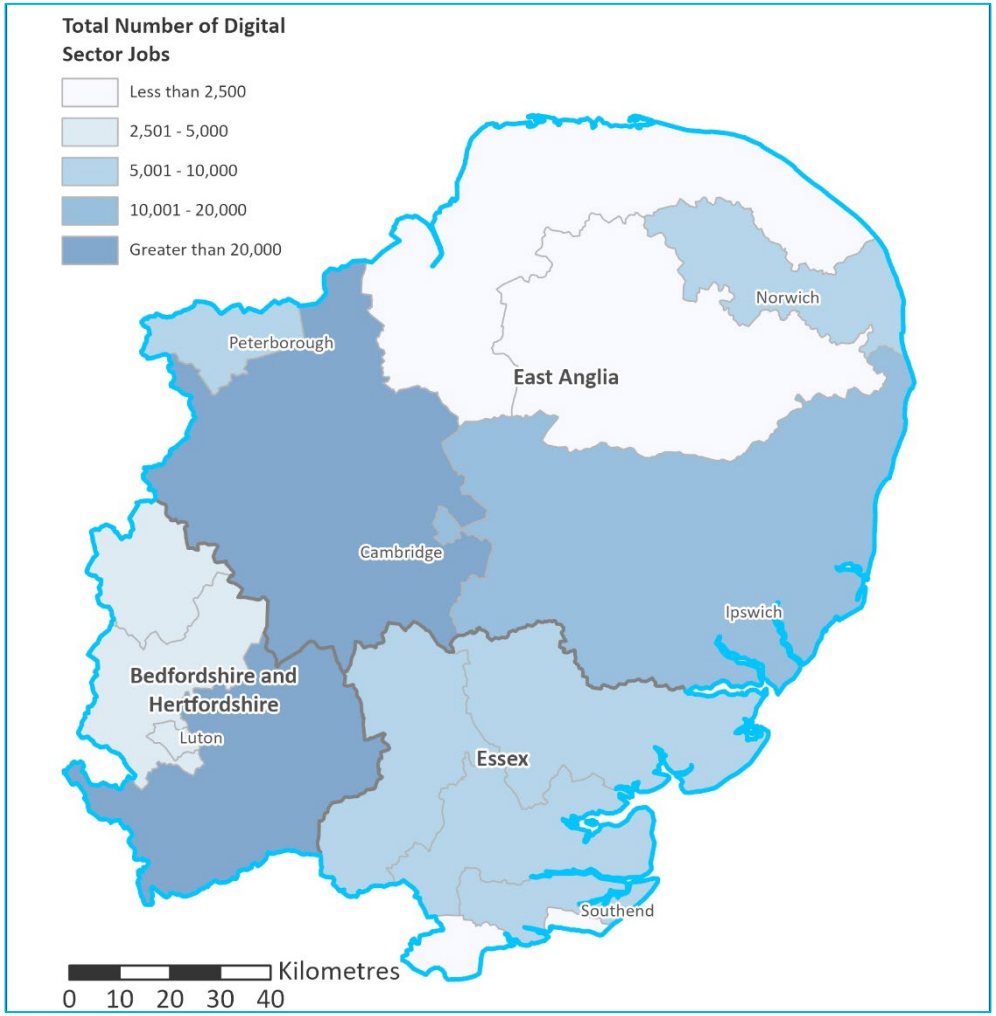
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**60.4**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**4.7**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.5**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**1.2**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**39.6**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**44.9**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**39.2**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**92.3**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**95.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**52.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**51.7**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**1.3**		1.3	1.4	1.8	2.3	2.6

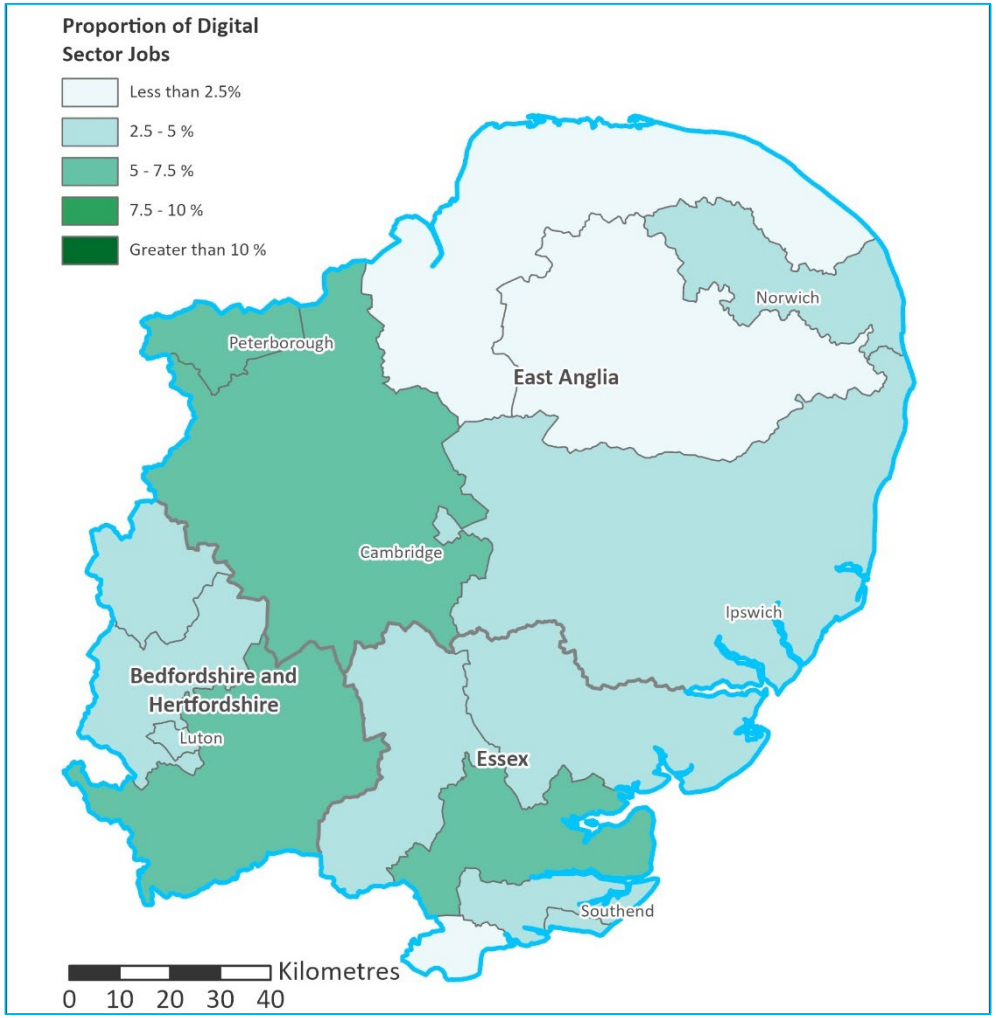
Source: Steer-ED and various datasets – See Appendix B

East of England Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

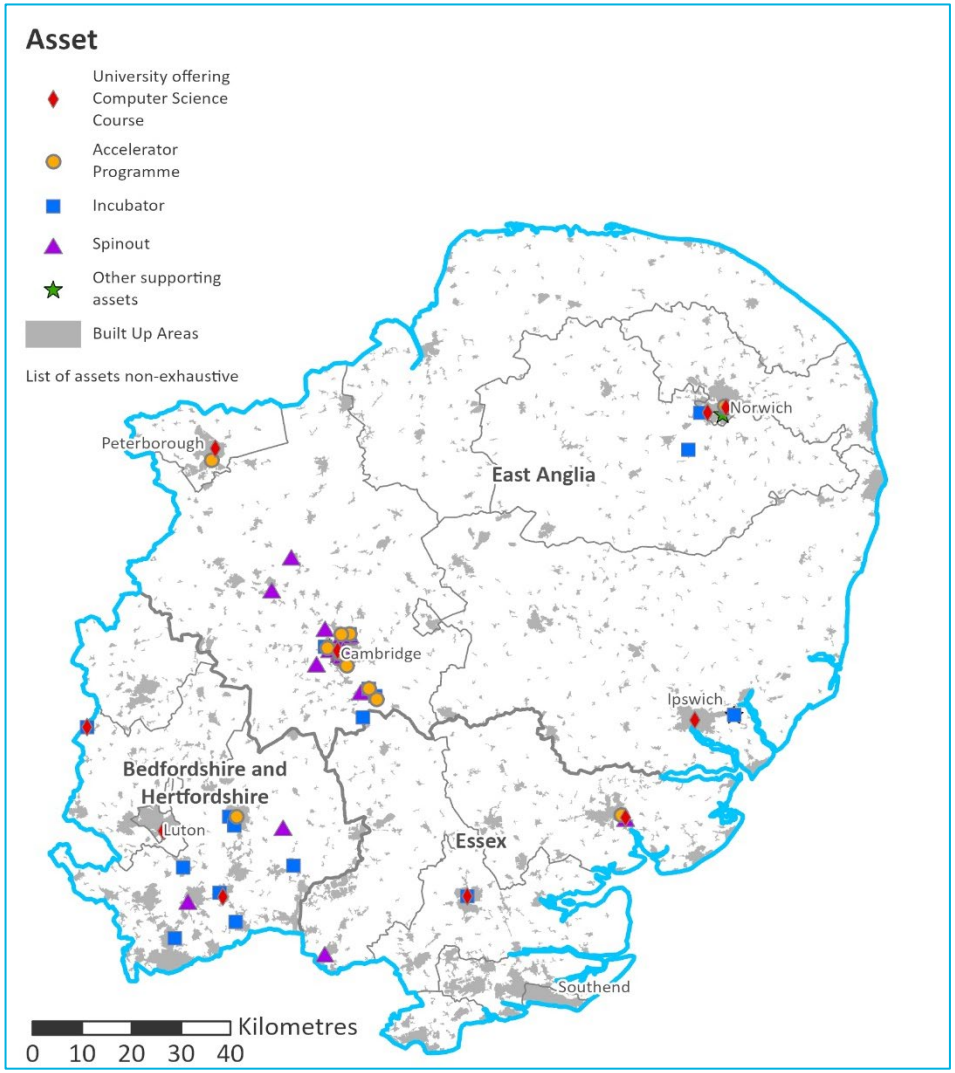
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

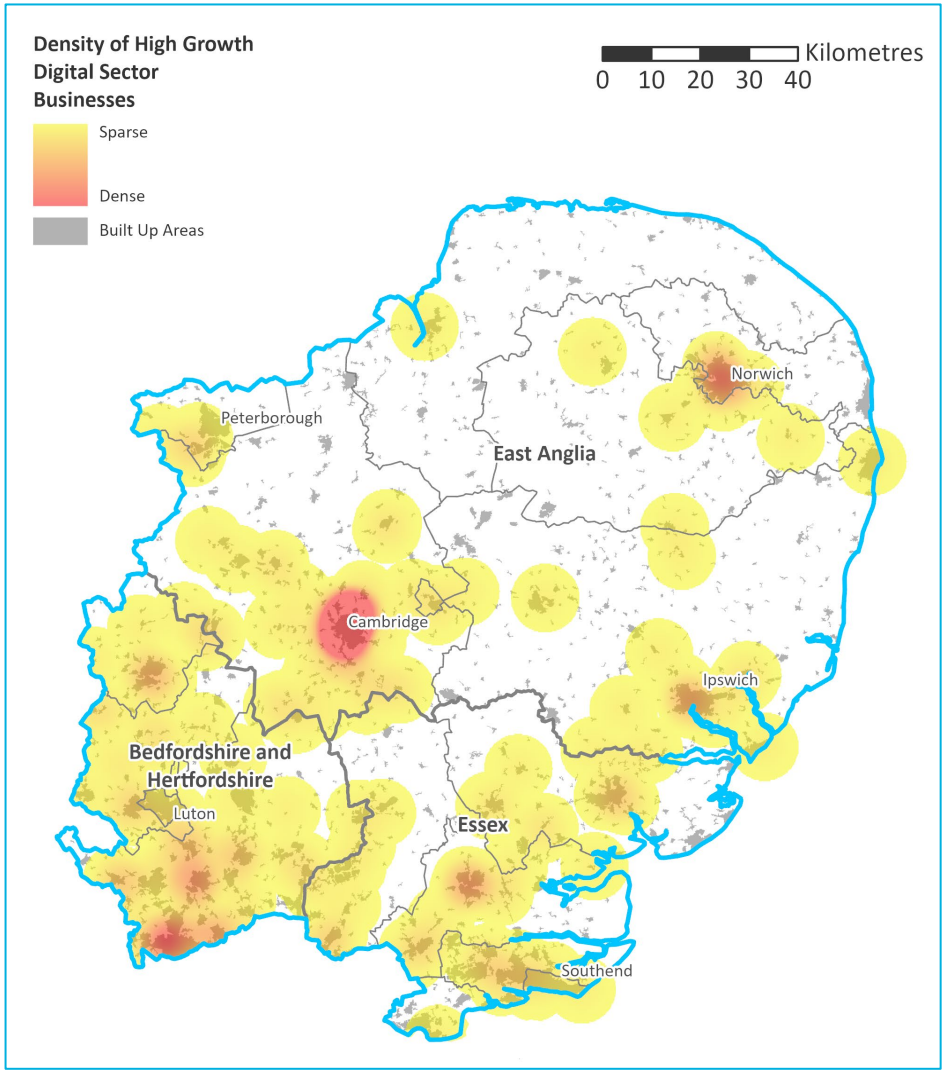




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in the East of England, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in the East of England. It highlights how high growth businesses are concentrated in larger urban areas.



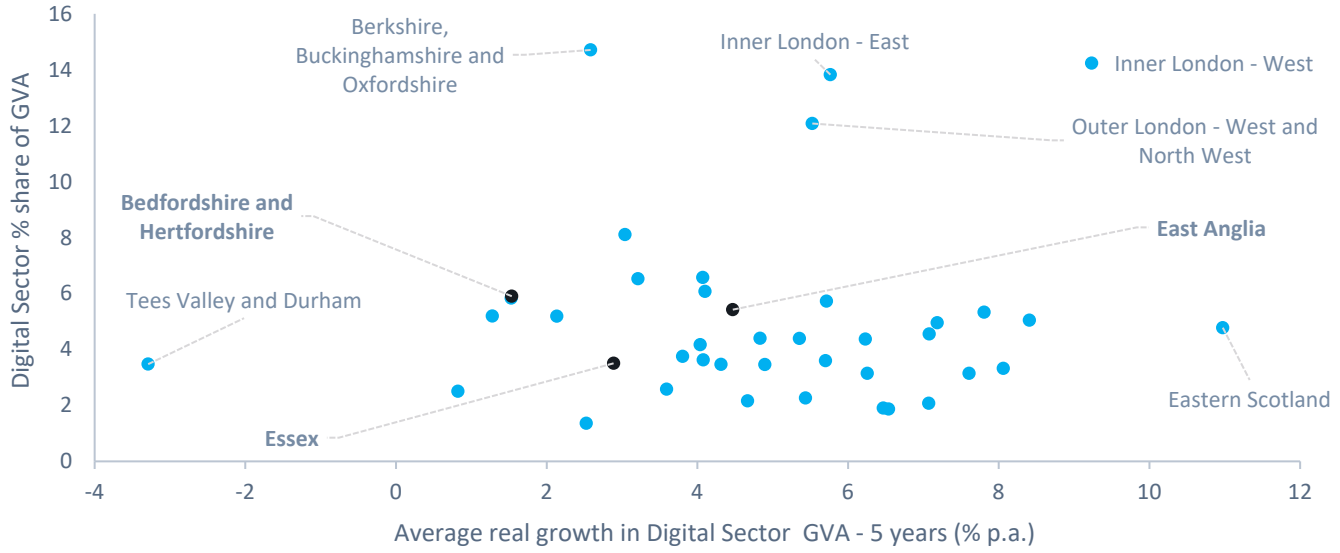


East of England – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in the East of England, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. The East of England are indicated in black. Key outliers outside the East of England are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in the East of England.

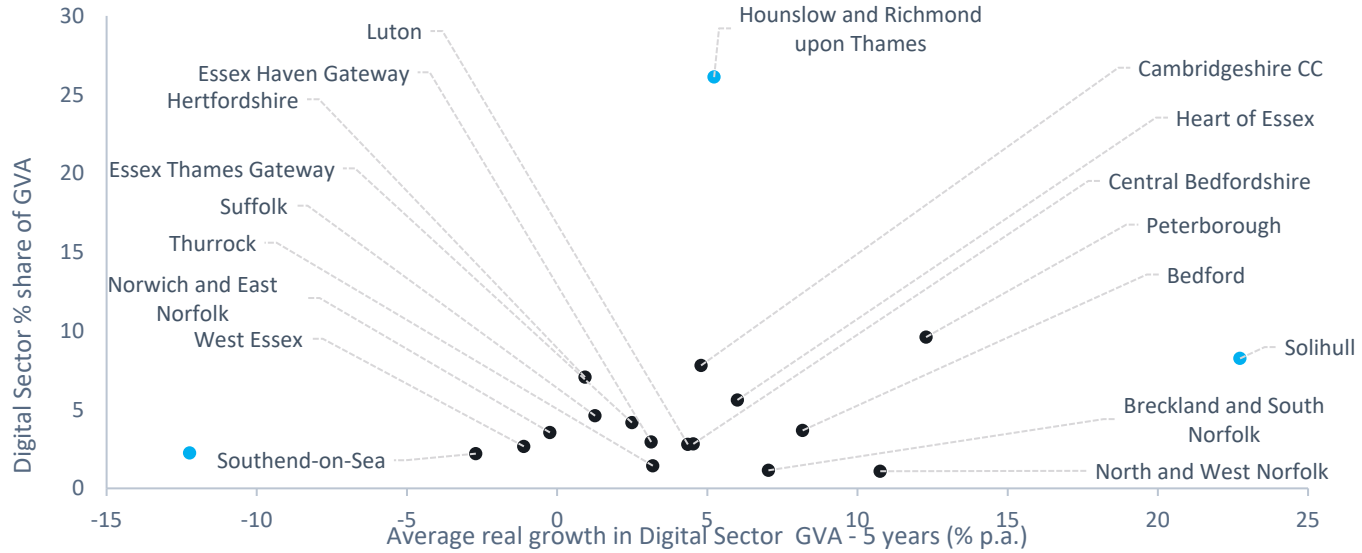
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

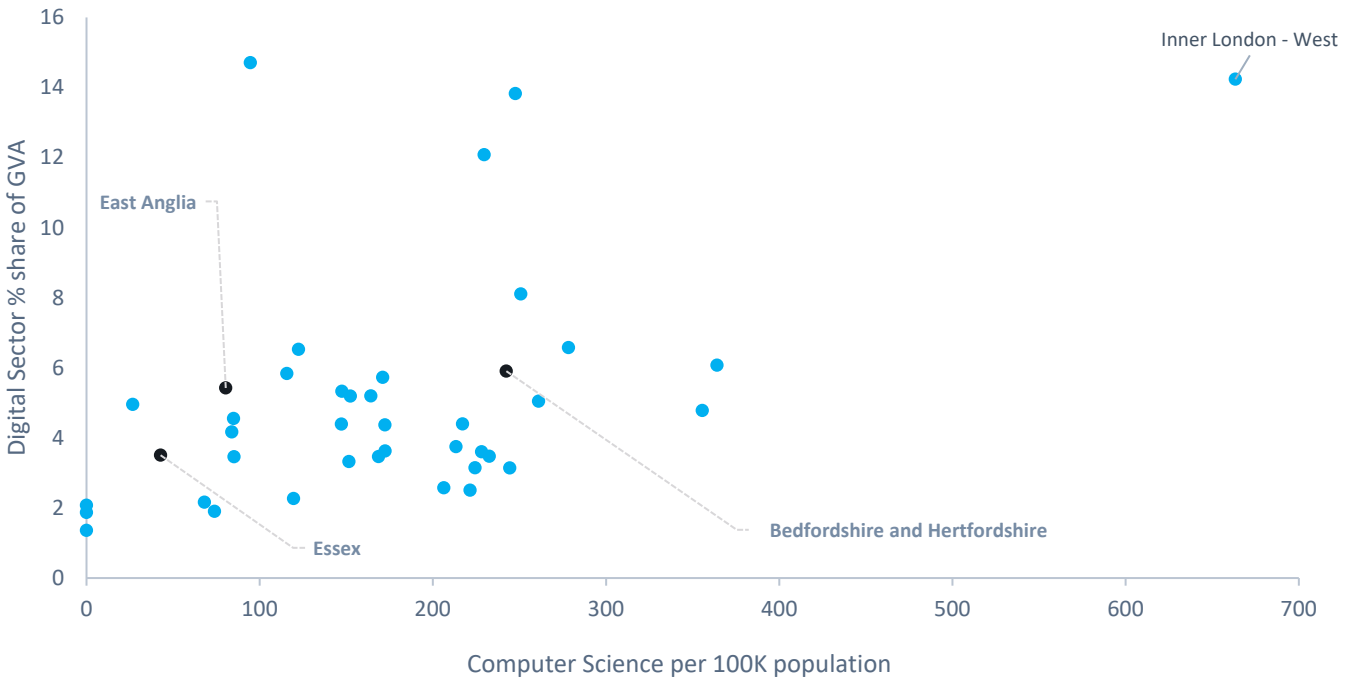
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – East of England NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in the East of England's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

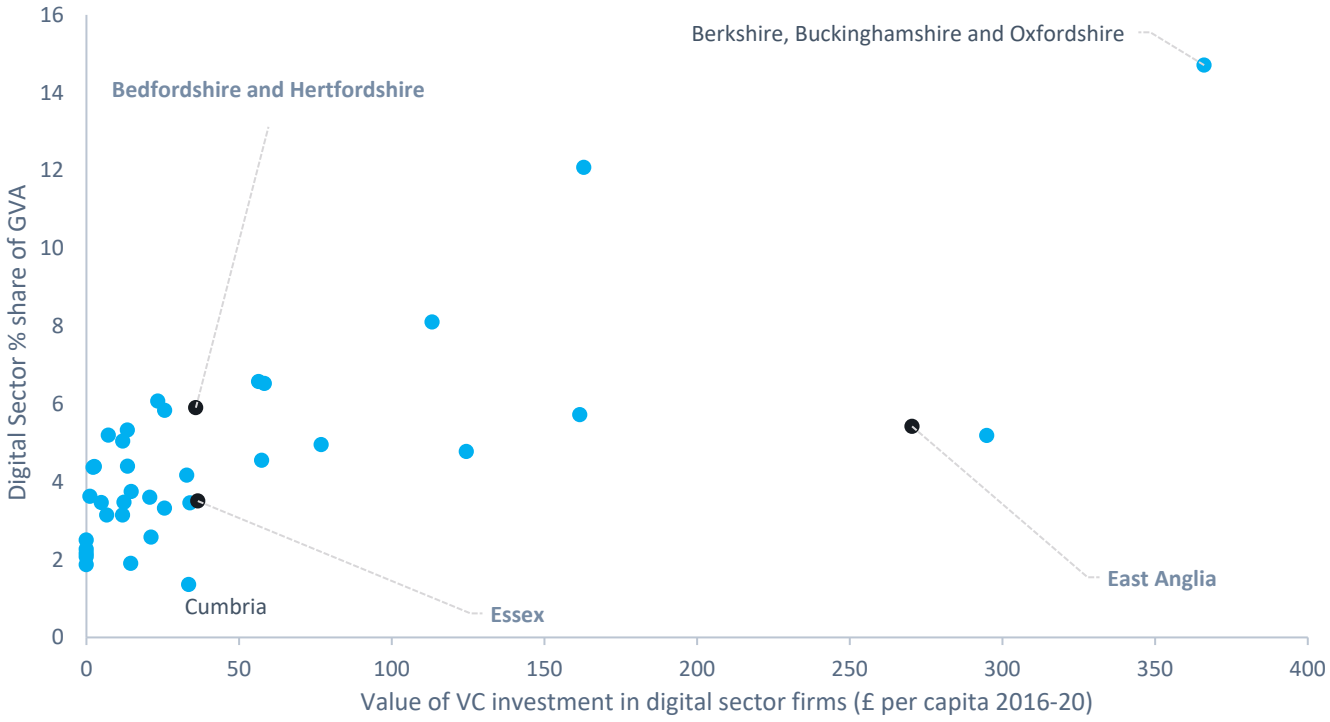
Digital Sector GVA % plotted against HE Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020) Inner London East and West excluded as large outliers (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

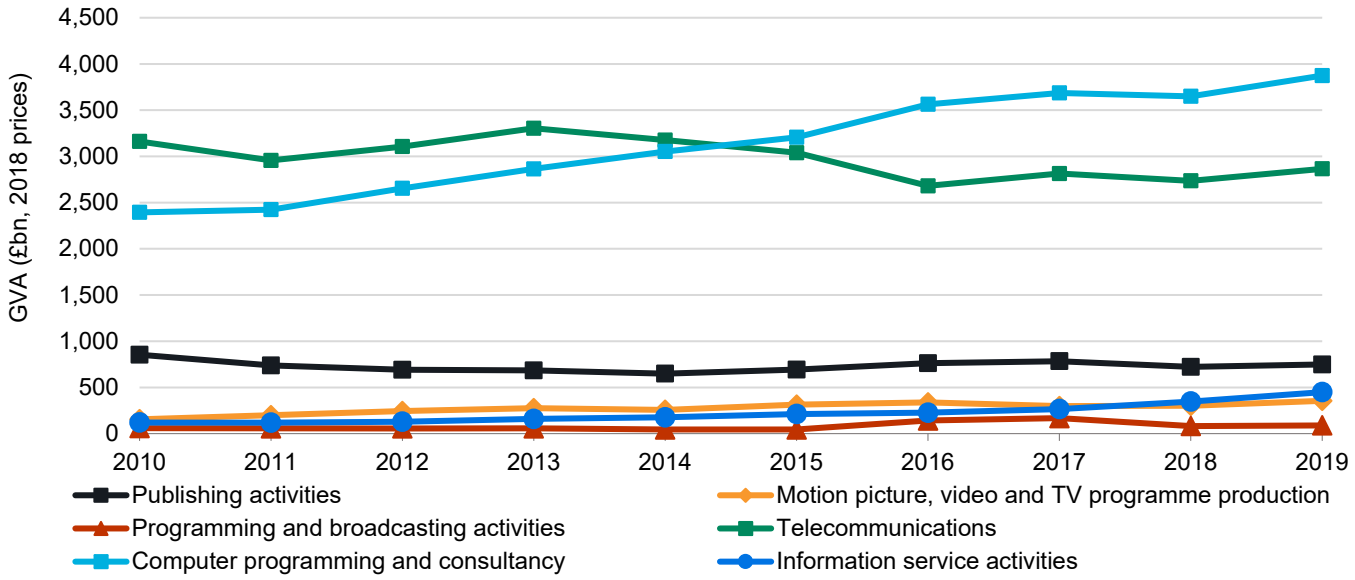
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector.

East of England – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of the East of England, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

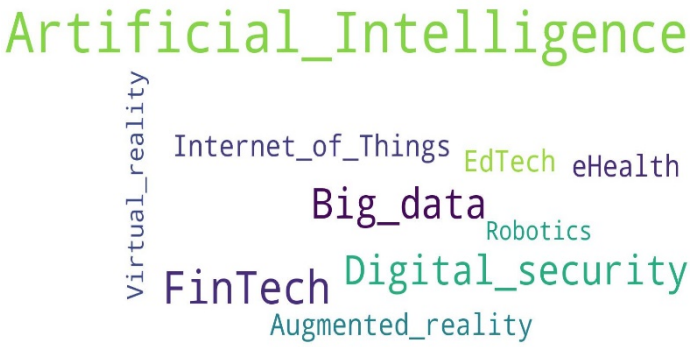
- The chart above shows that there has been significant growth in Computer programming and consultancy, which is now the largest sub-sector in the East of England. These sub-sectors are where the growth potential for the East of England is. Telecommunications is the second largest sub-sector in the East of England, but the sub-sector experienced some decline over the last decade.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which the East of England's potential for further economic growth lie. There were 302 high growth businesses in the digital sector in the East of England in 2021 equating to 1.3% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

The East of England's Digital Ecosystem in Summary

Strengths

- The sector accounts for 8.7% of all enterprises in the region (upper quartile for UK regions), with digital sector employment as a share of all employees and digital occupations as a share of all employment at 3.8% and 5.2%, respectively. Both measures are in the upper quartile for UK regions.
- Three-year survival rates for digital firms are the second-best for UK regions, at 63.8%, and digital sector average gross annual pay is also in the upper quartile, at £39.6k pa.
- Spatially, the digital sector is very well developed in Cambridge, with the University playing a central role alongside internationally significant firms (such as Darktrace (recently taken to market), Arcus Global, Arm, Featurespace, FiveAI, Leso Digital Health, Kymab, and The Raspberry Pi Foundation). The southern boundary of the Cambridge agglomeration is stretching progressively down the M11 Motorway. Digital sector clusters are developing in Peterborough, Norwich, Ipswich, and South Essex; the sector is becoming more spatially distributed across the width of the region, providing resilience.
- Technology hub/incubator provision is well developed, taking in facilities such as St John's Innovation Centre and the Biodata Innovation Centre in Cambridge, Innovation Martlesham (adjacent to Adastral Park, Ipswich), the Digitech Factory (Norwich), the EpiCentre (Haverhill), and the Innovation Centre (Colchester). Accelerator programmes include TechVelocity (Norwich), Accelerate Cambridge, and Knowledge Gateway (Colchester).
- The region has a strong networking heritage in general, with digital sector groups including, for example, Tech East, Cambridge Network and funding circles supported by, for example, Anglia Capital Group. These organisations play an important role in maintaining sector profile and, crucially. in linking experienced firms with start-up and scaling entrepreneurs.
- Although the region is at the median for Average % Computer Science Research rated '4*', this masks the strong performances of the universities of Cambridge and Essex, with the former specialising in AI, Machine Learning, Security, and Systems/Networks, and the latter Artificial Intelligence and Common Systems.

Opportunities/Specialisms

- Amongst the region's 302 digital sector companies identified as high growth, prominent sub-sectors include Software-as-a-Service (30% of firms), Mobile Apps (20% of firms), and Analytics/Insight/Tools (19% of firms). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (12% of firms), FinTech (8%), Big Data (7%) and Digital Security (6%).
- Medium and large-sized firms tend to be concentrated in Cambridge, Hertfordshire, and Peterborough. The developing Cambridge-Norwich Corridor is a key enabler for developing the digital economy further afield.
- As recognised in local digital strategies, the region has built global reputation in artificial intelligence (AI) and machine learning (ML) technologies. Focused on both the development and exploitation aspects of AI and MC, the region is well-positioned to develop further these specialisms, although the international competition is moving fast.
- There are major opportunities for the region's digital economy to support the growth of the East of England's Digital Health and Life Sciences cluster, which includes AstraZeneca, The Wellcome Genome Campus, The Sanger Institute, The Babraham Institute, the Universities of Cambridge and East Anglia, the Sainsbury Laboratory, and recent investments in scaleups by IBM and Boots.
- Similarly, a substantial part of region's economy is accounted for by Agriculture, often at large scale. New methods, such as precision agriculture, remote crop-sensing, and agricultural automation present major opportunities for the digital economy.
- The region is claimed to have the second-biggest InsureTech sector outside London and the South East.
- The East of England's well-established reputation as a technology hotspot is reflected in growing investment activity, with regional firms increasingly successful at engaging with investors in China, India, the US, and beyond.

Barriers to Growth

- The region is in the lower quartile for average real growth in digital sector GVA (3.0% per annum).
- Earnings per annum as a percentage of house prices is the second lowest of the UK regions, acting as a barrier to labour market mobility, and the retention of workers.
- Gigabit capable coverage (as a percentage of premises) is in the lowest quartile.
- The region is the worst performing one in terms of the percentage of first-degree graduates remaining in-region. This will in part reflect the 'Cambridge University' effect – one of the top HE institutions in the world with a globally-wide and globally-mobile intake. Notwithstanding this, talent is being lost.
- Furthermore, despite the expertise in the region's HE institutions, the number of HE Computing students per 1k of the population is the lowest of all UK regions.
- As elsewhere, ensuring a sufficiently skilled future workforce across all parts of the digital sector is vital. As local digital strategy recognises, the demand for digital skills will increase as vertical industries embed increasingly digital methods and models into their business processes. Equipping young people with entry-level digital skills, and upskilling the existing adult

population with the skills to join, or progress in, the sector will be key. The labour market in Cambridge is especially tight, with international recruitment continuing to be hampered, to which Brexit has further added.

- Whilst the region benefits greatly from its proximity to one of the world's three global cities, it leaves the area prone to labour poaching and firm re-locations.

Achieving Prosperity

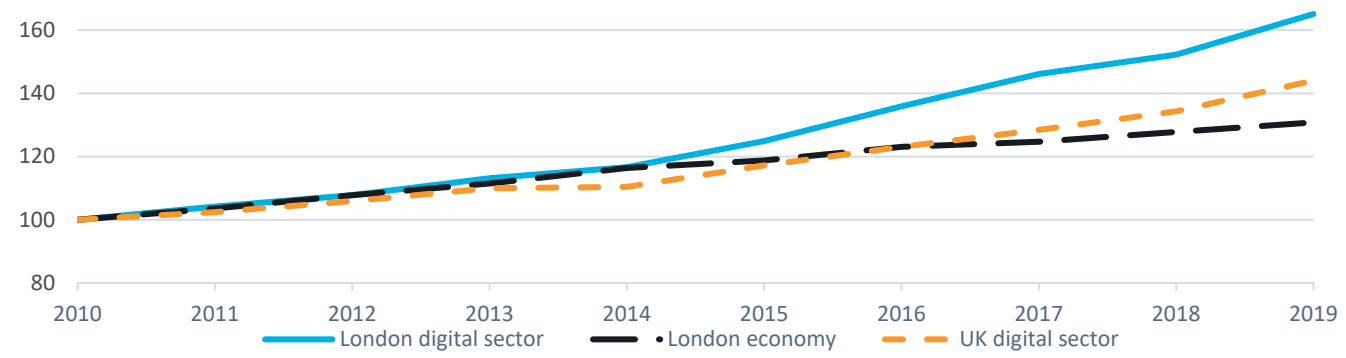
- On the basis of Steer-ED's indicative modelling (see Section 2 of the Main Report), the digital sector in the East of England has the potential to grow by at least £2.2 billion in annual GVA by 2025 (an increase of 27% on the 2019 value), creating an additional 41,400 jobs (an increase of 30% on the employment in 2019).
- Whilst the region's digital economy ecosystem is at, or marginally ahead of, the median for the majority of ecosystem indicators, there are clear areas of performance which will constrain achieving prosperity. These include the present soft rates of annual growth in digital sector employees and digital sector occupations, average real growth in digital sector GVA, gigabyte capable coverage, and HE computing students as a share of regional population. Graduate retention is a major issue, and housing affordability is a key structural issue for the medium and long terms.
- Thought needs to be given as to how these region-specific constraints can be addressed. More generally, the ecosystem in its totality must continue to improve relentlessly, this to 'close the gap' with best-of-class performance at the level of UK regions overall, and recognising that individual regions will each be working to enhance their own digital economy performance.
- The recent and successful efforts to spread and embed digital economy activity across the region should continue. This will help to ensure more balanced growth across the region outside of the extant main centres (such as Cambridge), and allow more parts of the region to achieve their digital economy prosperity potential.

London – Summary Dashboard

Region

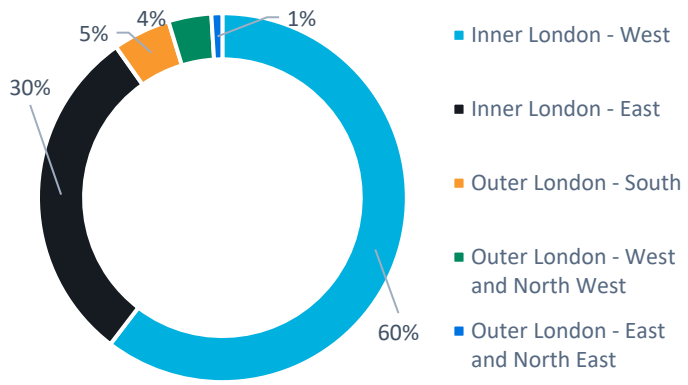
- **Component NUTS2 regions**: Inner London – West, Inner London – East, Outer London - East and North East, Outer London – South and Outer London - West and North West.
- **Key Statistics:** 1,572km^2, 9.0m population, £458bn total GVA (2019), 2.4% total annual GVA growth (2014-2019)
- London is a region comprised of 32 boroughs, the population is scattered throughout but the most populous areas are Barnet, Croydon and Newham, while the least populated area is the City of London.
- This region performs strongly in Scientific Research and Development and Financial Services, and has a very strong fintech subsector.
- The digital sector has the largest share as a percentage of total output (12.3%) of any UK region, and had strong digital sector growth (7.2%, 2014-2019), significantly faster than the UK's Digital Sector, and much faster than London's economy as a whole.
- Digital employment (estimated at 585k in 2019) is weighted towards the digital sector; it is one of the few regions where the number of individuals working in the digital sector is greater than those in digital occupations in other sectors.
- Demand for digital occupations is dominated by Inner London West, accounting for 60% of digital occupation online job postings 2019-2020. This is followed by inner London East, with these two most urbanised NUTS2 regions constituting 90% of demand.
- There is relatively high demand for 16 occupations (location quotient above 1.0, the UK average), the top three occupations are Data Scientists, Technical Authors and DevOps Engineers although the largest absolute demand for occupations is Software Developers, making up 17.4% of digital occupation job adverts over the 2019-2020 period. The location quotient for Software Developers (0.9%), however, is slightly below the UK's average.

Digital Sector GVA growth 2010-2019 (indexed to 2010), London NUTS1 Region



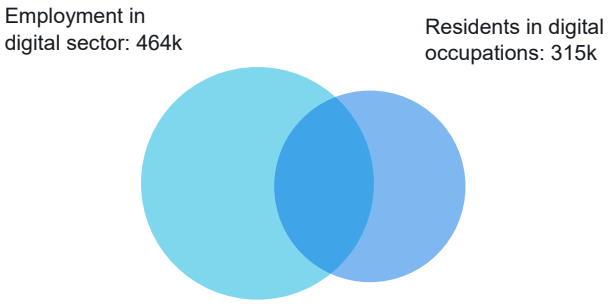
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in London (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), London NUTS1 Region



Total digital employment in London: c. 585k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations, London NUTS1 Region

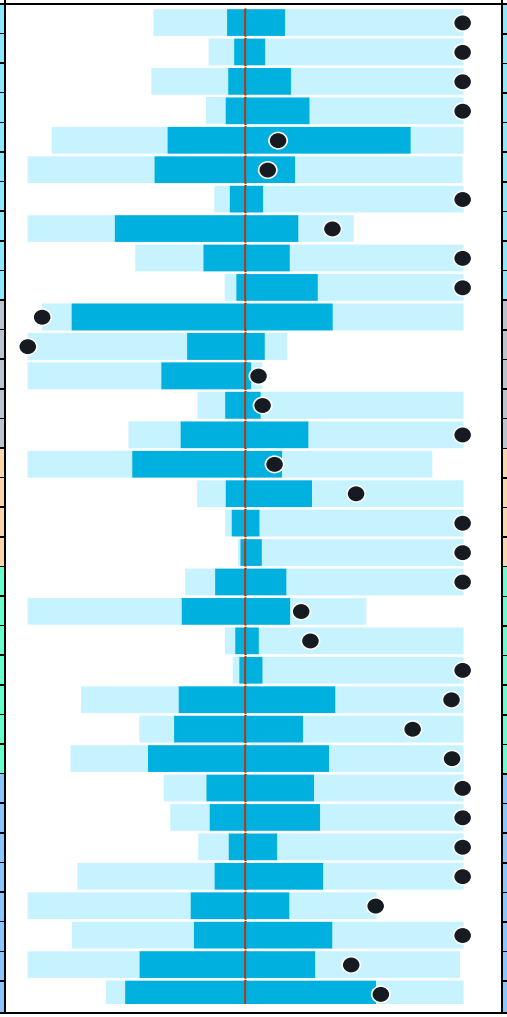
- This table shows digital occupations by demand for London. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, Data Engineers, and Business Analysts, but comparative demand is highest for Data Scientists, Technical Authors and DevOps Engineers. Broadly these in demand roles are digital occupations that are not always located within the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Data Scientist	24,753	3.2%	1.67
Technical Author	18,309	2.3%	1.41
DevOps Engineer	29,028	3.7%	1.37
Management Consultant	7,263	0.9%	1.31
IT Architect	59,642	7.6%	1.27
Data Governance	14,109	1.8%	1.27
IT Consultant	19,268	2.5%	1.23
Data Analyst	25,142	3.2%	1.19
Business Development Executive	13,112	1.7%	1.18
Full Stack Developer	13,670	1.8%	1.12

Source: Geek Talent, 2021

London - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for London and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where London (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, London is above the median value on this indicator.

Indicator name	Period	LDN	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**14.1**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**8.4**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**7.2**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**12.7**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**3.6**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**6.0**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**12.3**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**7.2**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**62.4**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**3.5**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**9.3**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**4.1**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**96.0**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**22.8**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**74.8**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**62.3**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**3.8**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**110.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**1256.7**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**413.8**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**29.0**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**36.0**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**232.7**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**7.1**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.7**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**1.7**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**47.4**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**51.7**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**58.5**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**95.1**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**97.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**67.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**78.7**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**2.3**		1.3	1.4	1.8	2.3	2.6

Source: Steer-ED and various datasets – See Appendix B

London - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.
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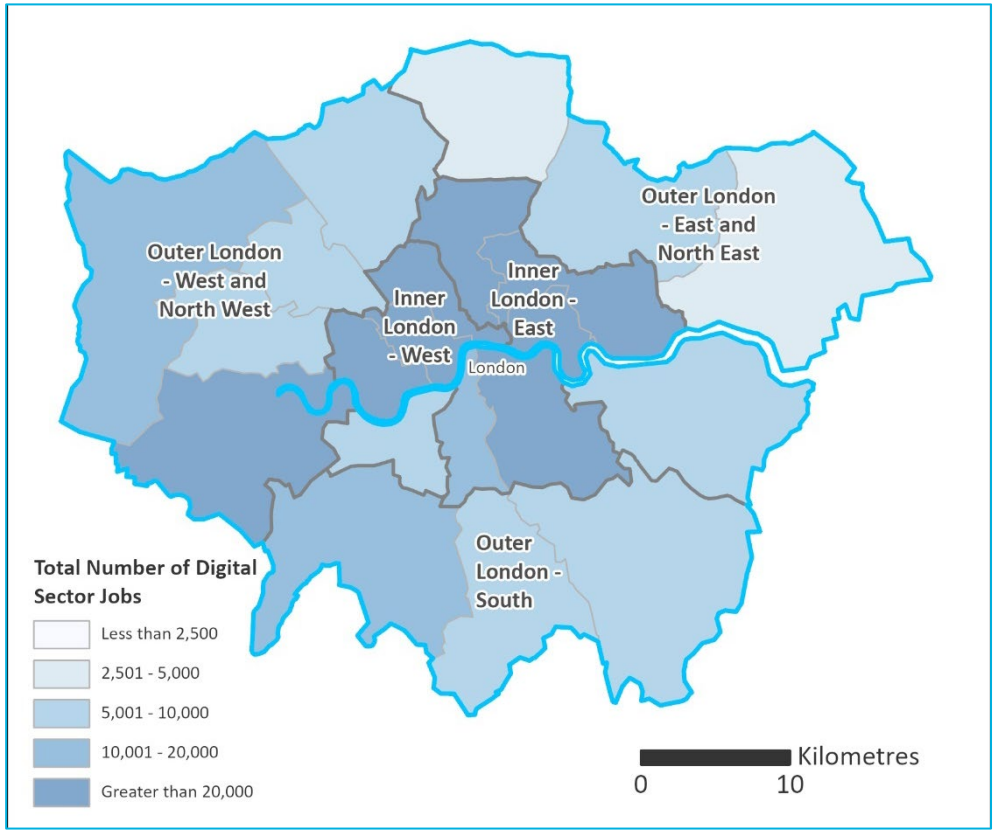

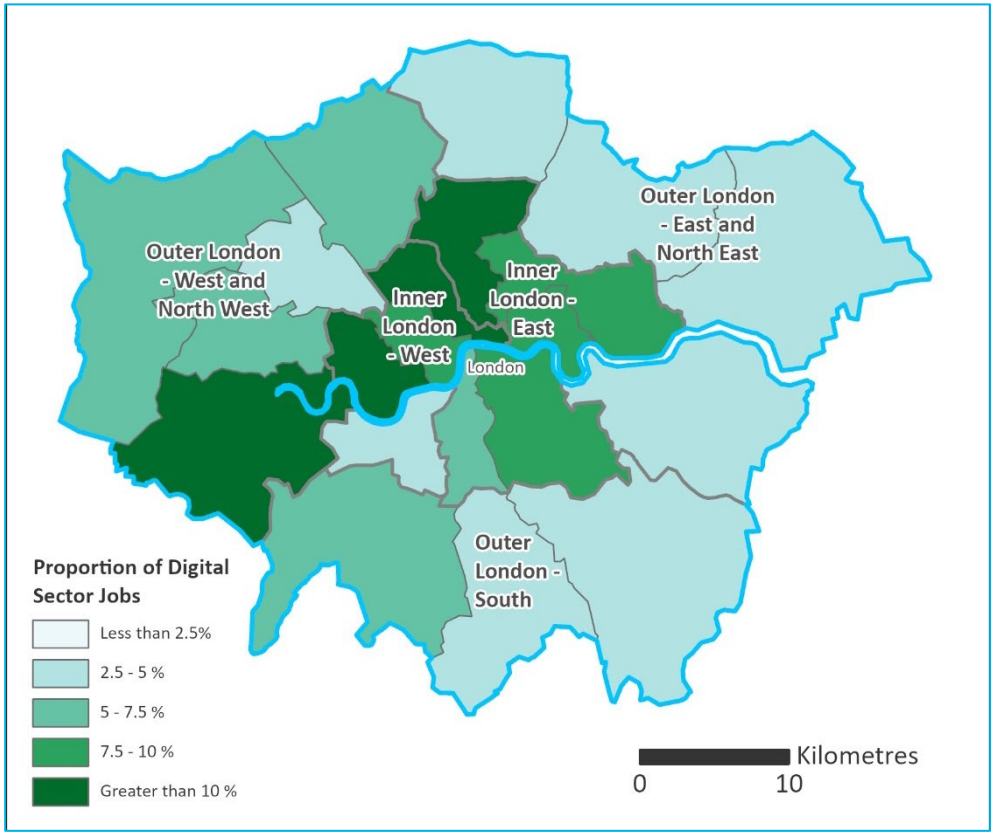

Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

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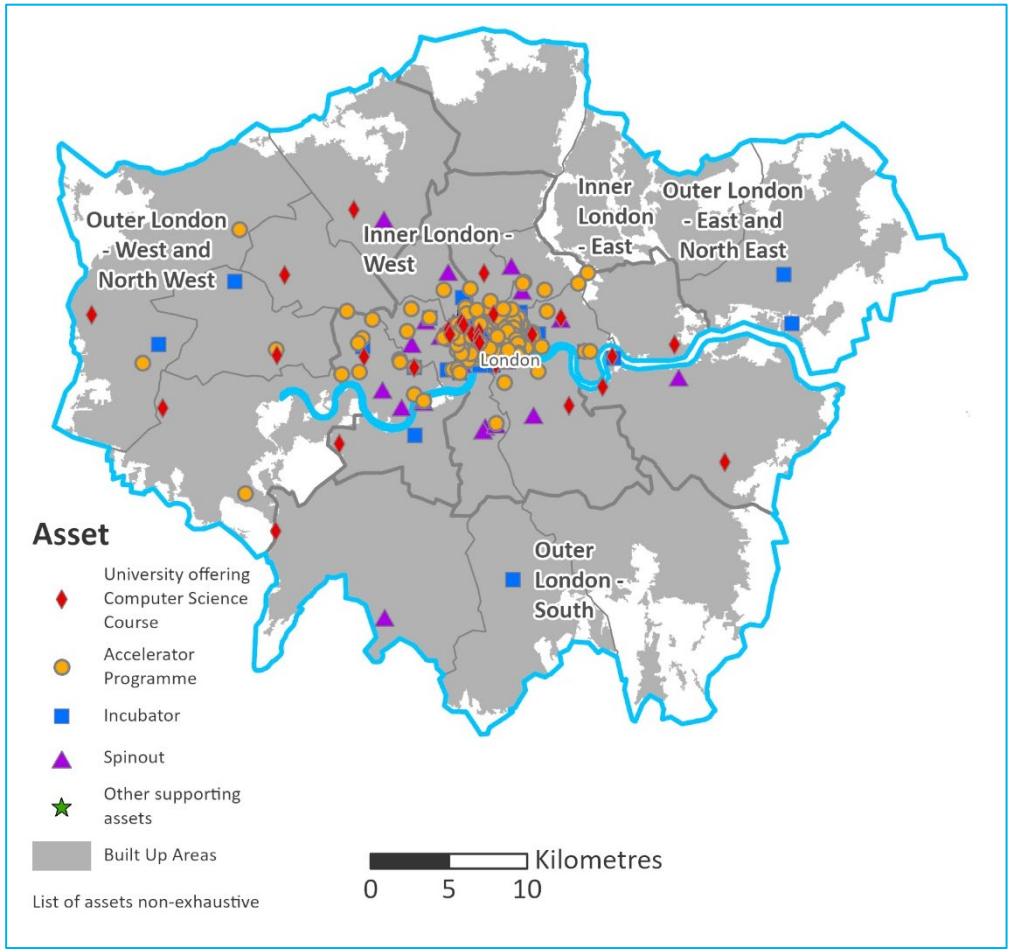
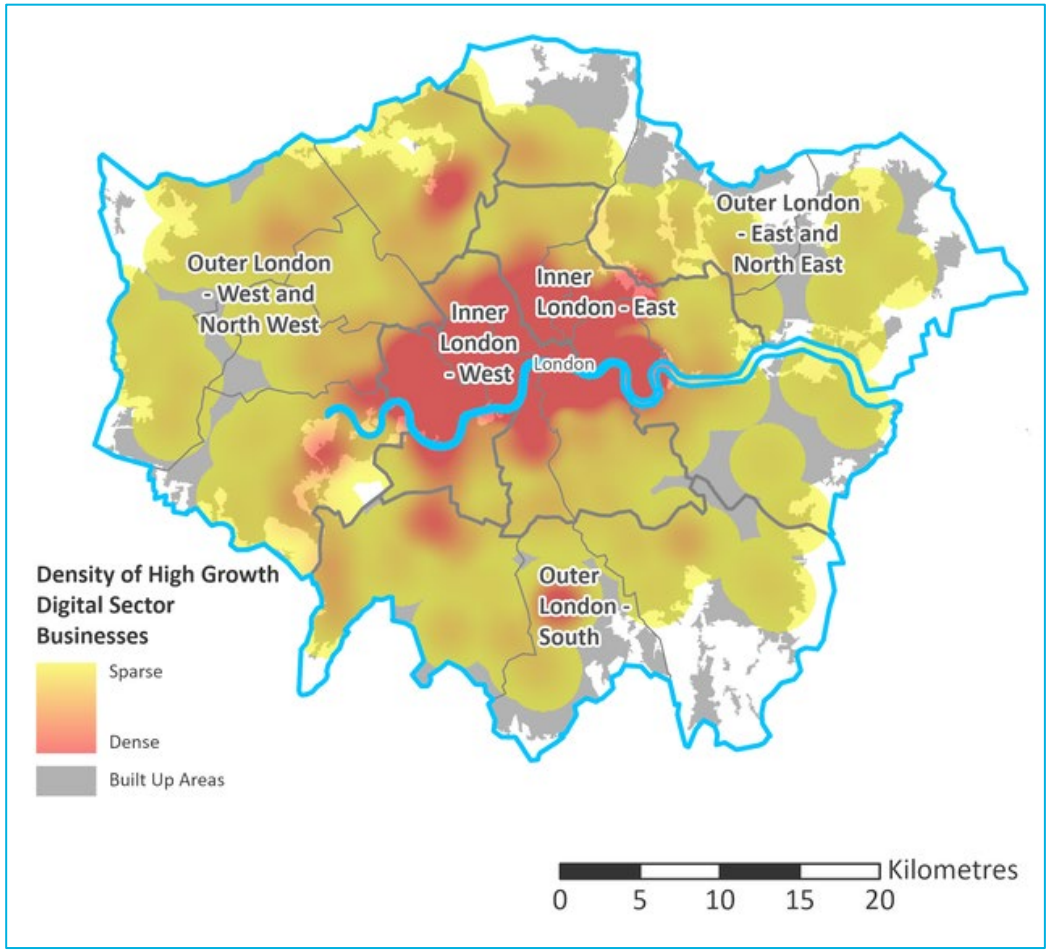


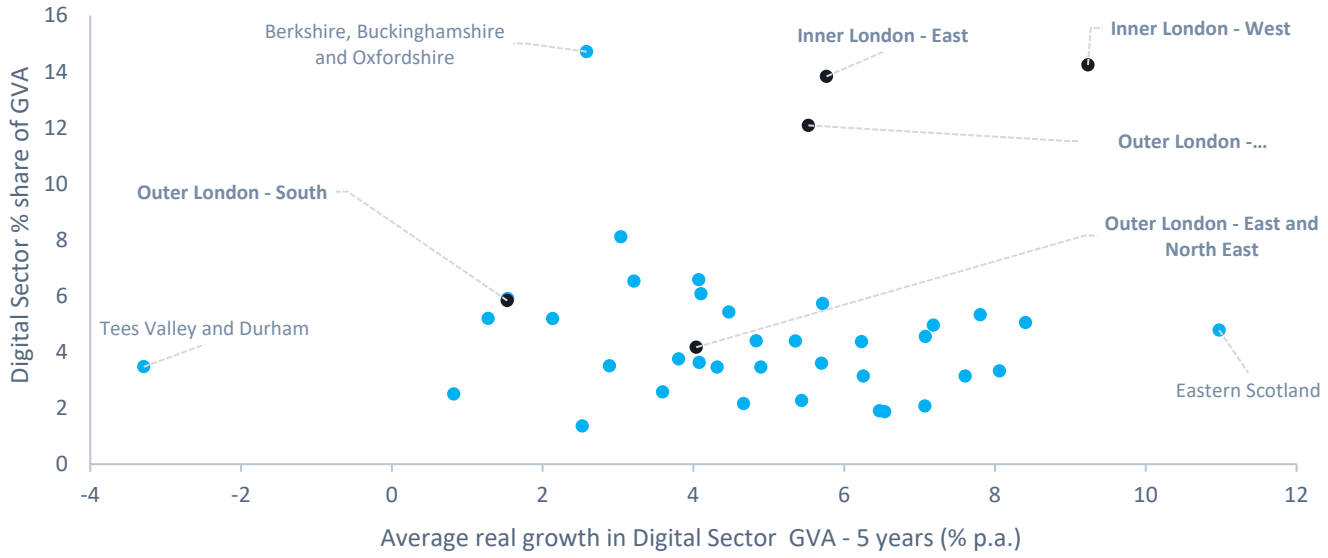


London – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in London, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. London is indicated in black. Key outliers outside London are labelled to provide context. National trends are largely replicated as sub-NUTS 1 regional trends in London.

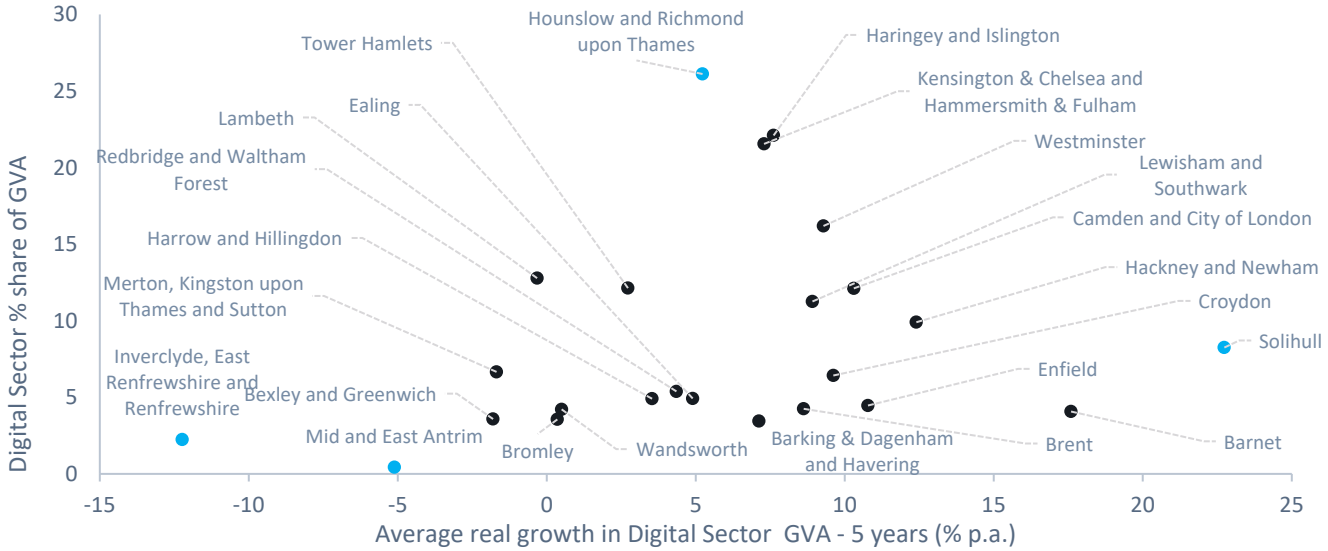
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

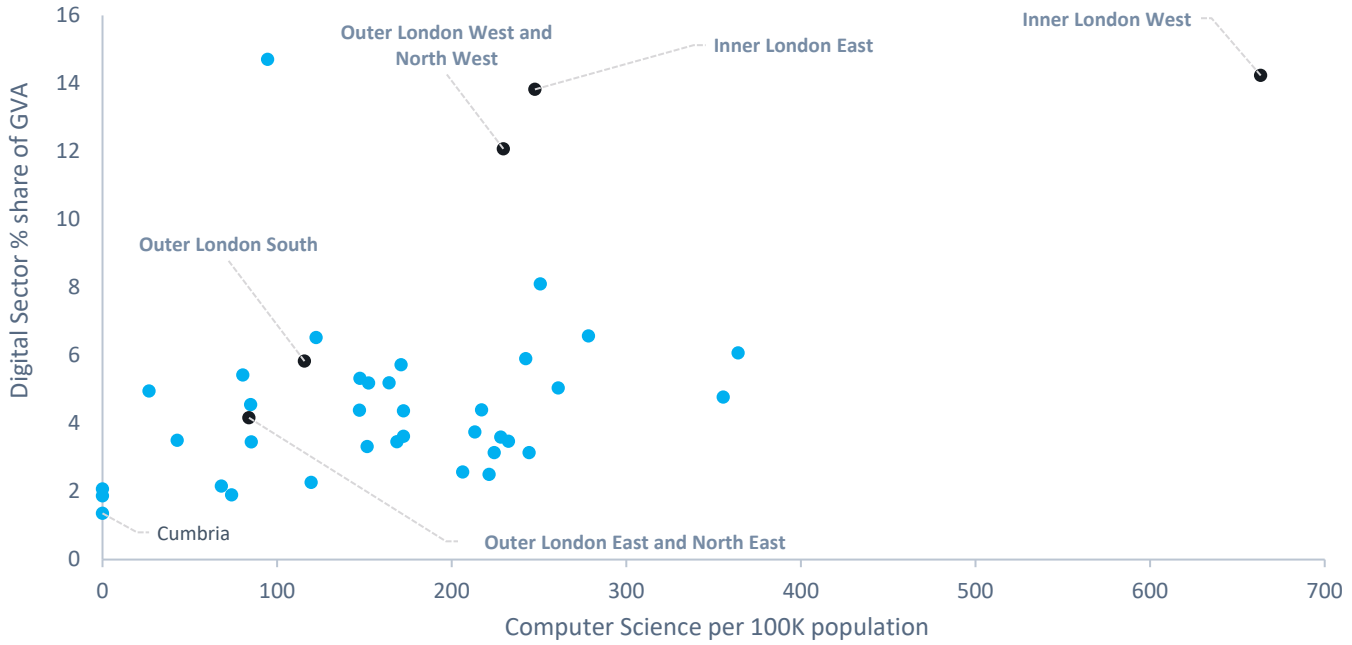
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – London NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is correlated with the relative size of the digital sector in London's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

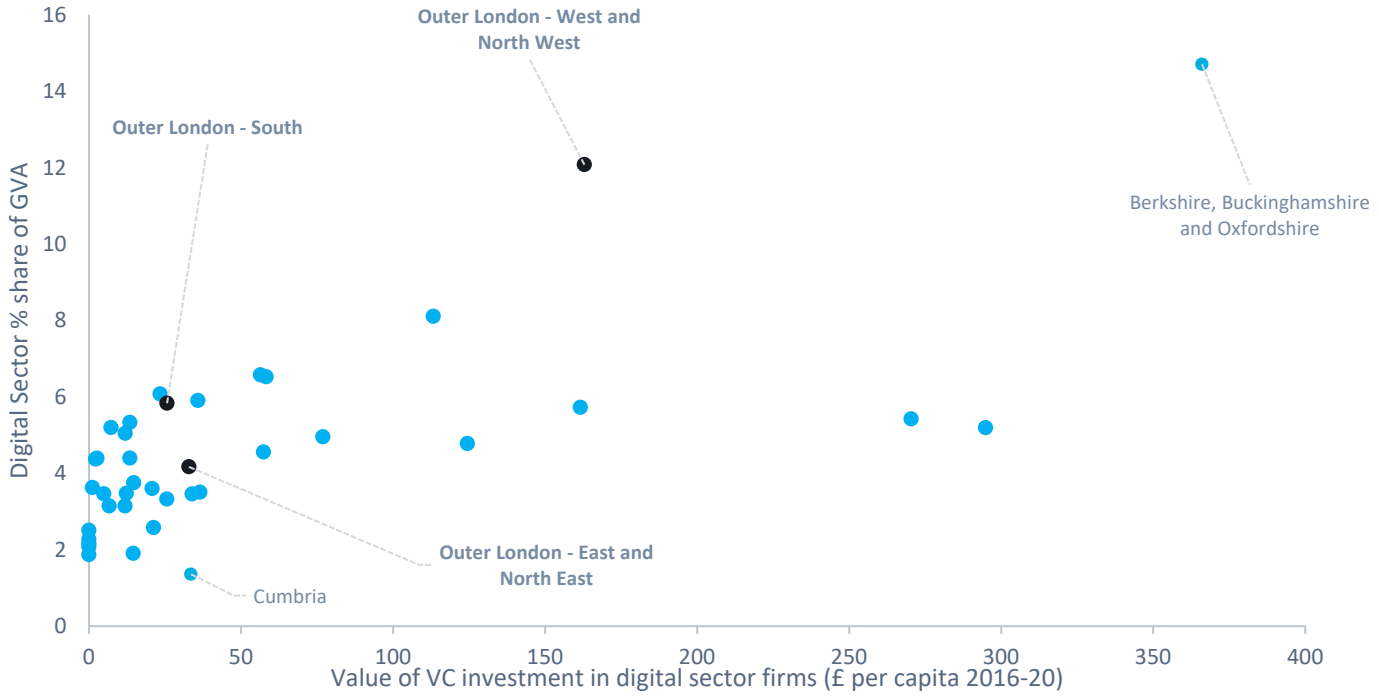
Digital Sector GVA % plotted against HE Computing Students per 100k population (NUTS 2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS 2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

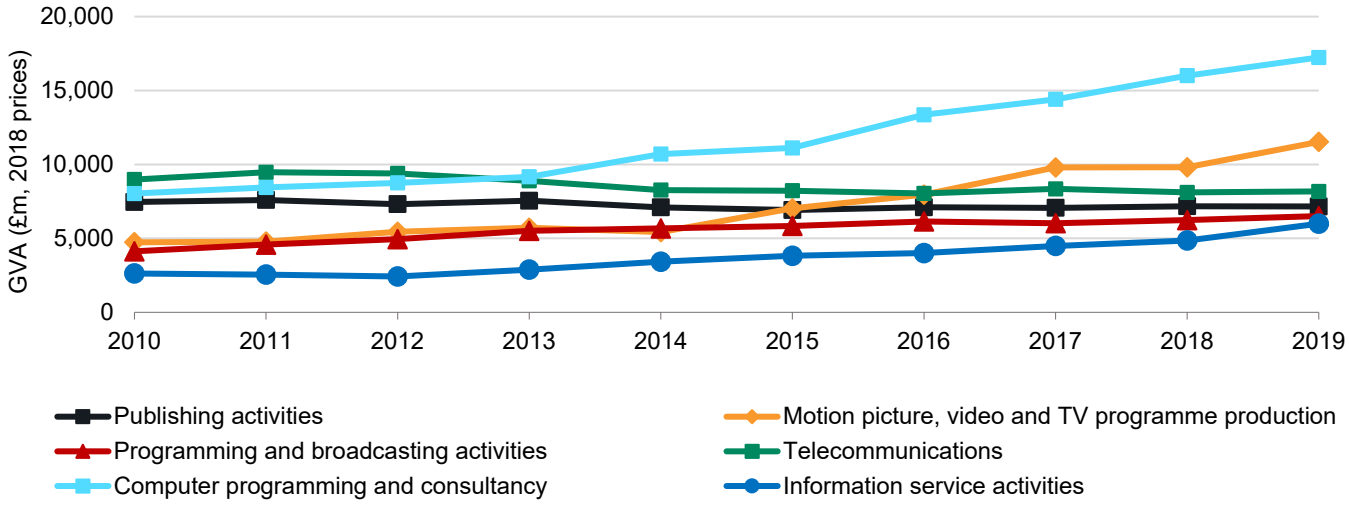
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector. Inner London East and West have been excluded as significant outliers, these two locations attract £2,504 and £3,928 per capita respectively.

London – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of London, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

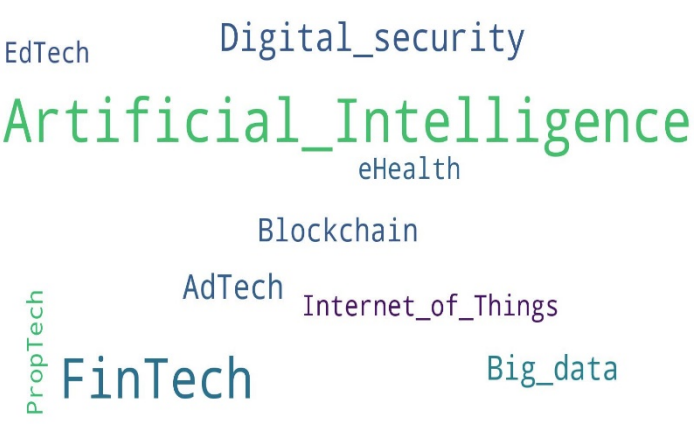
- The chart above shows that there has been significant growth in Motion picture, video and TV programme production (CAGR of 16.3%). Computer programming and consultancy is the largest sub-sector in London, and was the third fastest growing sector from 2014-2019 (10.0%).

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which London's potential for further economic growth lie. There were 2,875 high growth businesses in the digital sector in London in 2021, equating to 3.8% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

London's Digital Ecosystem in Summary

Strengths

- GVA from the digital sector was 12.3% of London's total economic output in 2019 (£56.6 billion), the highest of any UK region. GVA grew by 7.2% per annum between 2014 and 2019, which is in the top quartile of UK regions.
- London has the highest share of digital sector jobs and digital occupations of any UK region, and growth for both measures has been above the UK average over the past five years.
- One in seven (14.1%) existing businesses in London are in the digital sector and a similar proportion (12.7%) of new business births are digital firms, both the highest in the UK. Productivity (GVA per hour worked) is London's digital sector is also the highest in the UK.
- At 3.5% of GVA, international trade in digital sector services is the highest in the UK. London has also been successful in attracting major inward investment from leading global tech firms.
- Very well established tech incubators and accelerators such as Seedcamp in Shoreditch, the Digital Catapult in Kings Cross, TechStars at Clerkenwell, and the Bakery in Dalston. 65% of the UK's accelerators are found in London, with more in Shoreditch than any other area.
- Angel and VC investment in digital sector firms in London is the highest among the UK NUTS1 regions, demonstrating the deep capital markets and networks of investors in the capital which are able to support and accelerate digital growth.
- London was above the 75th percentile for Computer Science and Informatics research rated 4*; at 29.0%, and the highest absolute number of computer science researchers entered to the 2014 REF.
- Annual digital sector R&D tax credit spend per capita is the highest in the UK, digital sector university spin outs are the second highest per 1m population in the UK, and the value of Innovate UK grants in the 'AI and Data Economy' is the highest in the UK.
- The proportion of higher education students studying computing and the proportion of graduates remaining in the region are both in the upper quartile of UK regions. Rates of pay in the digital sector are higher in London than any other UK region.

Opportunities/Specialisms

- Amongst London's 2,875 digital sector companies identified as high growth, prominent sub-sectors include 'Software as a Service' (34% of firms), mobile apps (24% of firms), and Analytic Insight Tools (20%) In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (16% of firms), FinTech (14%), Digital Security (6%), Ad Tech (4%) and Big Data (4%).
- London's opportunities are not based on a single sector or asset, rather they come from the confluence of multiple strengths. Numerous cultural and civil society institutions, incubators and support organisations, universities, public agencies, innovative start-ups and global corporates create a powerful and dynamic tech ecosystem with multiple opportunities and specialisms.
- The Mayor of London's 'Smarter Together' strategy identifies CleanTech, GovTech, Digital Health, EdTech, mobility, FinTech, LegalTech and the professional services needed to support innovation as key strengths in London's tech ecosystem. AI and data are particularly fast growth areas.
- The relationship with London's finance sector is very important. In a narrow sense, it has led to the growth of the FinTech sector and a number of high growth 'unicorns', but it also provides the finance to fuel growth across a wider range of sub-sectors.

Barriers to Growth

- Lack of availability of talent has the potential to be a key barrier to future growth and digital prosperity. A key challenge in attracting talent is that London has the most unaffordable housing for digital workers in the UK.
- Relatedly, ensuring that more Londoners from a range of backgrounds have the skills and competencies to access digital jobs is also a challenge, both to ensure digital inclusion and to ensure businesses have access to a diverse and skilled talent base.
- As the most international UK digital region, London will need to respond rapidly to the post-European Union exit trading environment to ensure it retains its position at the global frontier.
- Developing more home-grown medium and large size firms that can trade internationally out of the highly successful London start-up sector.
- London stakeholders consulted identified that the absence of clear roles and responsibilities for different tiers of government in London can result in fragmentation and duplication of activity. This creates policy and regulatory uncertainty, which can stifle private sector investment and innovation.
- London is relatively unaffordable, with the highest house price to pay ratio in the UK and the highest business floorspace costs, although both of these are, to a large extent, a sign of high demand that is a result of the success of London's digital economy.

Achieving Prosperity

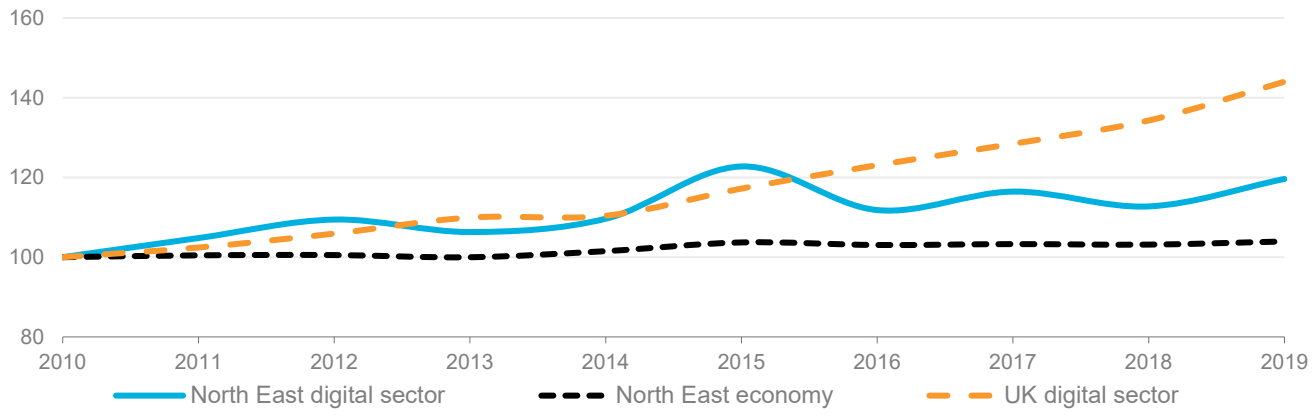
- On the basis of Steer-ED's indicative modelling (see Section 2 of the Main Report), London's Digital Sector has the potential to grow by at least £16.8 billion in annual GVA by 2025 (an increase of 30% on the 2019 value), creating an additional 216,500 jobs (an increase of 48% on the 2019 value).
- London is well-placed to deliver this 'prosperity prize'. It has an extremely strong digital ecosystem, with nationally (and internationally) leading performance across all five of the enabling domains of the digital ecosystem. The Place, Infrastructure, and Assets domain is the most unbalanced, with London scoring poorly for both housing and business floorspace. While the high cost of space is, to a large degree, a function of London's success and the high level of demand this creates, if left unchecked it has the potential to price out the talent and innovative start-ups essential for future growth and prosperity.
- More broadly, London cannot afford to be complacent across any of the domains. In the People, Skills, and Inclusion domain, London needs to continue to be a welcoming and interesting place to live for UK and global talent, as well as ensure that Londoners have the skills and competencies to be able to access the high quality jobs the sector creates.
- To strengthen the digital tech Business domain, the challenge is to drive more scale-ups from London's dynamic digital start-up scene. In 2020 3.8% of London's digital firms were classified as 'high growth', above the median figure but some way behind the leading region (Northern Ireland, 5.7%). Similarly, job creation (in both the digital sector and digital occupations) over the past five years has only been around the UK average. Creating more high-quality jobs from London's dynamic tech sector will be key to creating widespread prosperity.
- In the Ideas and Innovation domain, London's rich and diverse public and private sector R&D base provides routeways for prosperity in a diverse set of established and emerging growth sectors, including AI and data, virtual and augmented reality, clean tech, and cyber security. London's investment and business environment provide a strong platform on which to realise new opportunities.

North East – Summary Dashboard

Region

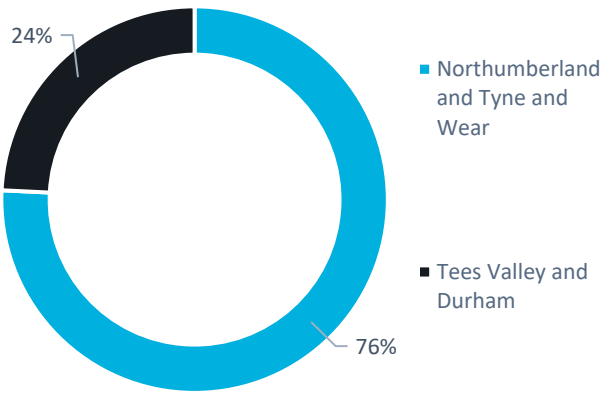
- **Component NUTS2 regions:** Northumberland and Tyne and Wear, and Tees Valley and Durham.
- **Key Statistics:** 8,592 km^2, 2.7m population, £54bn total GVA (2019), 0.5% total annual GVA growth (2014-2019).
- The North East has multiple hubs but there a strong focus on activity in Newcastle. The main population centres are in Newcastle upon Tyne, Sunderland, Middlesbrough, Darlington and Gateshead.
- This region continues to perform strongly relative to the UK particularly in Human Health and Social Work as well as Wholesale and Retail trade, with more recent diversification into renewables and financial services.
- The Digital Sector is relatively small as a percentage of total output for the region (5.3%), and has shown relatively weak growth in economic output (1.8%, 2014-2019), below the UK digital sector growth but above the North East economy as a whole.
- Digital Employment (estimated at 65k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector, indicative of higher demand for digital skills in non-digital sector industries, such as Administration and the Public Sector.
- Demand for digital occupations is dominated by Northumberland and Tyne and Wear, with 76% of digital occupation online job postings 2019-2020. In contrast, Tees Valley and Durham has a 24% share.
- There is relatively high demand for IT Support/Test Analysts (location quotient above 1.0, the UK average) although the largest absolute demand for occupations is Software Developers, making up 21.6% of digital occupation job adverts 2019-2020, indicating increasing demand for innovative software and accelerating growth in technology.

Digital Sector GVA growth 2010-2019 (indexed to 2010), North East NUTS1 Region



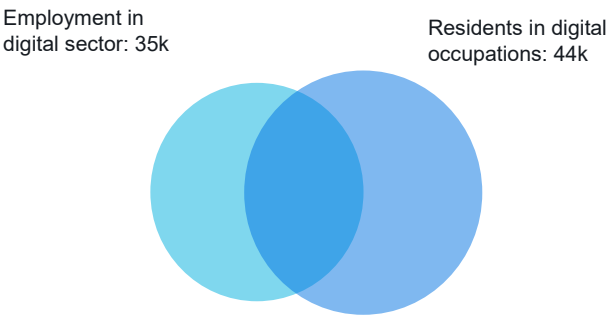
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in the North East (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), North East NUTS1 Region



Total digital employment in the North East: c. 65k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations (2019-2020), North East NUTS1 Region

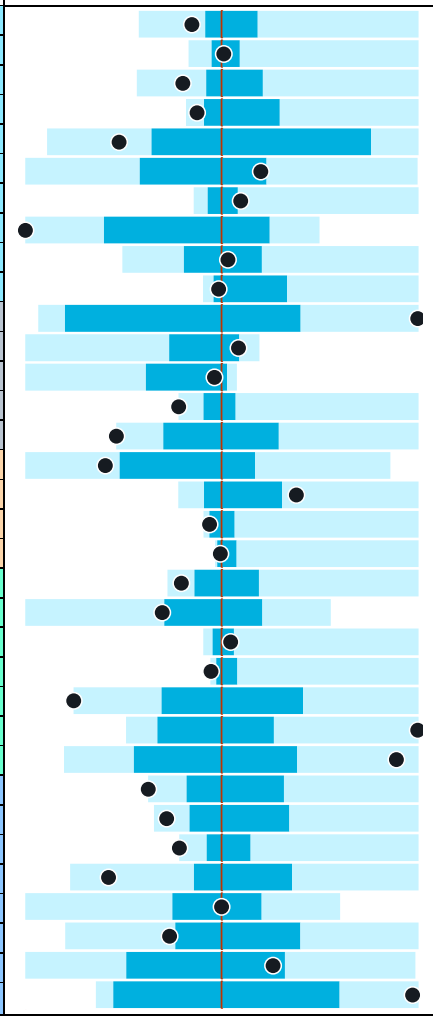
- This table shows digital occupations by demand for the North East. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, IT managers, and IT Support Analysts, but comparative demand is highest for IT Support Analysts, Test Analysts, and Database Administrators. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
IT Support Analyst	3,423	7.7%	1.51
Test Analyst	1,645	3.7%	1.38
Database Administrator	666	1.5%	1.18
IT Service Manager	935	2.1%	1.18
Field Service Engineer	1,044	2.4%	1.16
Web Developer	2,112	4.8%	1.10
Test Automation Engineer	780	1.8%	1.08
Software Developer	9,582	21.6%	1.08
Network Engineer	1,024	2.3%	1.08
Full Stack Developer	746	1.7%	1.08

Source: Geek Talent, 2021

North East - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for the North East and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where the North East (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, the North East is above the median value on this indicator.

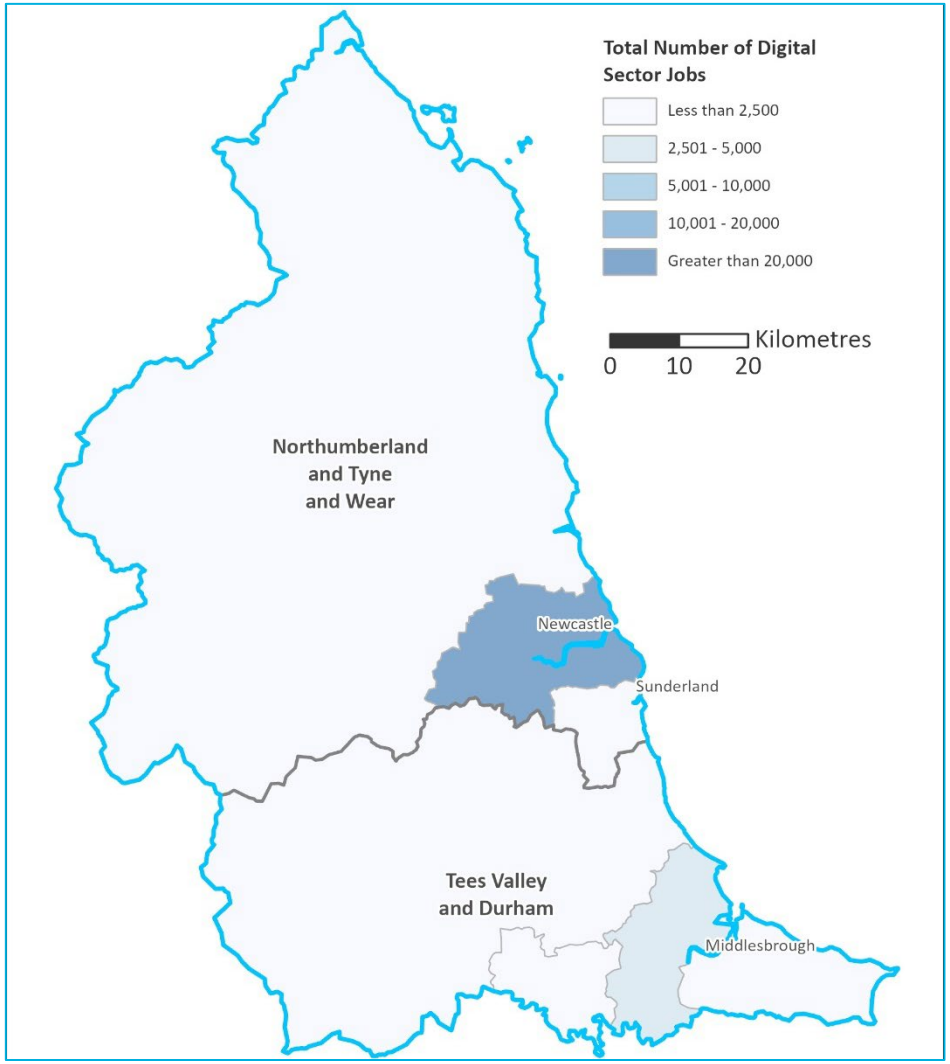
Indicator name	Period	NE	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**5.1**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**3.1**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**3.7**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**5.2**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**0.0**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**6.3**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**5.3**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**1.8**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**41.4**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.2**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**20.3**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**17.9**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**95.3**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**10.5**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**10.5**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**59.6**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**3.3**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**5.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**36.5**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**80.4**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**20.5**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**21.6**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**2.9**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**1.1**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.8**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**1.7**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**30.2**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**35.8**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**34.5**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**88.9**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**94.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**36.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**74.6**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**2.6**		1.3	1.4	1.8	2.3	2.6

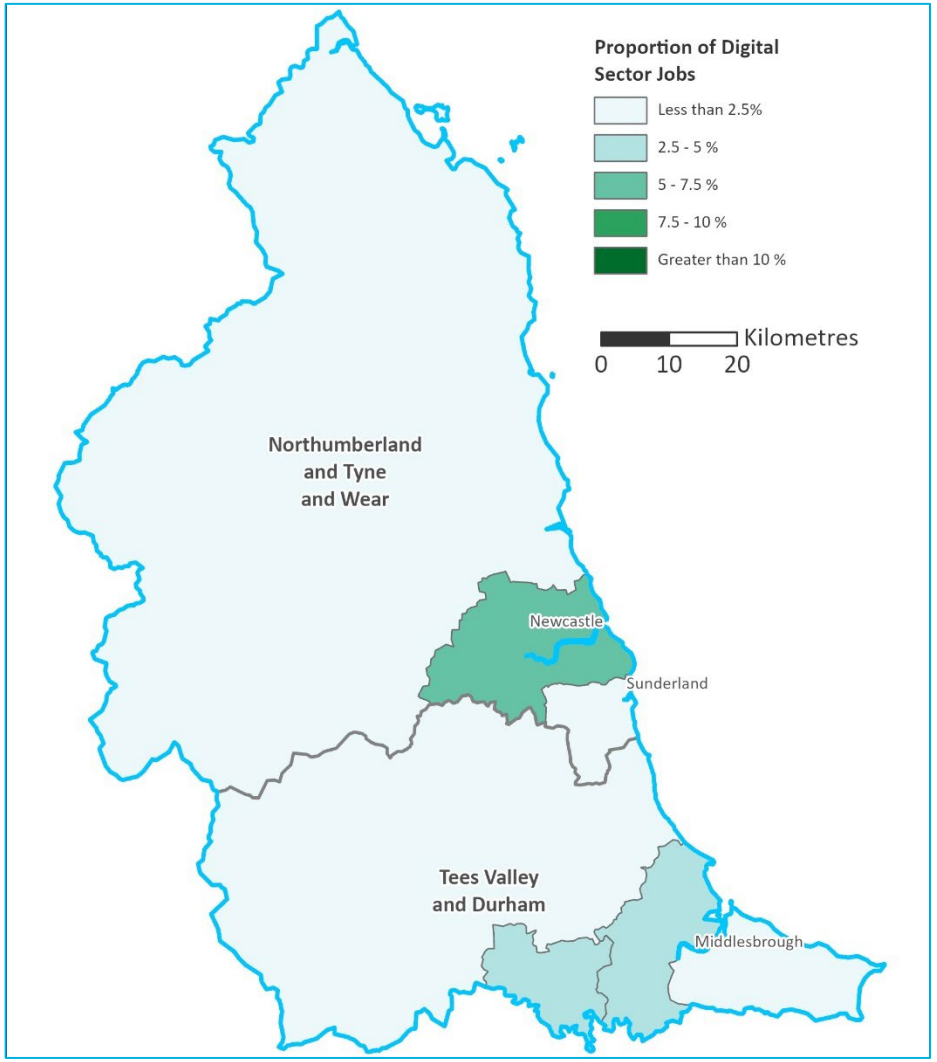
Source: Steer-ED and various datasets – See Appendix B

North East - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

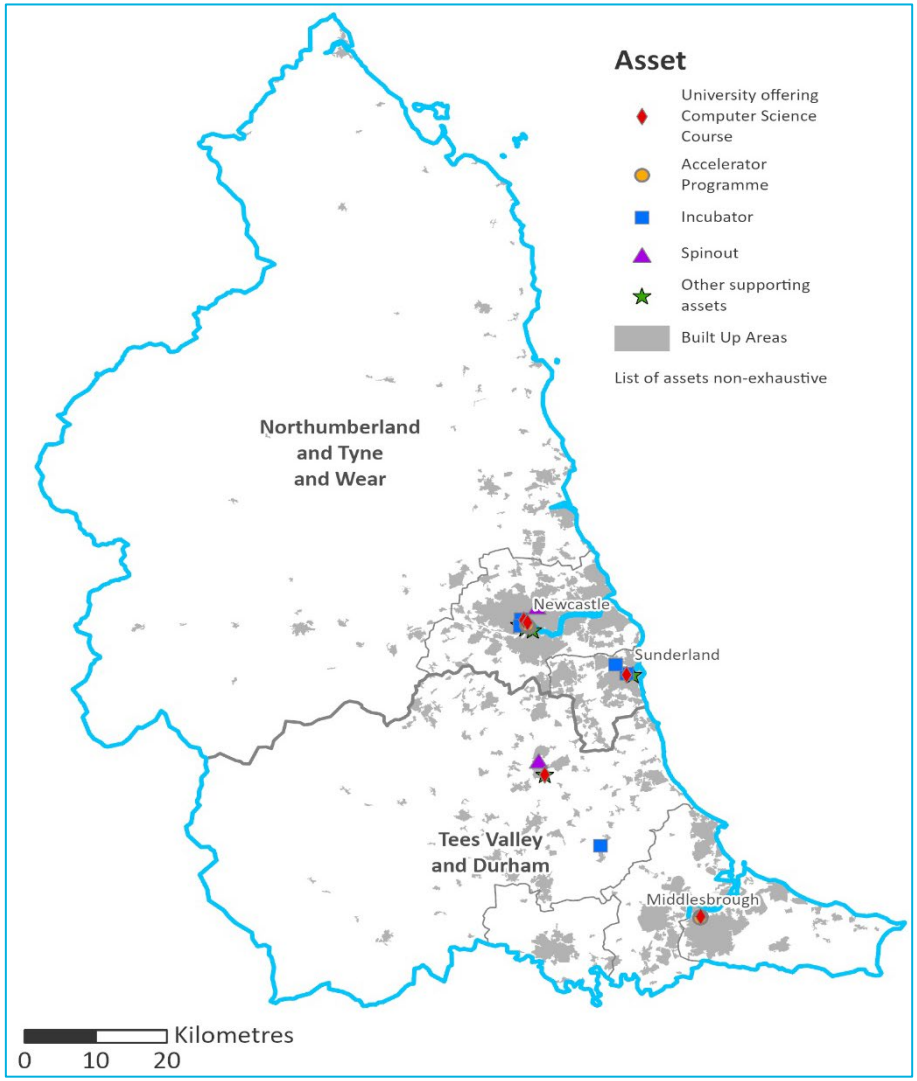
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

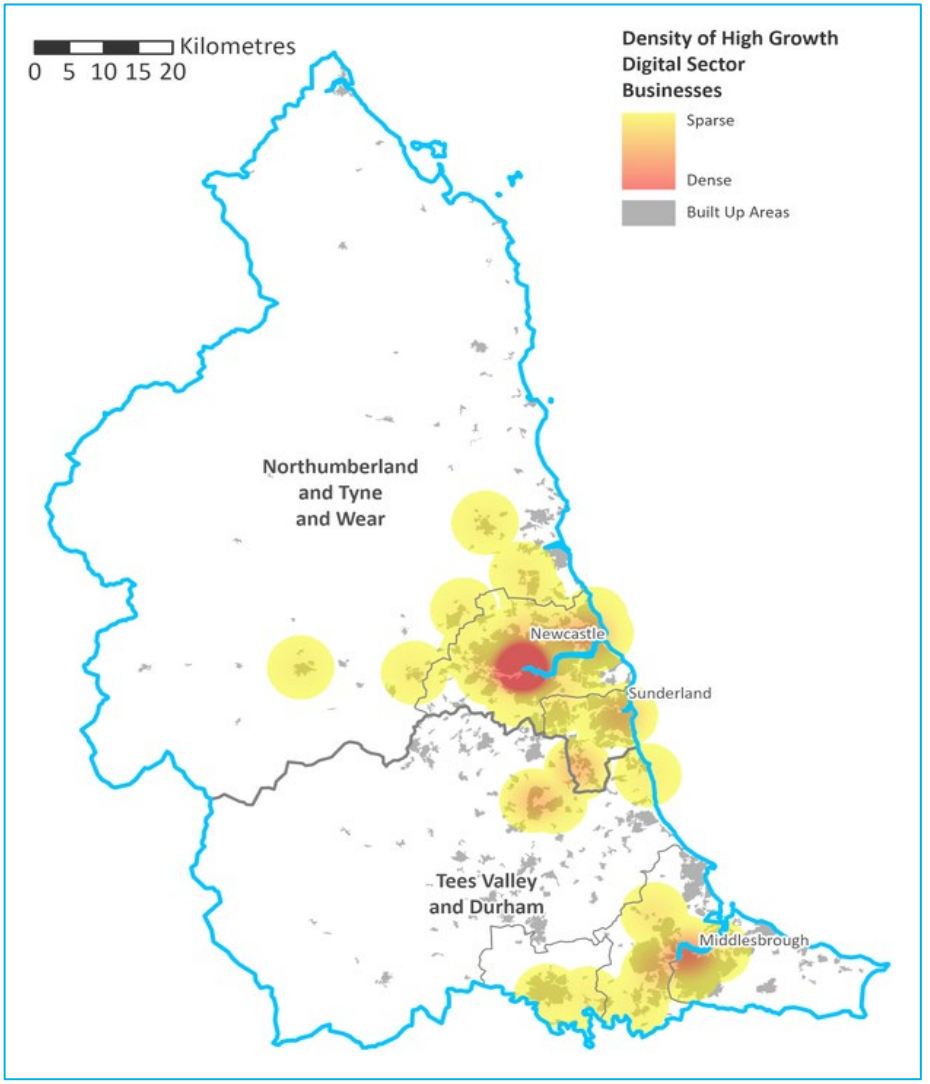




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in the North East, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in the North East. It highlights how high growth businesses are concentrated in larger urban areas.



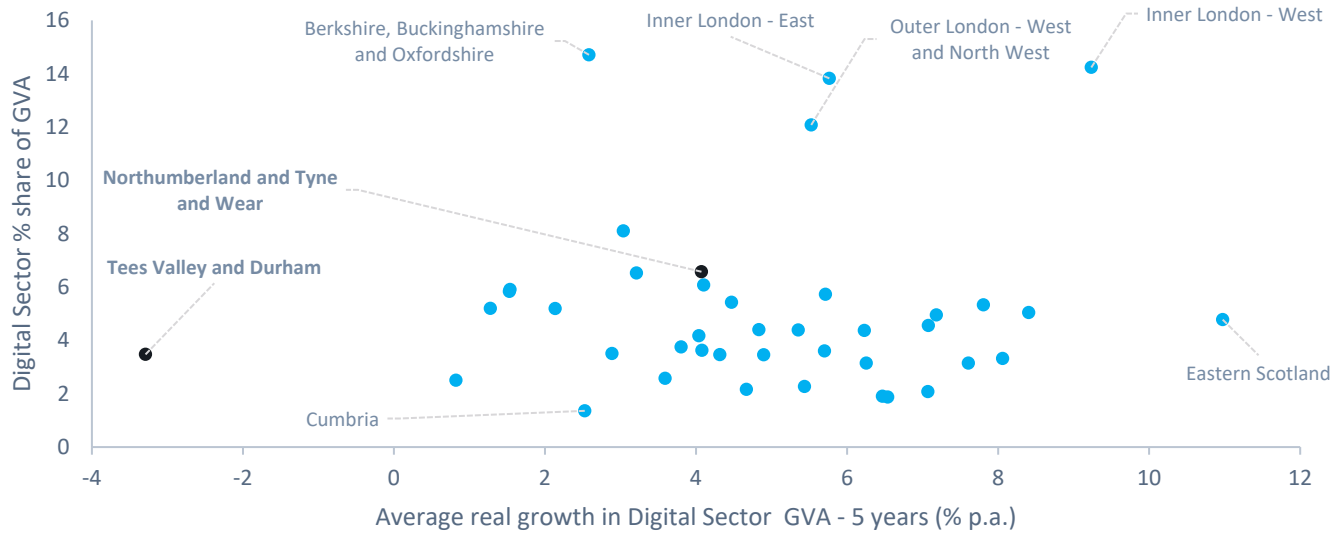


North East – Sub-Regional Potential

Analysis of Key Metric Combinations, NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in the North East, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. The North East is indicated in black. Key outliers outside The North East are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in the North East.

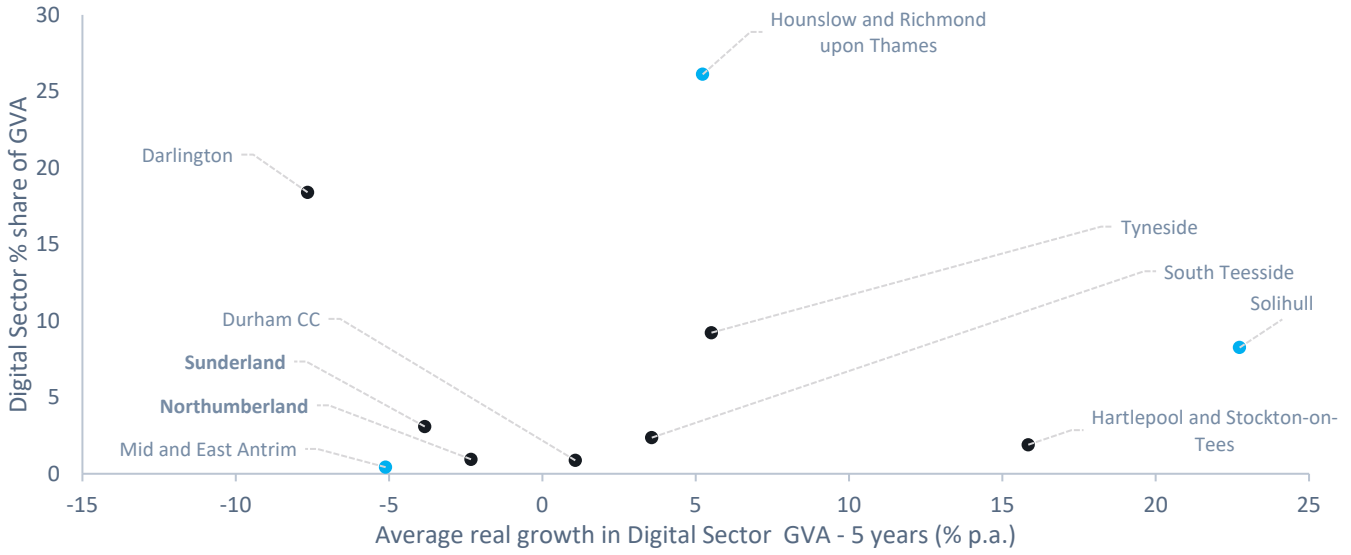
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

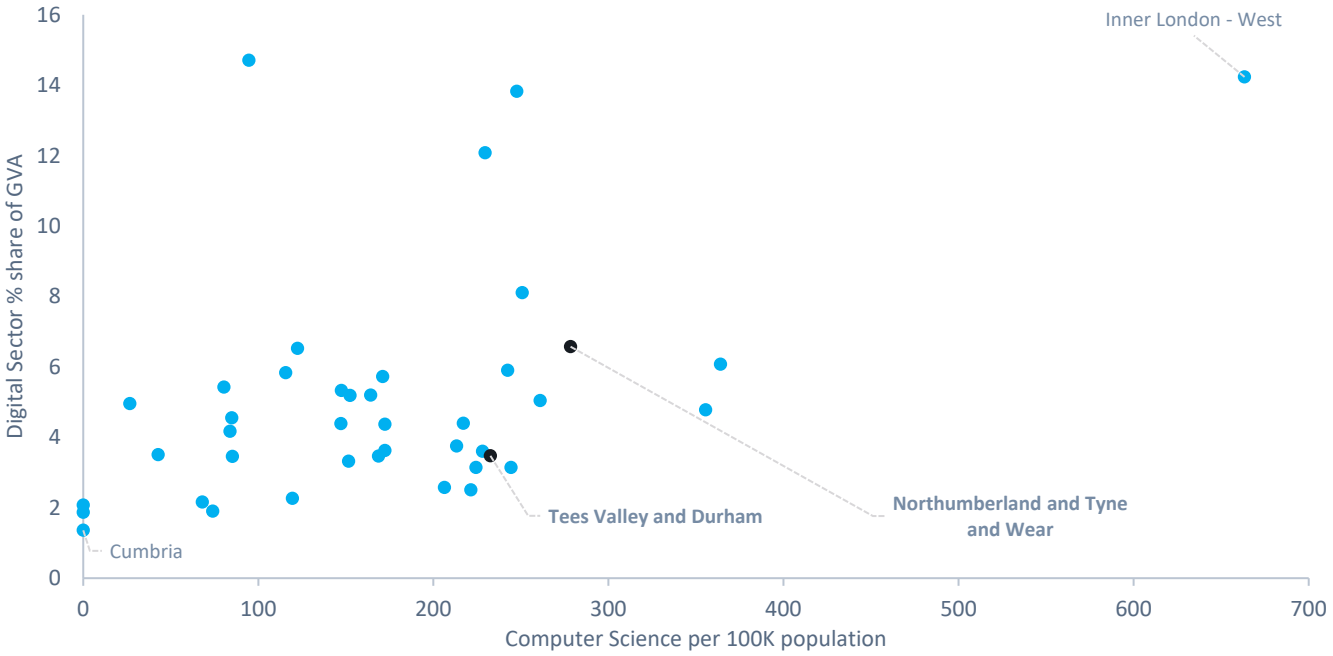
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – North East NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is positively corelated with the relative size of the digital sector in the North East NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

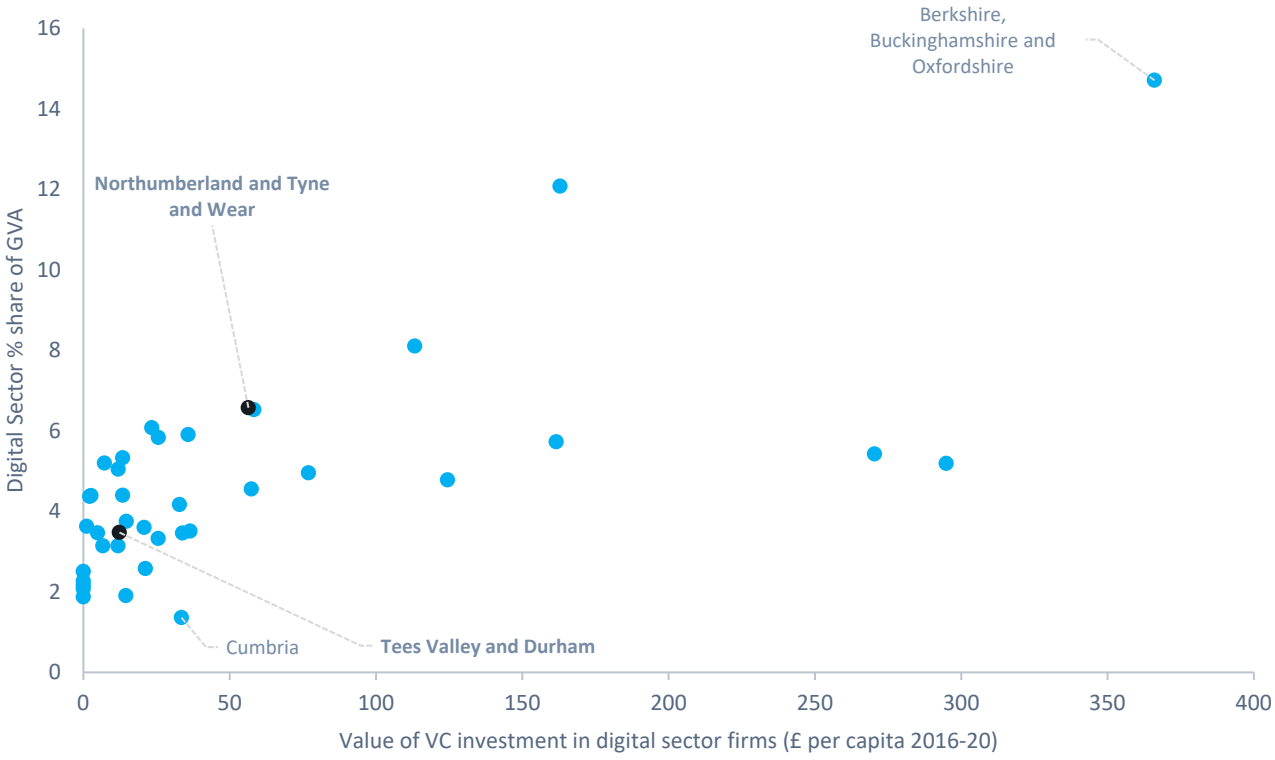
Digital Sector GVA % plotted against Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

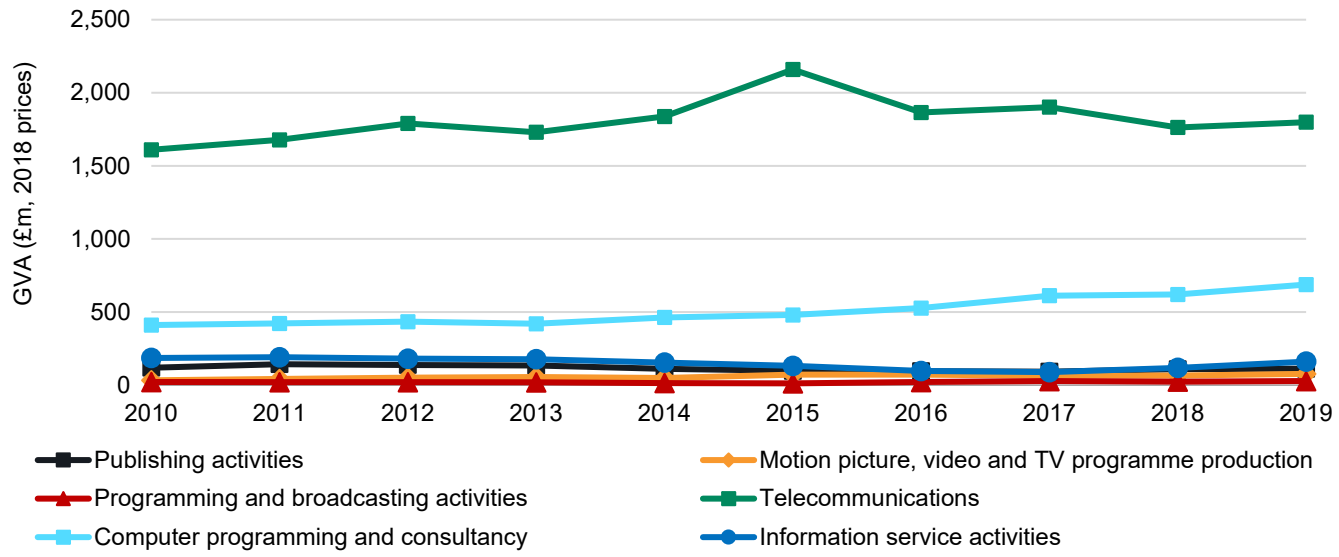
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector. Inner London East and West have been excluded as significant outliers.

North East – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of the North East, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

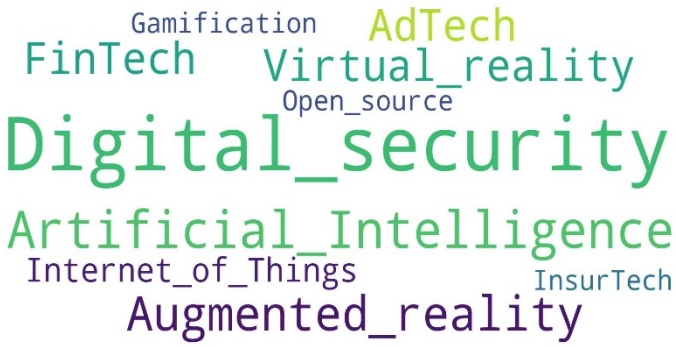
- The chart above shows that there has some growth in the Computer programming and consultancy (CAGR of 8.24%). The highest growth, although starting from a low base, was seen in the Programming and broadcasting activities (CAGR of 14.87%), doubling in size over the period of 2014-2019. The next faster growth sector was Motion picture, video and TV programme production (CAGR of 9.46%). These sub-sectors are where the growth potential for the North East is. Telecommunications is the largest sub-sector in the North East, but it its growth remained largely flat from 2014-2019.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which the North East's potential for further economic growth lie. There were 120 high growth businesses in the digital sector in the North East in 2021, equating to 3.3% of the total number of digital sector businesses in the NUTS1 region. Of the regions only London and Northern Ireland have larger shares.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

North East's Digital Ecosystem in Summary

Strengths

- Strong growth in digital occupations over the last five years (averaging 6.3% per annum). This has been fuelled by a diverse mix of digital employers, including large digital firms (such as Sage, Accenture, Ubisoft, Visualsoft, and DXC Technology), public sector digital delivery centres (such as DWP, HMRC, Homes England, NHS BSA, and Defra) and successful new North East-based companies (like Atom Bank, Opencast Software, Scott Logic, Jumping Rivers, and Wordnerds).
- Digital sector GVA has grown almost four times faster than the overall regional economy in recent years (at an average of 1.8% per annum in real terms from 2014 to 2019). Within this, the region's 'Computer programming and consultancy' sub-sector has grown particularly rapidly, at a rate of 8.2% per annum over the period, matching the average UK growth rate for this sub-sector.
- This surge in IT-based economic activity has been supported by considerable strengths in computing-related subjects at the region's universities. This helps to attract talent to the region, and provides graduates and postgraduates into local firms. In Academic Year 2019/20, the North East had 6,880 students enrolled on Higher Education Computer Science courses, with the majority of these at Teesside University (2,335), Northumbria University (2,130) and Newcastle University (1,390). With a total of 2,105 postgraduate students, the North East is the region with the most Higher Education postgraduate computing students per head of population (at 0.8 per 1,000 population). There are also considerable research strengths at the region's universities; in REF 2014, the proportion of Computer Science & Informatics research rated 4* was 46% at Newcastle University and 19% at the University of Durham.
- As a location for digital sector firms and for people with digital skills, its relative affordability is an important advantage. The ratio of average annual earnings to average house prices (at 20%) is the highest of any region, and the cost of business floorspace is lower than in most other regions.
- Supporting the growth of the region's digital sector, established organisations are providing local networking opportunities and business support specific to the digital arena. These include Dynamo North East, Sunderland Software City, and DigitalCity in Tees Valley.

Opportunities/Specialisms

- Amongst the region's 120 digital sector companies identified as high growth, prominent sub-sectors include Software-as-a-Service (25% of firms), mobile apps (21%), analytics, insight, tools (19%) and other software (19%). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are digital security (7% of firms), Artificial Intelligence (6%, and augmented reality (5%).
- The region has invested in various initiatives supporting digital innovation which are supporting future growth opportunities. These include: the National Innovation Centre for Data and the National Innovation Centre for Ageing (both at Newcastle University); the development of the BIM Academy (for digital construction) at Northumbria University; PROTO in Gateshead – the first digital production facility of its kind in Europe; and the North East Centre of Excellence in Satellite Applications in County Durham.
- Other areas in which the North East has developed particular specialisms and opportunities for future growth include FinTech (e.g. Sage, Atom Bank, and Atos), Subsea Robotics (the Subsea North East alliance of companies accounts for the design and build of more than half the world's subsea robots), MarketingTech (e.g. Partnerize, SalesCycle, ZeroLight), Gaming and Immersive Tech (e.g. Ubisoft, Coatsink, Dimension, Double Eleven), and Transport Tech (e.g. Cubic, TUI Group).
- The region has capabilities in advanced manufacturing, and competences in the digital transformation of established industries, with Accenture and various mid-sized consulting firms serving national and international clients from bases in the North East. The region also has a strong track record in the development and delivery of digital public services, including organisations such as DWP, HMRC, and NEC Software Solutions.
- Local authorities and LEPs in the region are actively seeking to growth their digital economies. For example, the North of Tyne Combined Authority has developed a £10 million Digital Growth and Innovation Programme, aiming to grow the number and scale of digital companies, maximise the impact of data and digital across the economy, and support the digital inclusion of residents and overall digital skill levels. Similarly, Tees Valley Combined Authority is developing its digital strategy addressing innovation, infrastructure and inclusion.

Barriers to Growth

- Two important barriers to growth are closely interlinked. First, the region faces difficulties in getting to a critical mass of digital activity in the region, given a relatively modest pipeline of digital start-ups (the region is currently in the bottom quartile for the digital sector share of enterprises). Second, there have been relatively low levels of external investment into the region's digital ecosystem. The distance from London, when combined with relatively few investment opportunities at the appropriate scale and stage, has led to there being under-investment from external funders into the region's digital sector (in the period 2016 to 2020, funds raised by North East digital companies amounted to just 0.6% of the UK total, according to Beauhurst data, compared to its UK population share of 4%). The shift to remote working due to COVID-19

restrictions could potentially lead to somewhat less reliance on physical meetings and travel, thereby reducing the barriers for North East firms in attracting external investment.

- The North East's digital sector is reported to suffer from limited availability of digital talent – especially at the mid-career level. This has been exacerbated to some extent by COVID-19, as the shift to remote working has meant that people can live in the North East while working for London-based, or even Silicon Valley, companies. That makes it difficult for North East-based SMEs to hire mid-level staff, as they are increasingly competing with London-based firms for North East-based talent. Some large North East firms have had to look elsewhere, because they cannot find enough talent locally. In terms of gross annual pay, the North East currently features in the bottom quartile for both the median pay in the digital sector (£30.2k) and the median pay for IT and telecoms professionals (£35.8k). While this may make the region relatively affordable for employers, the lure of larger salaries available elsewhere makes it challenging to attract and retain talent.
- More generally, the region has a shortage of people qualified to undertake higher value-added jobs, with the lowest proportion of any UK region in terms of working age residents with any degree-level qualifications (35%).
- Some indicators suggest that there is also some way to go in tackling digital inclusion, which is a pre-requisite for enabling people from disadvantaged communities to participate in digital economy employment in the future. Whilst the latest data shows that the North East is in line with the regional median for the proportion of households with internet access (94%), it features in the bottom quartile for the proportion of people aged 16+ using the internet (89%) and for some relevant usage measures such as the proportion of internet users finding information online for work or study (36%).
- Most of the region's digital sector and digital employment is in the cities and/or at large business sites, but the availability of high-quality broadband remains an issue for smaller businesses in smaller towns and rural areas. Although the region has high coverage of superfast broadband (95%), it currently has the lowest coverage of the UK NUTS1 regions for full fibre and gigabit-capable broadband (10.5% of premises at January 2021). However, this is a fast-moving area; BT Openreach and CityFibre are rolling-out full fibre to parts of the region, Virgin Media is rolling-out gigabit-capable technology across its cable network, and the UK Government's Gigabit Programme is targeting the hardest-to-reach areas.
- Although there are some workspaces targeted at tech firms (such as BOHO in Middlesbrough, and the Toffee Factory in Newcastle), the lack of a flagship physical hub for digital activity is considered by some to be a barrier to the sector's growth, following the closure of the Campus North co-working space in Newcastle.
- In employment and GVA, the North East's digital sector is highly dependent on Telecommunications. This accounted for 64% of the region's digital sector GVA in 2019 (UK average: 24%), which is the highest share of any UK region. While this leads to above-average productivity levels in terms of GVA per hour worked (given the high capital intensity of telecoms), in practice much of the telecommunications-related activity is associated with call centre operations. Such activities are major employers in the region (customer service occupations account for 2.9% of jobs in the North East, versus the UK average of 2.1%) and contribute to ensuring that there is a wide spectrum of job opportunities in the sector, but they are relatively mobile. The region will need to do what it can to safeguard such jobs for the future.

Achieving Prosperity

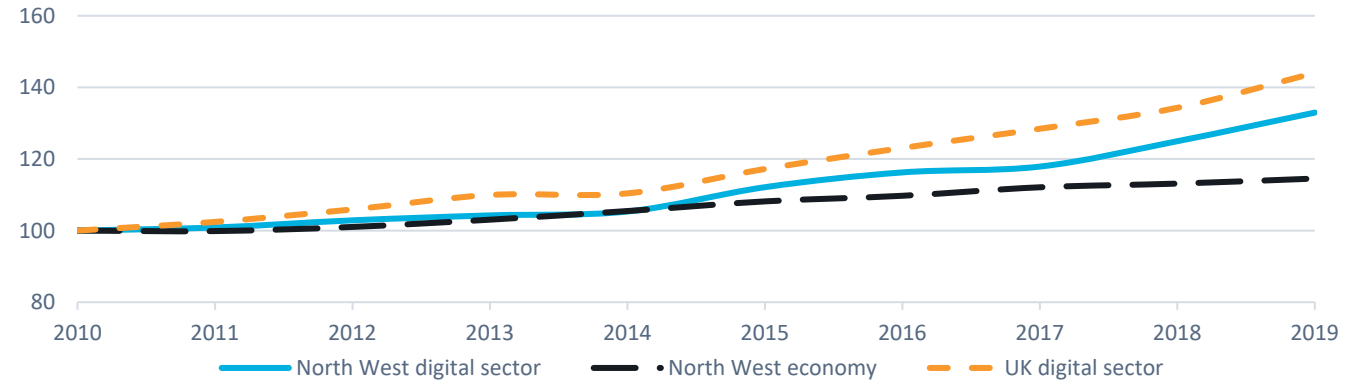
- On the basis of Steer-ED's indicative modelling (see Section 2), the digital sector in the North East has the potential to grow by at least £460 million in annual GVA by 2025 (an increase of 16% on the 2019 value), creating an additional 13,800 jobs (an increase of 32% on the employment in 2019).
- In working to seize this 'prosperity prize', the region needs to maintain and further develop the computing and digital science excellence in its academic base and its associated commercial vehicles (such as NIC-D), recognising the role that Innovation and Ideas play in enabling the competitiveness of the digital economy.
- The diversity of employers – product-, market-, and business-model wise – is a key strength of the region. Keeping the focus on maintaining and further growing this variety will provide the confidence to grow further the digital economy for prosperity.
- Finally, effective, stable, and high performing start-up and scaling activities are central to enterprise growth in all places. Accordingly, present and future start-up and scaling programmes must be positioned and tailored to support the further forward development of the region's digital economy, especially in relation to software and data-intensive activities.

North West – Summary Dashboard

Region

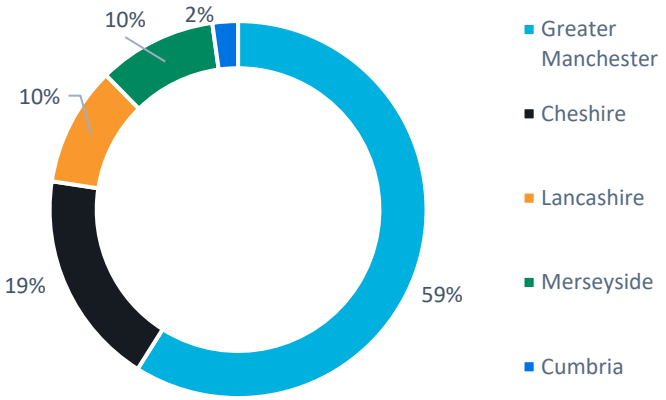
- **Component NUTS2 regions:** Cumbria, Cheshire, Greater Manchester, Lancashire, and Merseyside.
- **Key Statistics:** 14,165km^2, 7.4m population, £184bn total GVA (2019), 1.7% total annual GVA growth (2014-2019).
- The North West is a region of five unique sub-regions, each with significant industrial heritage, centred around the main population centres of the Manchester and Liverpool city regions.
- This region continues to perform strongly relative to the UK in manufacturing, particularly in Manufacture of Food, Textiles, Metal, Chemicals and Wood, Metal Products, Electrics and Machinery with additional comparative sector strengths in Health, Transport, and Retail.
- The Digital Sector is relatively small as a percentage of total output for the region (4.8%), but has shown growth in economic output (4.8%, 2014-2019), but less growth than the UK average for the Digital Sector.
- Digital Employment (estimated at 200k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector, indicative of higher demand for digital skills in non-digital sector industries, such as in the Public Sector, in Retail, Transport and Finance, where the North West has large employers of digital occupations.
- Demand for digital occupations is dominated by Greater Manchester, with 59% of digital occupation online job postings 2019-2020. This is followed by Cheshire with 19%, then just 10% of demand coming from Merseyside and 10% also from Lancashire, and just 2% from Cumbria. The relatively small proportion of demand of digital occupations from Merseyside is surprising, given Manchester and Liverpool are the region's two populous city regions.
- There is relatively high demand for Database Administrators (location quotient of 1.26, where the UK average equals 1.0) although the largest absolute demand for occupations is for Software Developers, making up 23.7% of digital occupation job adverts 2019-2020, indicating increasing demand for innovative software and accelerating growth in data occupations.

Digital Sector GVA growth 2010-2019 (indexed to 2010), North West NUTS1 Region



Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in the North West (2019 – 2020)

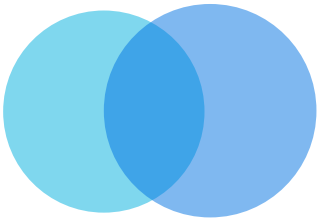


Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), North West NUTS1 Region

Employment in Digital Sector: 117k

Residents in Digital Occupations: 131k



Total digital employment in the North West: c. 200k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations (2019-2020), North West NUTS1 Region

- This table shows digital occupations by demand for the North West. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, Data Engineers, and Business Analysts, but comparative demand is highest for Database Administrators, Web and Software Developers, IT Support Analysts, and Tech Analysts. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Database Administrator	4,058	1.6%	1.26
Web Developer	12,963	5.1%	1.18
Software Developer	59,633	23.7%	1.18
IT Support Analyst	14,485	5.7%	1.13
Test Analyst	7,519	3.0%	1.11
Data Analyst	7,433	3.0%	1.09
IT Service Manager	4,826	1.9%	1.07
Business Development Executive	3,780	1.5%	1.06
Business Analyst	19,627	7.8%	1.04
Full Stack Developer	3,919	1.6%	0.99

Source: Geek Talent, 2021

The North West – Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for the North West and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where the North West (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, the North West is above the median value on this indicator.

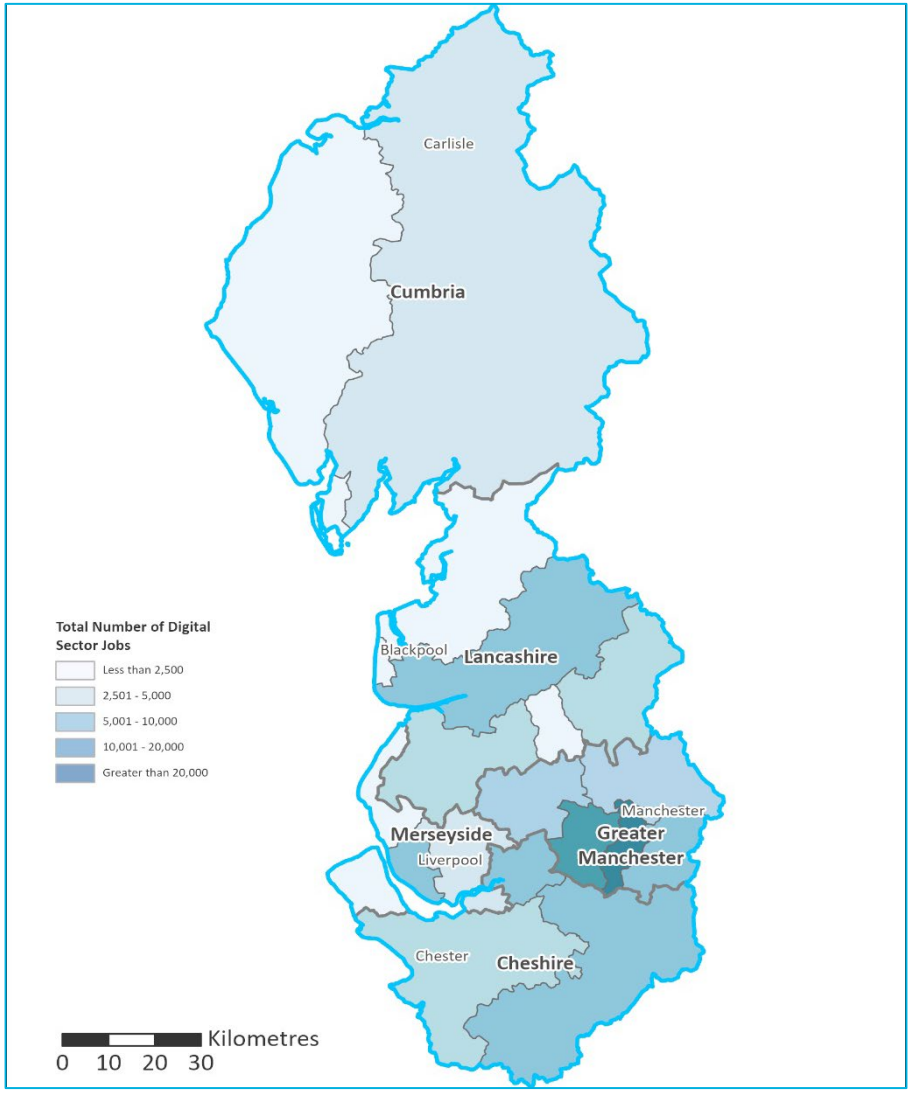
Indicator name	Period	NW	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**6.4**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**2.8**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**4.3**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**6.1**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**-2.0**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**4.0**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**4.8**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**4.8**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**41.9**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.1**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**16.4**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**16.7**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**96.0**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**17.7**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**38.6**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**58.2**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**1.7**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**15.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**77.1**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**152.1**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**27.9**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**16.0**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**15.6**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**1.8**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.3**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**0.9**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**33.7**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**40.8**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**38.7**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**91.1**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**92.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**44.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**74.5**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**1.4**		1.3	1.4	1.8	2.3	2.6

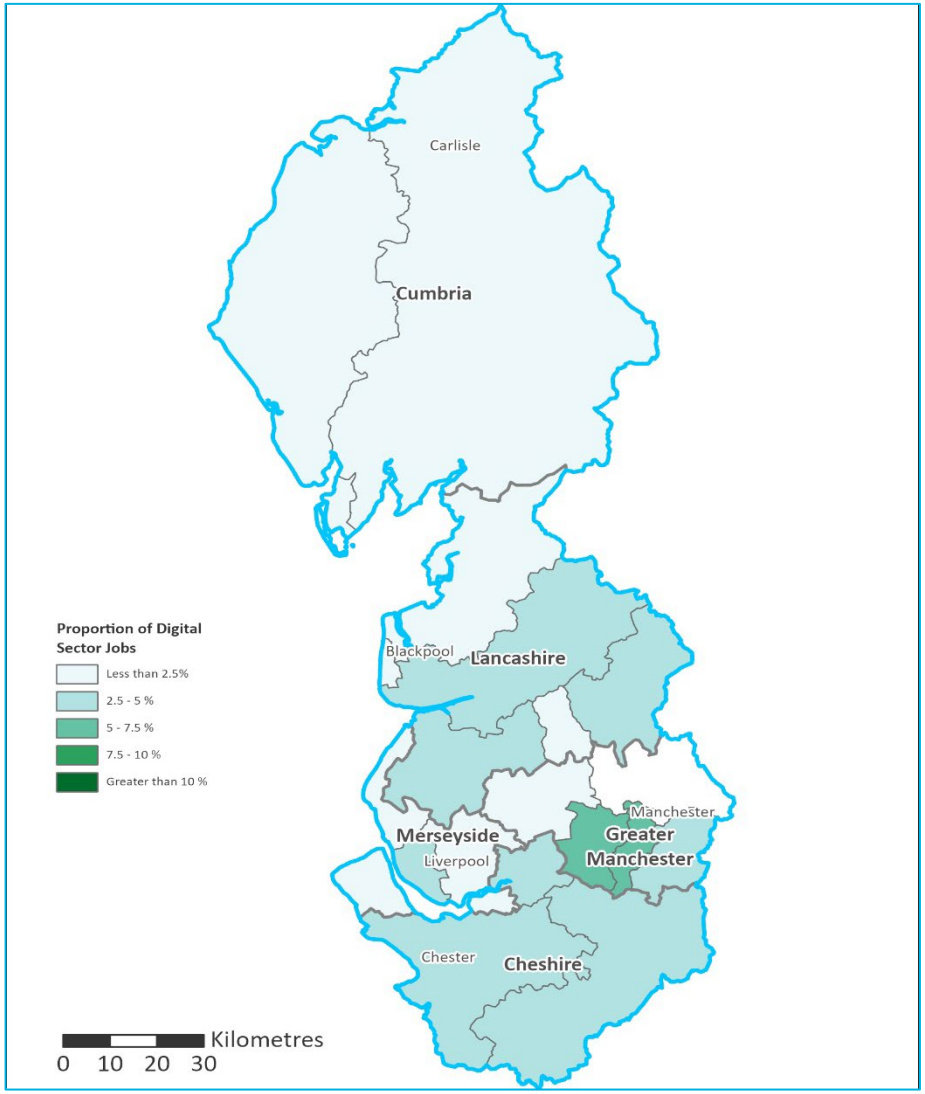
Source: Steer-ED and various datasets – See Appendix B

The North West - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

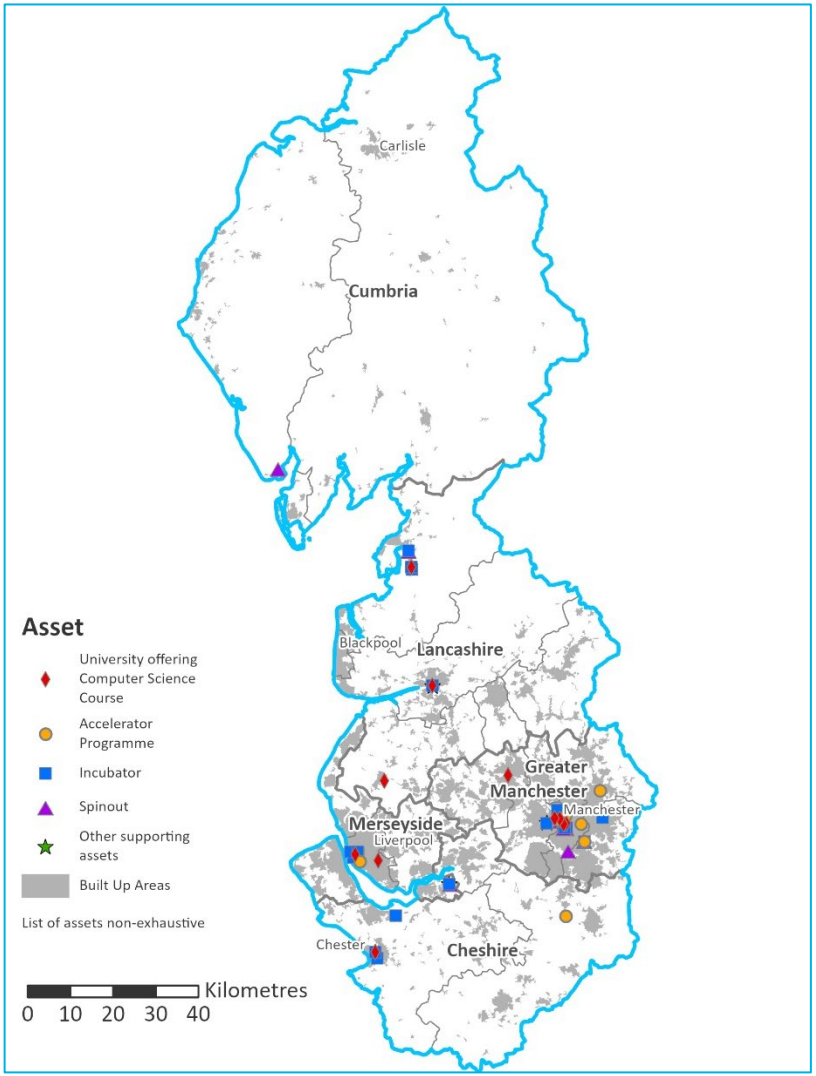
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

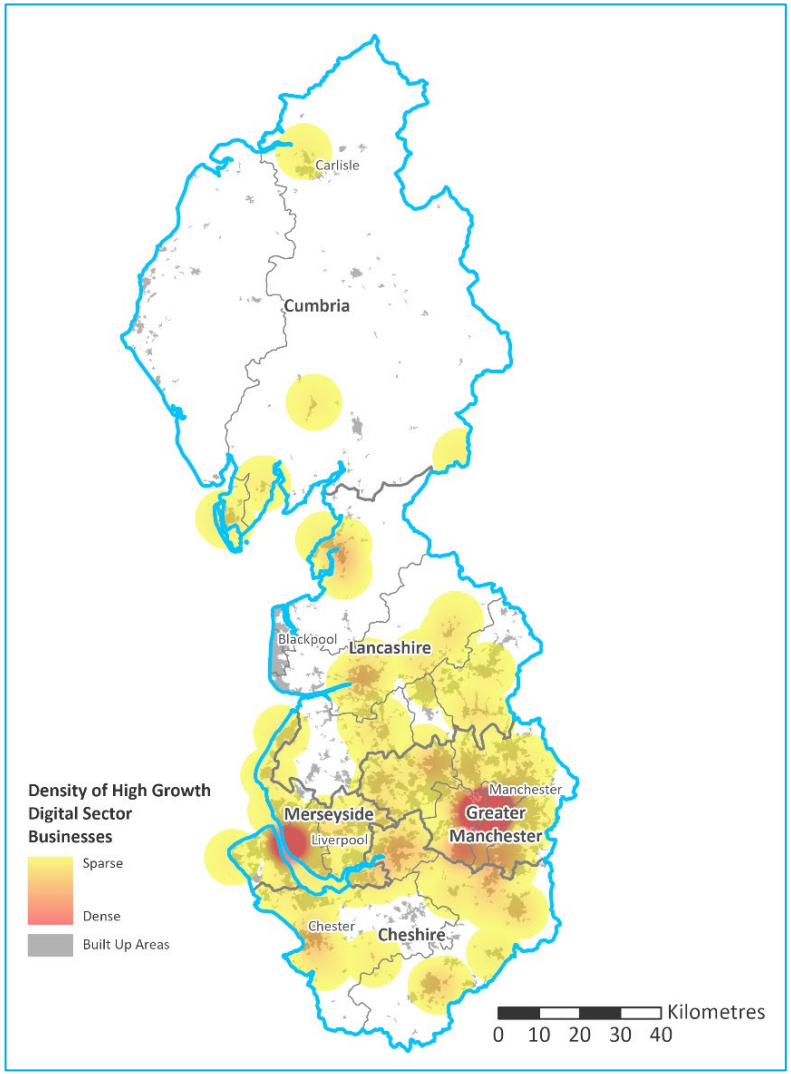




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in the North West, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in the North West. It highlights how high growth businesses are concentrated in larger urban areas.



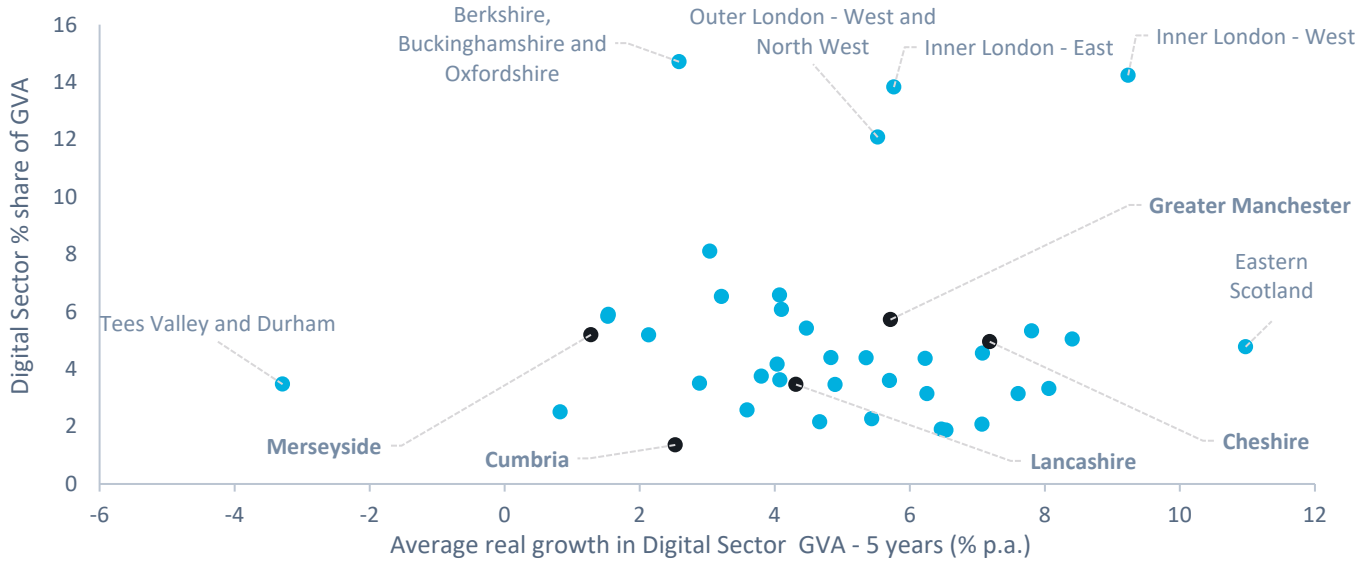


The North West – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in the North West, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. The North West is indicated in black. Key outliers outside the North West are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in the North West.

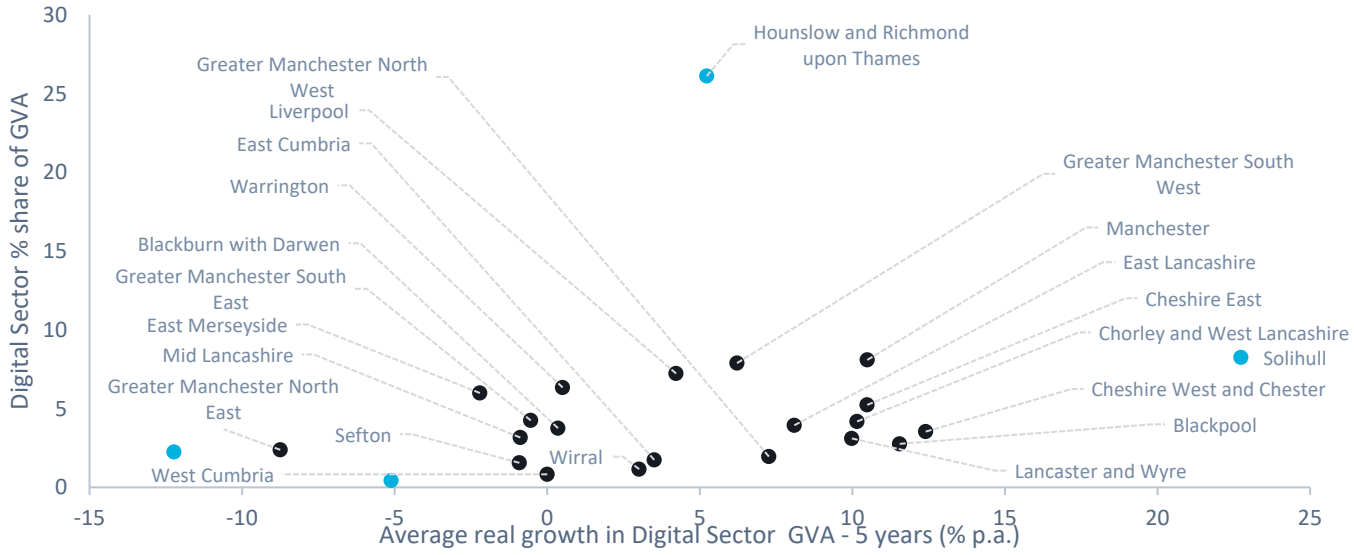
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

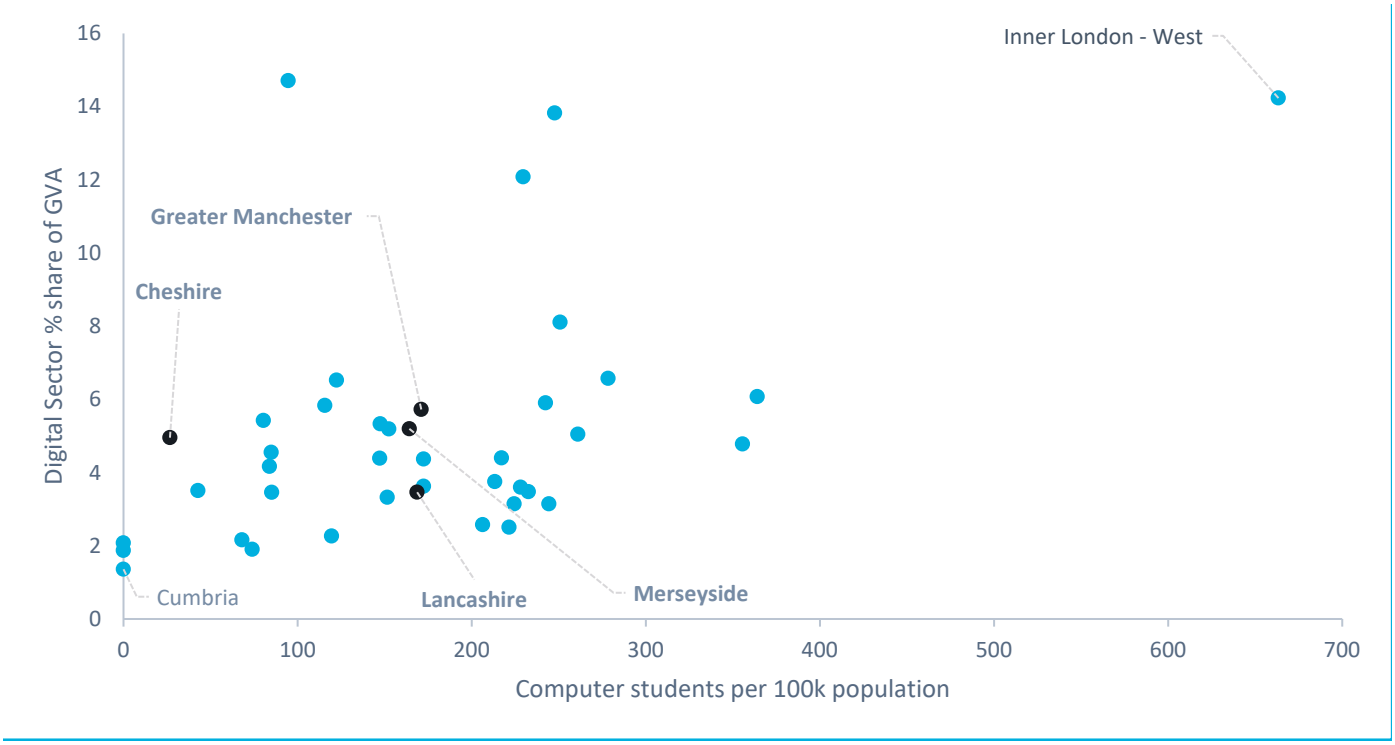
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – North West NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in the North West's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

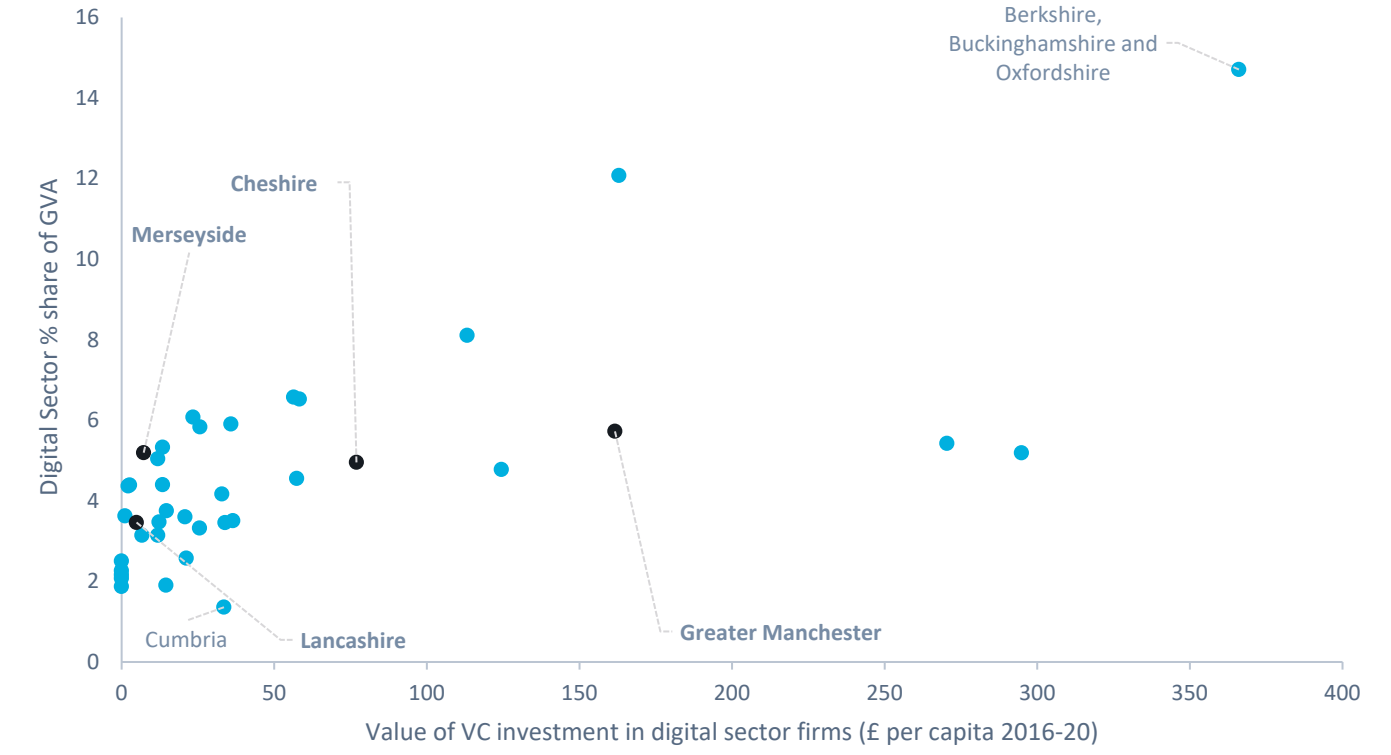
Digital Sector GVA % plotted against HE Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

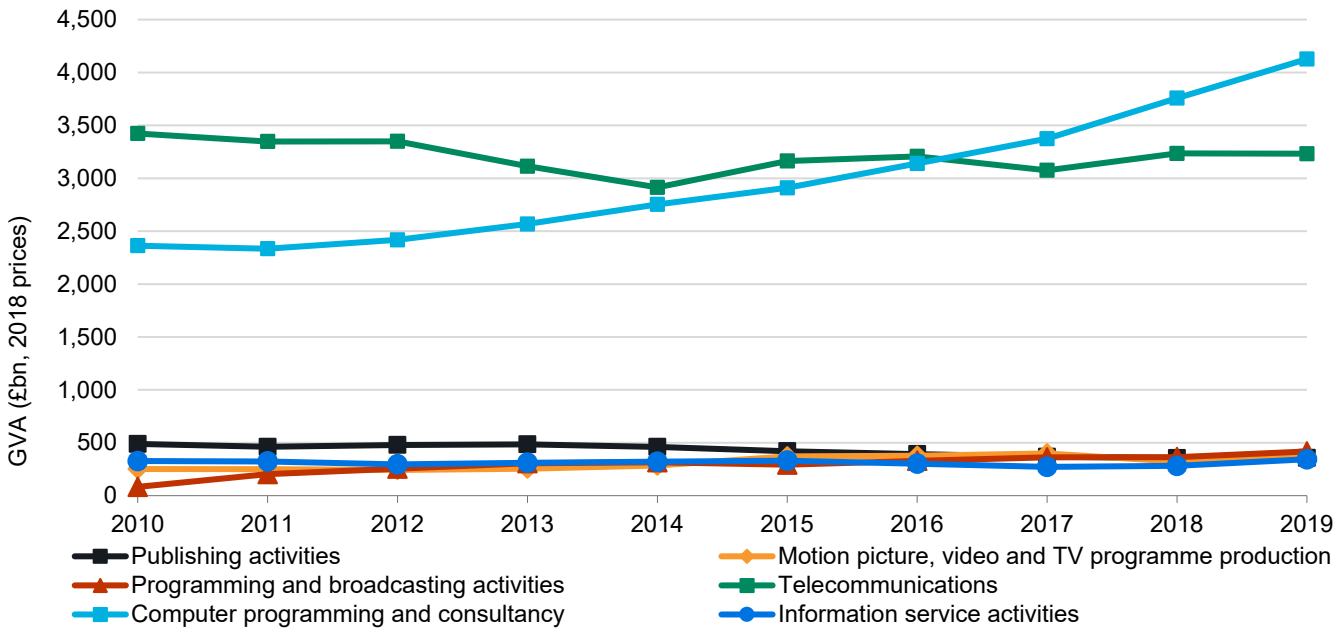
The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector.

The North West – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of the North West, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that there has been significant growth in Computer programming and consultancy, which is now the largest sub-sector in the North West. The second largest sub-sector is Telecommunications, which has, however, shown a slight decline 2010-2019.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which the North West's potential for further economic growth lie. There were 300 high growth businesses in the digital sector in the North West in 2021, equating to 1.7% of the total number of digital sector businesses in the NUTS1 region.
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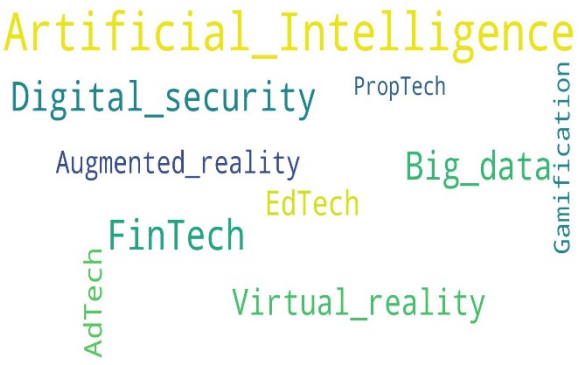


Source: Beauhurst, 2021

The North West's Digital Ecosystem in Summary

Strengths

- For most measures in the digital economy ecosystem framework, the North West ranks at or around the UK median. Positively, productivity has seen a sharp improvement over the past decade, which is critical for future competitiveness.
- At 74.5%, graduate retention is in the second quartile of NUTS1 regions.
- The sector is strongly clustered in a corridor that runs from Manchester in the east, through Cheshire and Warrington, to Liverpool in the west. This corridor is home to the region's major commercial and R&D assets and key employment sites such as the Oxford Road Corridor, MediaCityUK, Daresbury and Baltic Triangle.
- Strong R&D assets, including at the Universities of Manchester, Liverpool and Lancaster. Based on REF results 27.9% of Computer Science and Informatics research was rated 4*, with both Greater Manchester and Lancashire being in the top quartile of NUTS2 regions for this measure. Major R&D assets also include the Engineering and Physical Sciences Research Council's (EPSRC's) Supercomputing Facility at Daresbury (the Hartree Centre).
- Growing base of tech accelerators linked to local sector specialisms, such as the Cyber Foundry (Greater Manchester), UP Accelerator (Salford), the Lancashire Technology Accelerator (Lancaster), and the Digital Manufacturing Accelerator (Liverpool).
- Strong civic leadership, with the region's Local Enterprise Partnerships, combined authorities and Metro Mayors all recognising 'digital' as a key growth opportunity.
- Good digital infrastructure. At 96% of premises, the region has the highest coverage of superfast broadband in the UK.

Opportunities/Specialisms

- Amongst the region's 300 digital sector companies identified as high growth, prominent sub-sectors include 'Software as a Service' (32% of firms), mobile apps (25% of firms), and Analytics/Insight/Tools (17%). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (9% of firms), FinTech (5%), Digital Security (5%), Big Data (4%) and Virtual Reality (4%).
- As recognised in local Industrial Strategies and growth plans of the North West's five sub-regions, opportunities and specialisms include E-commerce, Industry 4.0, digital health, creative, and digital security.
- E-commerce has grown rapidly over the past decade, with companies such as Boohoo and the Hut Group, successfully introducing new digital technologies to disrupt traditional retail, logistics, and manufacturing.
- The region's large traditional manufacturing sector is shifting towards digital. The North West is home to the 'Made Smarter' Pilot, which that works with SMEs to support them to adopt digital technologies, as well as key R&D assets like the Advanced Manufacturing Research Centre North West (Preston), the Manufacturing Technology Centre (Liverpool), and the new Advanced Machinery and Productivity Institute (Rochdale).
- There are major opportunities related to digital health and life sciences, building on assets including academic strengths at the region's universities, clinical trials expertise, a strong life sciences cluster (including Alderley Park, home of the Medicines Discovery Catapult), public sector health datasets, and the devolved health and social care system in Greater Manchester.
- The region has a strong base of digitally enabled creative and cultural industries, in areas such as broadcasting, content creation, and gaming.
- Digital security is an exciting emerging area of specialism for the region. GCHQ's decision to significantly increase its presence in Manchester presents new opportunities for growth.
- The high-performance computing, data analytics and artificial intelligence research capability at The Hartree Centre is a major asset and opportunity.
- Initiatives such as the Lancashire and Cheshire and Warrington Digital Skills Partnerships (funded by DCMS) and Fast Track Digital Workforce Fund (in partnership between DCMS and Greater Manchester Combined Authority) can play important roles in linking within/across the sector.

Barriers to Growth

- Employment in the region's digital sector fell over the 2014 to 2019 period by 2% per annum and the rate of growth in digital occupations was slightly above the bottom quartile for NUTS1 regions (by 0.03% points).
- Access to talent is reported to be a major barrier to digital growth. The region has one of the lowest ratios of Computing Students per head of population amongst UK NUTS1 regions. Digital sector gross annual pay is below the UK median, and regional stakeholders report that the shift to online working during the pandemic has led to a 'virtual brain drain' of staff who can now more easily work for firms in higher-paying regions.
- Access to funding continues to be a challenge. While deal flow for venture capital and angel funding in the North West are around the median for the UK, they are an order of magnitude below the level seen in the highest performing regions. Regional partners have sought to address this by creating new public-private funds such as GC Angels and Northern Gritstone to fill gaps in the private sector funding market.

- A lack of firms progressing from the start-up to scale-up phase is a barrier to digital growth The North West has the lowest three-year business survival rate of any NUTS1 region.
- Low levels of digital innovation are also a barrier. Despite the region's strong R&D assets, the North West performs at slightly below UK average for digital sector R&D tax credit expenditure and slightly above for Innovate UK grants in the AI & Data area. Digital sector university spin-outs per 1m population are in the bottom quartile.
- The North West also has one of the lowest levels of digital services international trade as a proportion of GVA, which is a barrier to accessing international markets and growth opportunities.

Achieving Prosperity

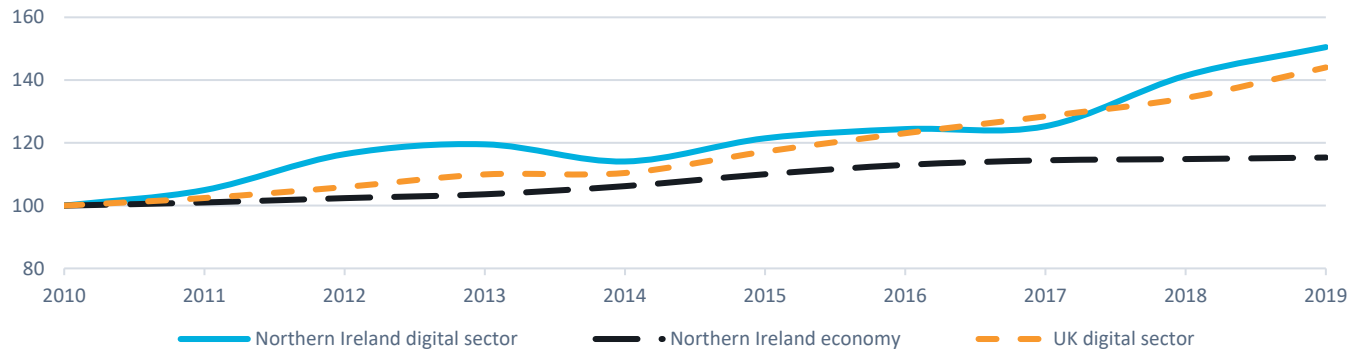
- On the basis of Steer-ED's indicative modelling (see Section 2 of the Main Report), the digital sector in the North West has the potential to grow by at least £2.7 billion in annual GVA by 2025 (an increase of 30% on the 2019 value), creating an additional 50,000 jobs (an increase of 42% on the employment in 2019).
- The North West's digital ecosystem provides a solid and balanced base on which to build, with the commercial and R&D place-based assets a particular strength. However, recent growth has been disappointing and there is a need to better capitalise on opportunities, and address challenges, in each of the five enabling domains.
- To strengthen digital tech business and employment base, it will be important to raise the number of digital start-ups and their survival rates, as well as increasing the number of start-ups that scale.
- The challenge for the Ideas and Innovation enabling domain is to capitalise on the region's digital R&D assets more fully, and complimentary industrial strengths, to increase digital jobs, growth, and productivity. The region's specialisms, such as digital security, e-commerce, creative and media, digital health, and Industry 4.0, all offer global growth opportunities.
- In line with most UK NUTS1 areas, access to talent is an immediate and longer-term constraint to achieving widespread prosperity through digital growth, and needs focusing on, building on initiatives such as the Department for Education and DCMS-funded Digital Skills Bootcamps which are being piloted in Greater Manchester, Lancashire and the Liverpool City Region.
- For the digital hotspots and well-developed place ecosystems in Liverpool and Manchester the challenge is to push forward to become genuinely international digital centres. Similarly, there are niche strengths located across the region, such as high-performance computing in Daresbury and cyber in Lancaster, which offer routes to regional prosperity. As digital becomes increasingly ubiquitous, maintaining a healthy digital ecosystem will be important for all parts of the North West.

Northern Ireland – Summary Dashboard

Region

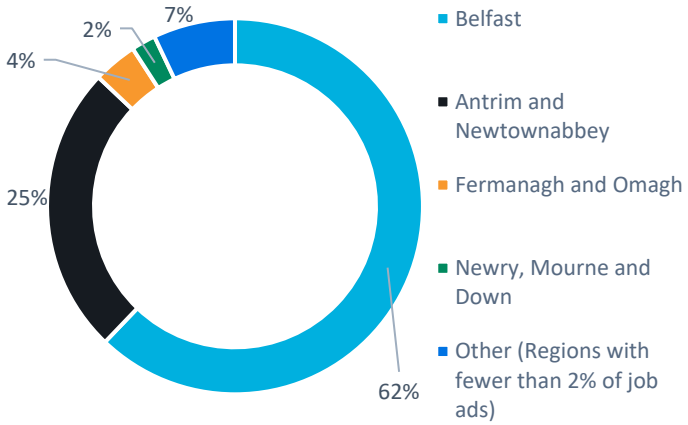
- Component NUTS2 regions: Northern Ireland.
- **Key Statistics:** 14,120km^2, 1.9m population, £41bn total GVA (2019), 1.7% total annual GVA growth (2014-2019).
- Northern Ireland's main population centre is in the Belfast City Region, with over 600,000 of Northern Ireland's population residing in the Greater Belfast Metropolitan Area.
- Northern Ireland has traditionally had an industrial economy, most notably in Shipbuilding, Textiles, and Food/Construction Engineering, with most heavy industry having since been replaced by Services, including a significant public sector. At present, 13% of Northern Ireland's GVA comes from manufacturing, with 74% of the economy's output now coming from the Service sector; the public sector, health, retail and education sectors drive the majority of this Services sector GVA.
- The digital sector is relatively small as a percentage of total output for the region (3.6%), but it is showing strong growth in economic output (5.7%, 2014-2019), faster than the UK's Digital Sector, and much faster than Northern Ireland's economy as a whole.
- Digital employment (estimated at 45k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector. This is indicative of the high demand for digital skills in non-digital sector industries, such as Consulting, Recruitment, and Finance, where Northern Ireland has large employers of digital occupations.
- Demand for digital occupations across Northern Ireland drove over 21,600 digital occupation online job postings between January 2019 and December 2020. The demand for digital occupations was concentrated in Belfast, accounting for 62% of all job adverts for digital occupations in Northern Ireland.
- There is relatively high demand for Test Automation Engineers and Embedded Software Engineers (location quotients of 1.7 and 1.5, significantly above 1.0, the UK average) although the largest absolute demand for occupations is for Software Developers, making up 24% of digital occupation job adverts in the 2019-2020 period.

Digital Sector GVA growth 2010-2019 (indexed to 2010), Northern Ireland NUTS1 Region



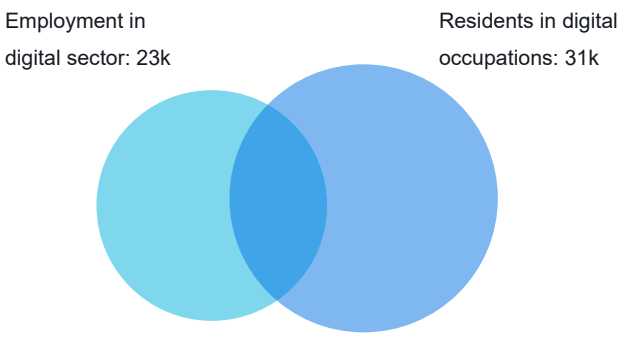
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS3 region in Northern Ireland (2019 – 2020)*



Source: Geek Talent, 2021. *'Other' includes Armagh City, Banbridge ad Craigavon, Lisburn and Castlereagh, Ards and North Down, Mid Ulster, Causeway Coast and Glens, Mid and East Antrim

Digital Sector and Digital Occupation Employment (2019), Northern Ireland NUTS1 Region



Total digital employment: c. 45k

Source: Business Register and Employment Survey and Annual Population Survey, 2019, Northern Ireland Statistics and Research Agency

Concentration of demand for Digital Occupations (2019-2020), Northern Ireland NUTS1 Region

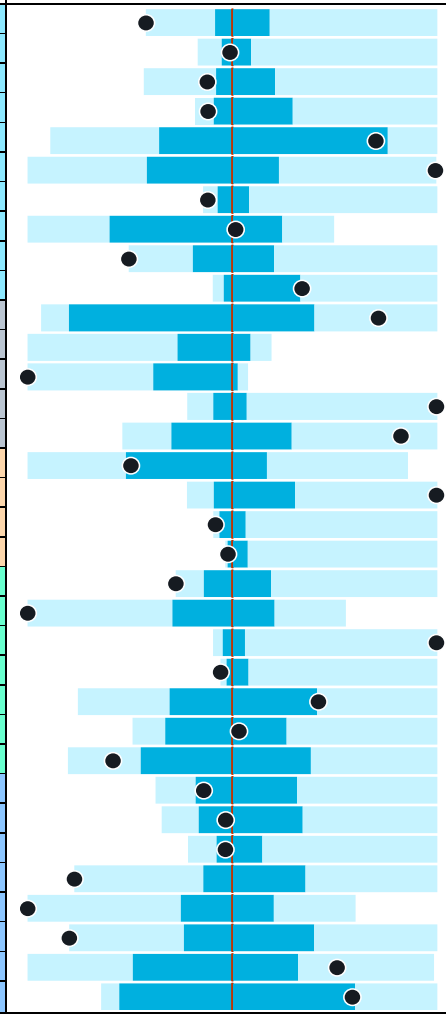
- This table shows digital occupations by demand for Northern Ireland. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, but comparative demand is highest for Test Automation Engineers and Embedded Software Engineers. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Test Automation Engineer	892	2.9%	1.75
Embedded Software Engineer	2,266	7.2%	1.51
IT Consultant	815	2.6%	1.30
IT Service Manager	723	2.3%	1.29
DevOps Engineer	1,068	3.4%	1.26
Software Developer	7,554	24.2%	1.20
Full Stack Developer	529	1.7%	1.08
IT Architect	1,897	6.1%	1.01
Management Consultant	224	0.7%	1.01
Cyber Security Analyst	1,099	3.5%	0.97

Source: Geek Talent, 2021

Northern Ireland - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for Northern Ireland and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where Northern Ireland (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, Northern Ireland is above the median value on this indicator.

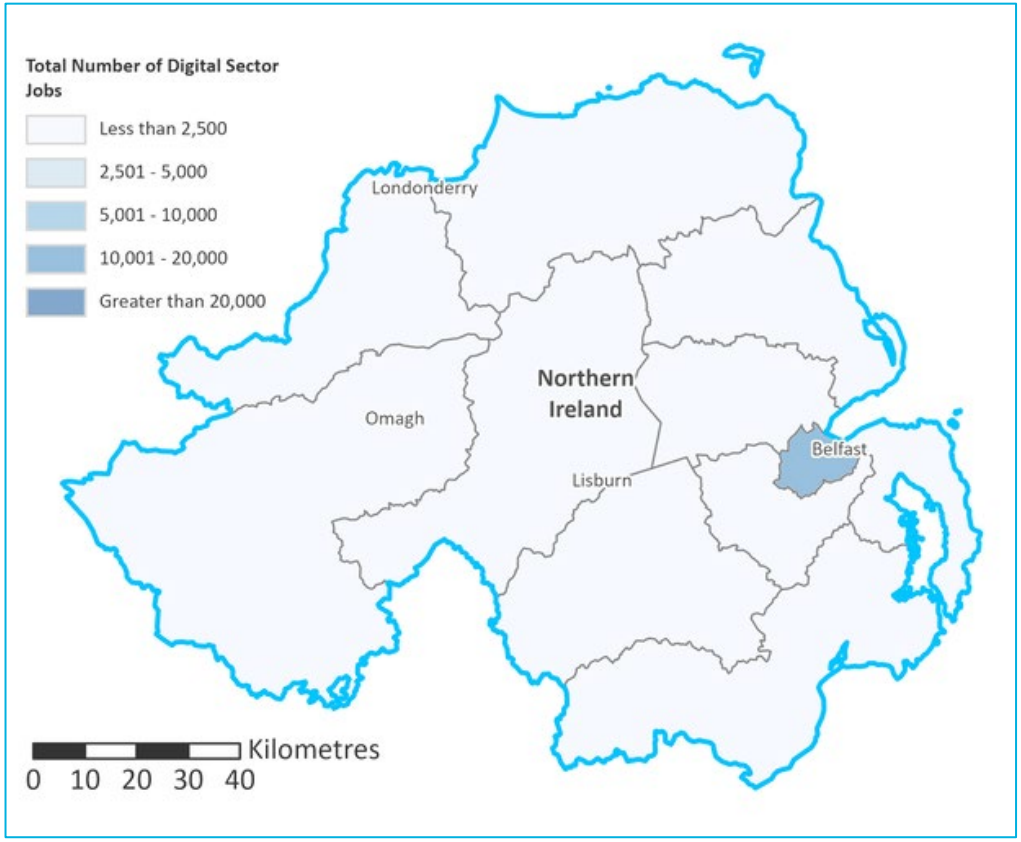
Indicator name	Period	NI	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**3.0**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**3.0**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**3.9**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**5.2**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**6.6**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**9.4**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**3.6**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**5.7**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**29.8**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**1.4**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**18.7**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	*		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**89.1**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**60.7**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**67.5**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**60.0**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**5.7**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**3.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**20.8**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**60.8**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**10.0**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**75.6**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**2.3**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**5.3**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.4**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**0.8**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**33.1**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**38.9**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**38.1**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**88.2**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**89.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**23.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**79.2**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**2.3**		1.3	1.4	1.8	2.3	2.6

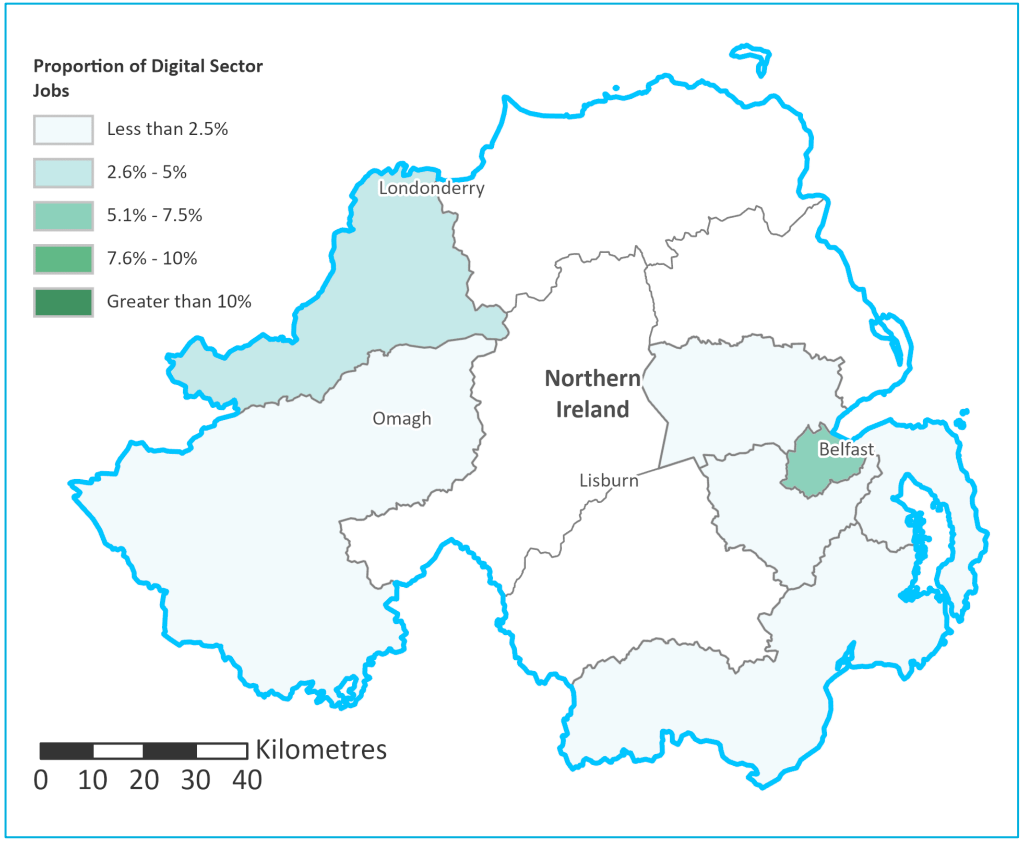
Source: Steer-ED and various datasets – See Appendix B, *not accessed for Northern Ireland

Northern Ireland - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

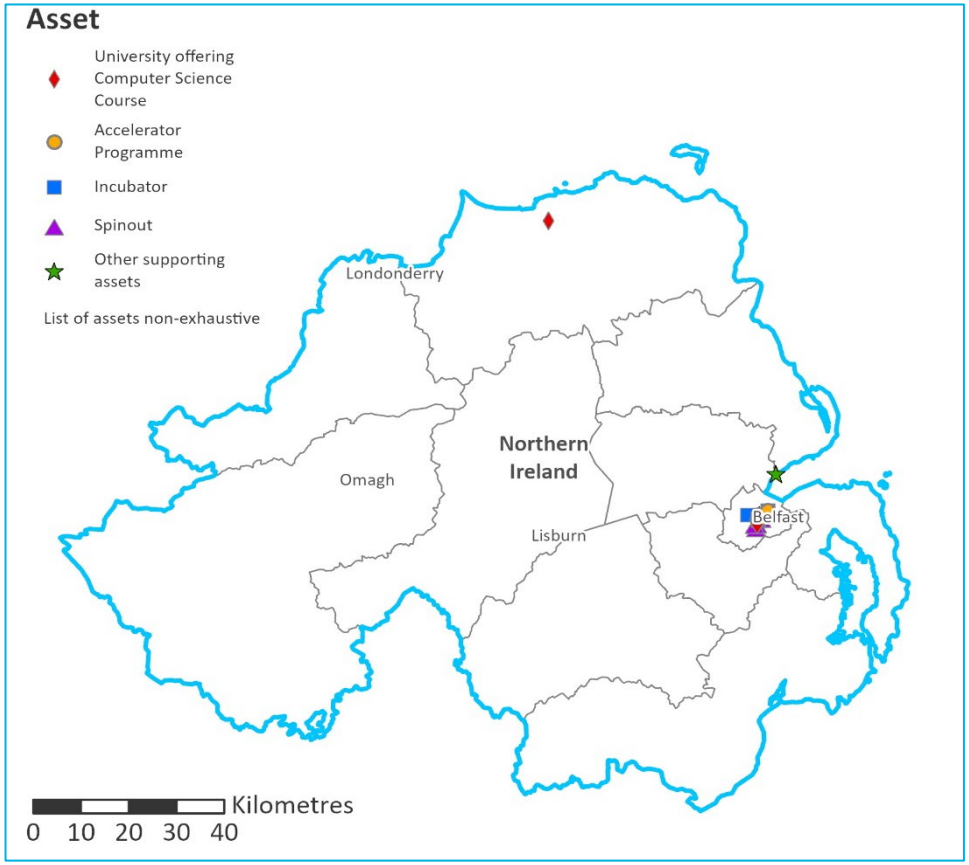
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

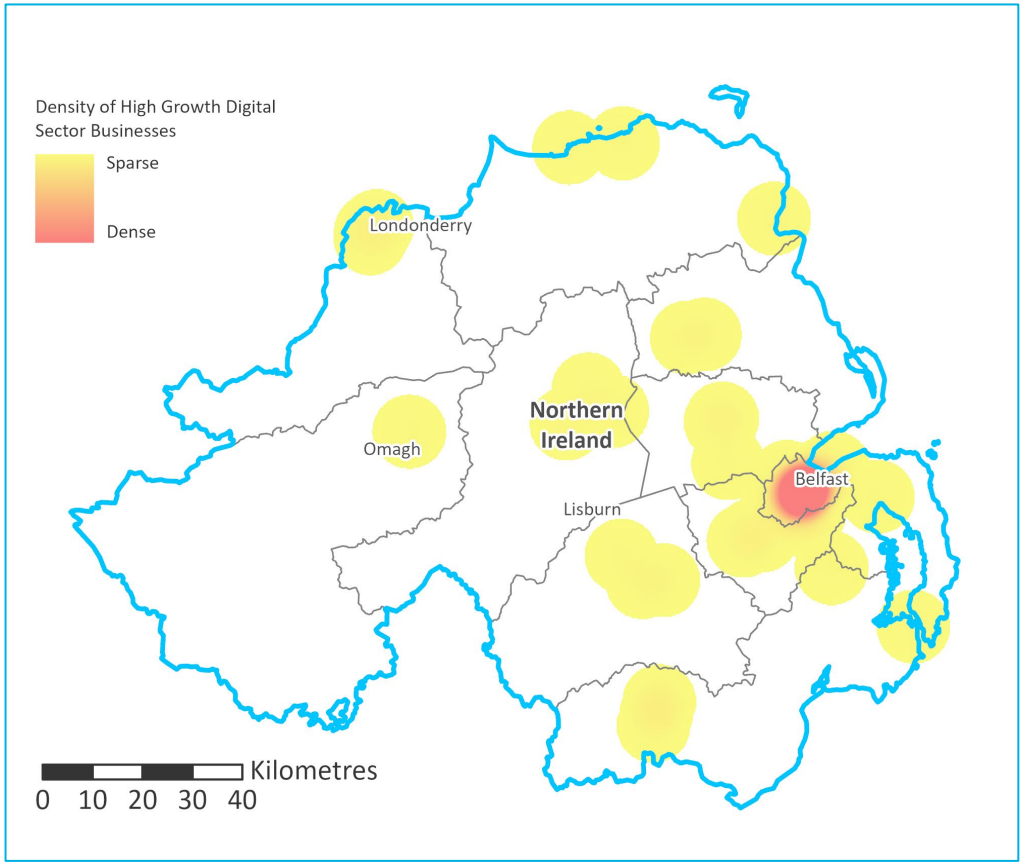




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in Northern Ireland, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in Northern Ireland. It highlights how high growth businesses are concentrated in larger urban areas.



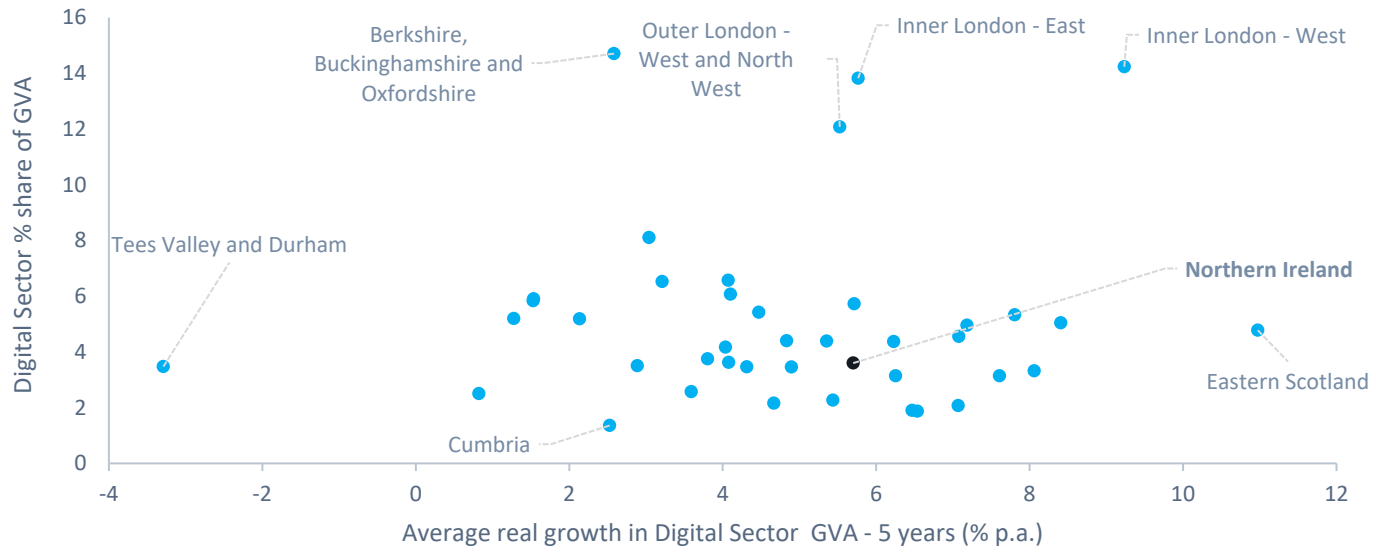


Northern Ireland – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in Northern Ireland, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. Northern Ireland are indicated in black. Key outliers outside Northern Ireland are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in Northern Ireland.

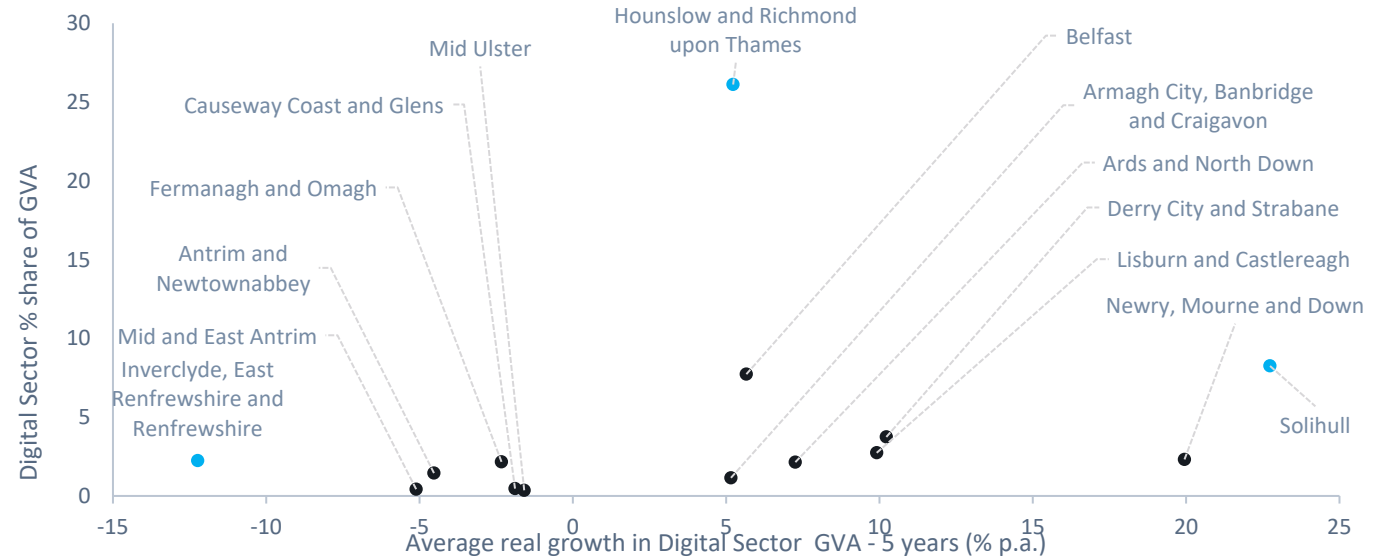
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

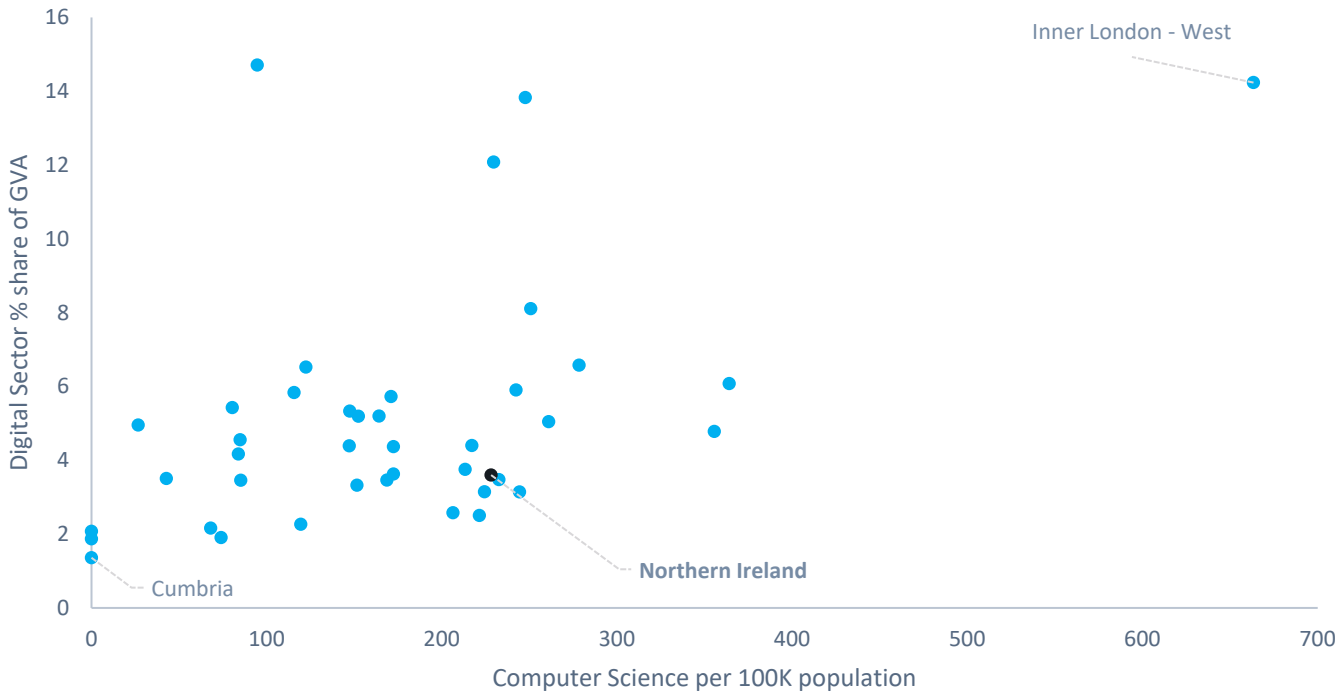
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – Northern Ireland NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in Northern Ireland's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

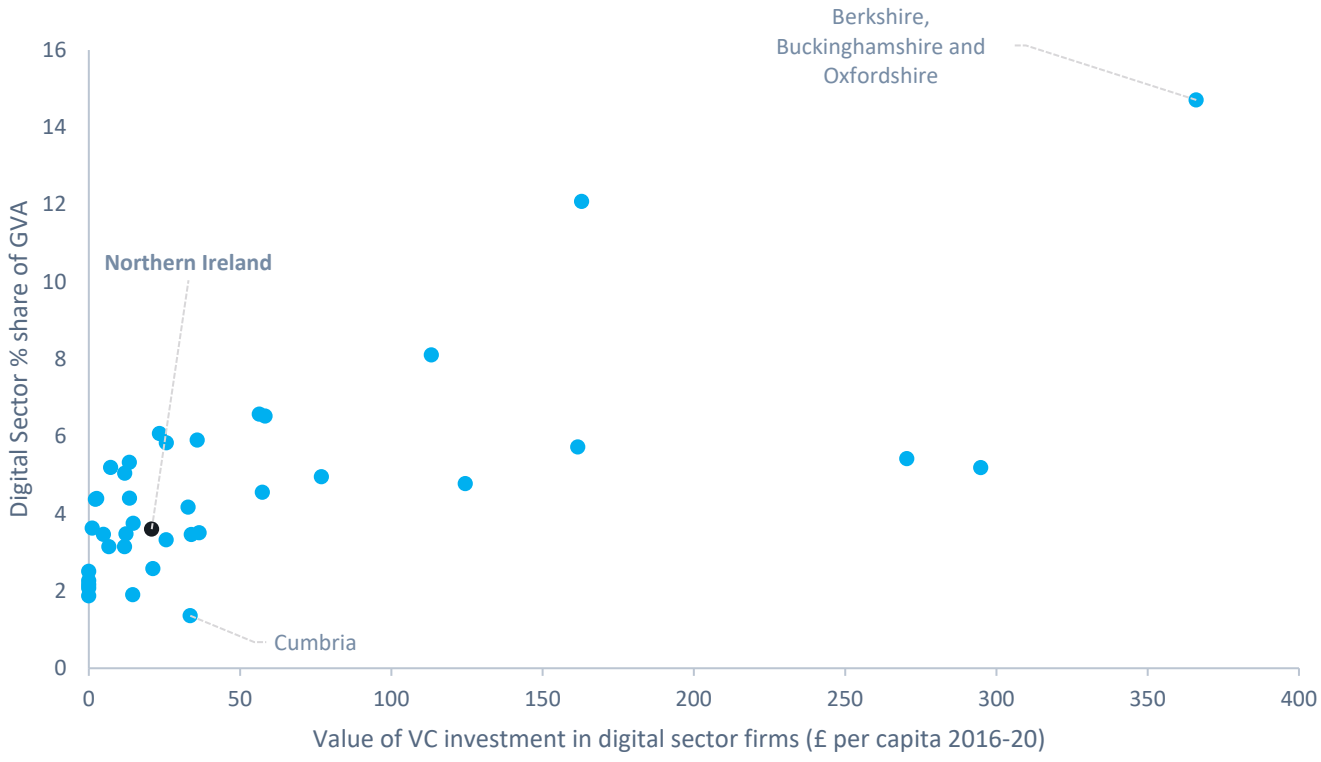
Digital Sector GVA % plotted against HE Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

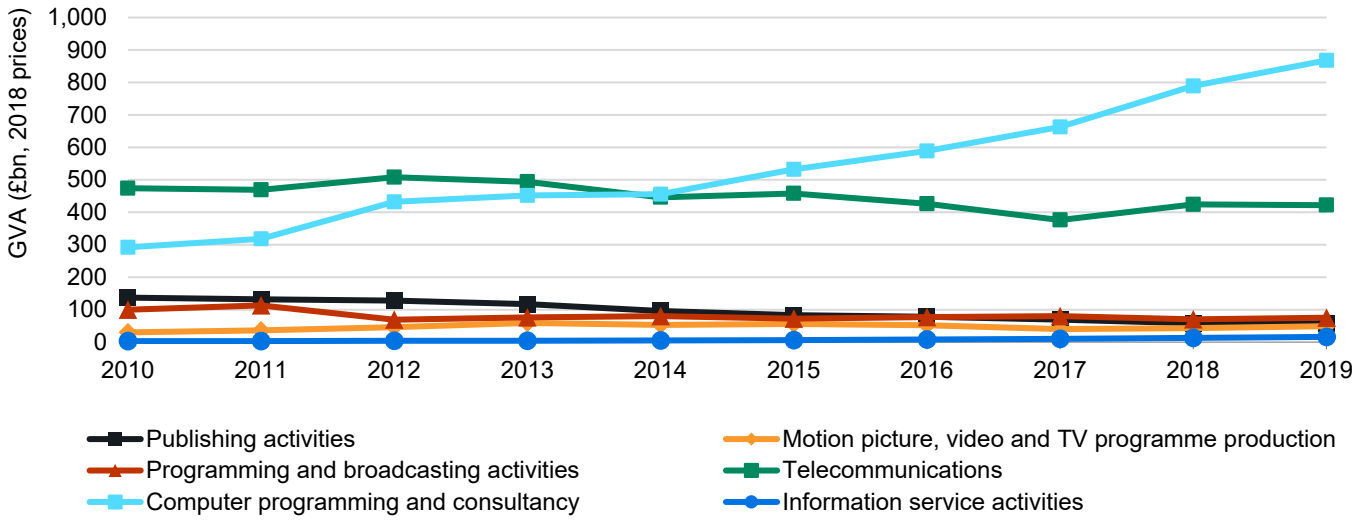
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector.

Northern Ireland – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of Northern Ireland, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

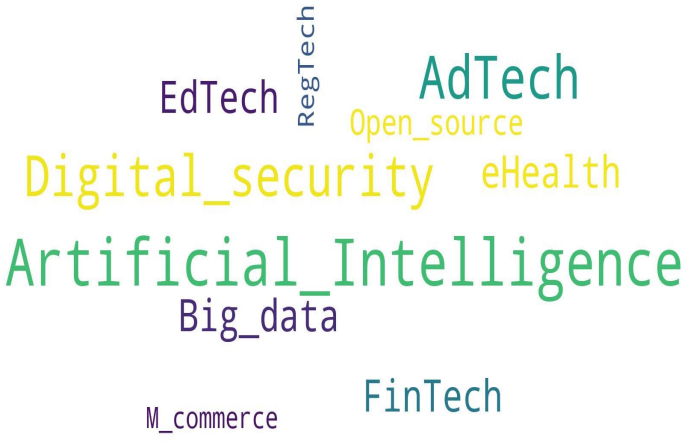
- The chart above shows that there has been significant growth in Computer programming and consultancy, which is now the largest digital sub-sector for Northern Ireland. These sub-sectors are where the growth potential for Northern Ireland is. Telecommunications is the second largest sub-sector in Northern Ireland, but this sector hasn't grown over the last decade.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which Northern Ireland's potential for further economic growth lie. There were 129 high growth businesses in the digital sector in Northern Ireland in 2021 equating to 5.7% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

Northern Ireland's Digital Ecosystem in Summary

Strengths

- Strong digital employment and digital occupation growth rates, averaging 6.6% per annum and 9.4% per annum, the latter being the highest of UK NUTS1 regions.
- Top-performing region for full fibre coverage (60.7% of premises), with gigabit-capable coverage in upper quartile (67.5% of premises).
- Top-performing region for percentage of regional digital sector stock identified by Beauhurst as 'high-growth'. Performance assisted by comprehensive suite of start-up and scale-up programmes from Invest Northern Ireland (Invest NI).
- Top-performing region for annual digital sector R&D tax credit expenditure, again helped by innovation and commercialisation programmes provided by Invest NI.
- Strong strategic underpinning to digital sector's development. Northern Ireland's Department for the Economy's (NI DfE's) 10X Strategy (2021) defines digital sector as one of five priority clusters for the region. Supported by route-maps, such as Invest NI Ireland's Business Plan and Digital Northern Ireland 2020, and close alignment between sector priorities and business support programmes (start-up and scale up).
- IPOs of home-grown firms – e.g. Kainos (ex Queens University) and First Derivatives - and scaling of others – e.g. Datactics – are important local demonstrators of growth and scaling success.
- '*Accelerate'*, delivered for Invest NI by IGNITE, is a key accelerator for the digital sector, with Invest NI's Propel programme also supporting digital firms. Sector also benefits from good incubation facilities e.g. those operated by Catalyst at Titanic Quarter Belfast, Derry/Londonderry, and Ballymena, and others such as Centre for Secure Information Technologies (CSIT) at Queens, and The Ormeau Baths.
- Inward investment (both reinvestment and new) is done well In Northern Ireland. Region's digital economy USP for Inward Investment builds on skills availability, infrastructure, cost-effectiveness, and supportive business environment. The India-UK Advanced Technology Centre of Excellence in Next Generation Systems/Services (University of Ulster) is a recent success. Growing recognition overseas for region's capabilities in Cyber-Security, FinTech, and HealthTech.

Opportunities/Specialisms

- NI DfE's 10X Strategy prioritises Cyber Security, AI and Data Analytics, Telecoms, Mobile and Data, Networks, Healthcare IT, Smart Cities, Sports Tech, and Digital/Entertainment Media. Added to this, research by Whitecap Consulting (Nov 2020) for FinTechNI finds the region's Fintech ecosystem to have the highest concentration of FinTech employment in the UK, with an estimated 7,000 FinTech-related roles, with one in five people working across the financial and tech sectors in Northern Ireland working in FinTech.
- Amongst the region's 129 digital sector companies identified as high growth, prominent sub-sectors include Software-as-a-Service (45% of firms) and Analytics/Insights/Tools (21% of firms). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (9% of firms), AdTech (8), Digital Security (7%), FinTech (4%), and Big Data (again, 4%).
- The region has an exceptionally strong and well-proven portfolio of start-up/scaling programmes, incorporating international good practice. This can be used to drive further digital economy start-ups and growth.
- Digital Catapult NI ensures the region' full and effective role in the wider GB Digital Catapult agenda.
- Infrastructure opportunities identified in Digital Northern Ireland 2020 include extending fibre to business parks/communities/homes, ensuring web-service ready business parks, establishing a global cloud computing node, and a population-wide E-skills Development Programme.
- The Institute of Electronics, Communications and Information Technology (ECIT) at Queens hosts an award-winning UKRI Innovation and Knowledge Centre (IKC), focused on Cyber Security. Similarly, the new AI Collaboration Centre (AICC), led by Ulster/Queen's Universities, will connect the region's AI cluster with the UK Office for Artificial Intelligence, helping to drive regional AI and Machine Learning activity. Will augment existing Small Business Research Initiative support for AI in the region.
- The global regional diaspora can play a major role in advocating, networking, and opportunity-spotting for the region's digital ecosystem, as exemplified by its recent investment in The Ormeau Baths Workspace). '*Do digital back home'* can be a key component of inward investment efforts.
- The shared border with the Republic of Ireland offers interesting opportunities for co-developing the digital economy on the island of Ireland.

Barriers to Growth

- Superfast broadband coverage is the lowest of all UK NUTS1 regions (89.1% of premises).
- Average percentage Computer Science Research rated as '4*' is the lowest of all UK NUTS1 regions.
- Internet access and use is weak – the region is worst performing for the proportion of households with Internet access (89%), and people aged 16+ using the internet is in the bottom quartile (88.2%).

- The scope and scale of financial incentives to business in the region, which are amongst the most attractive of all UK NUTS1 regions may reduce in future. This may influence the region's ability to attract and retain digital economy firms.
- Energy prices for business remain high in Northern Ireland. This is like to constrain the region's attractiveness to energy intensive digital sectors, such as data centres.

Achieving Prosperity

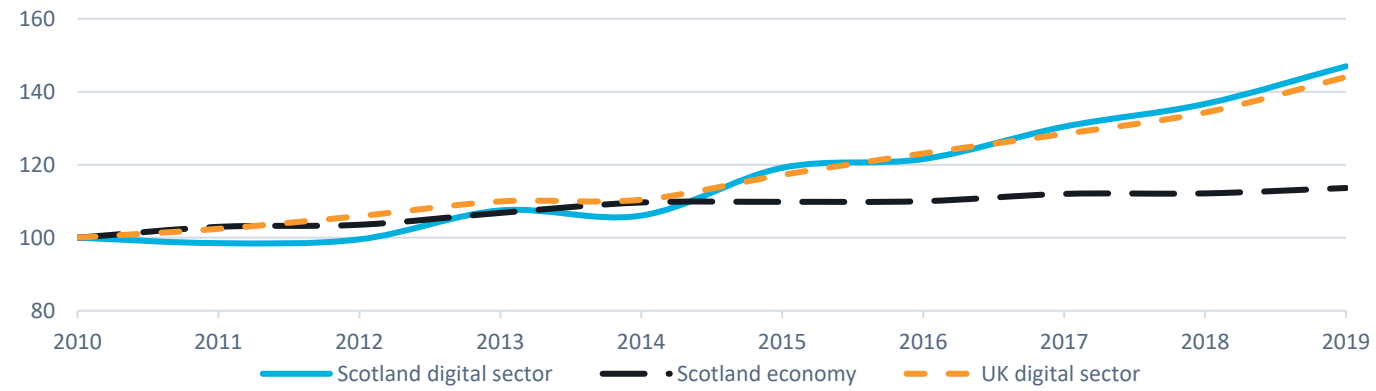
- On the basis of Steer-ED's indicative modelling ((see Section 2 of the Main Report), the digital sector in Northern Ireland has the potential to grow by at least £0.8 billion in annual GVA by 2025 (an increase of 53% on the 2019 value), creating an additional 13,300 jobs (an increase of 47% on the employment in 2019).
- The digital economy ecosystem in the region, well supported by public policy, is firmly established and provides a highly collaborative foundation to build on. But, performance across the ecosystem's enabling domains is mixed. Positively, growth rates for employment and digital occupations have been strong, as are full fibre and gigabit coverage, and the proportion of digital sector firms identified as 'high-growth' is best-in-class.
- Set against this, the digital sector as a proportion of total enterprises is significantly smaller than elsewhere, digital sector productivity is in the lower quartile, and Superfast broadband coverage, the average percentage of Computer Science Research rated '4*', and the proportion of households with internet access are all the weakest of UK NUTS1 regions. These specific constraints on the 'prosperity potential' of the region's digital economy should be a key focus.
- The digital sector's already strong cluster in Belfast should be maintained and strengthened further, this in addition to developing-out wider digital economy growth as the Belfast City Region establishes.
- The sector priorities defined in NI DfE's 10X Strategy, and supporting operationally by Invest NI, provide certainty and clarity of direction going forward. Policy should, however, however remain agile in accommodating new and breaking digital sector opportunities as they come into view, as has been the case with Cyber Security and FinTech.

Scotland – Summary Dashboard

Region

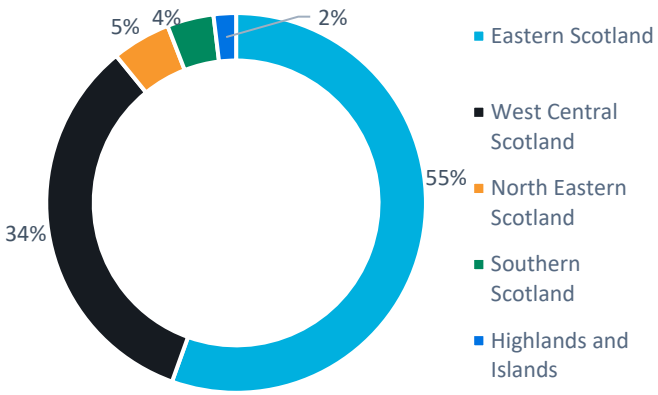
- **Component NUTS2 regions:** North Eastern Scotland, Highlands and Islands, Eastern Scotland, West Central Scotland and Southern Scotland.
- **Key Statistics:** 77,910km^2, 5.5m population, £144bn total GVA (2019), 0.7% total annual GVA growth (2014-2019)
- Scotland is a multi-centred nation, with main population centres in Edinburgh, Glasgow, Dundee and Aberdeen.
- This region continues to perform strongly relative to the UK in scientific research and development, security and investigation activities and office administration and business support activities.
- The Digital Sector is relatively small as a percentage of total output for the region (4.3%), but it is showing strong growth in economic output (6.7%, 2014-2019), marginally faster than the UK's Digital Sector, and much faster than Scotland's economy as a whole.
- Digital Employment (estimated at 145k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector, indicative of higher demand for digital skills in non-digital sector industries such as Energy and scientific research and development.
- Demand for digital occupations is dominated by Eastern Scotland, with 55% of digital occupation online job postings 2019-2020. This is followed by Western central Scotland, with these two most urbanised NUTS2 regions constituting 89% of demand. This reflects the dominance of both Edinburgh and Glasgow in Scotland.
- There is relatively high demand for Embedded Software Engineer (location quotient above 1.0, the UK average) although the largest absolute demand for occupations is Software Developers, making up 21% of digital occupation job adverts 2019-2020 and Data Engineers (10%), indicating increasing demand for innovative software and accelerating growth in technology.

Digital Sector GVA growth 2010-2019 (indexed to 2010), Scotland NUTS1 Region



Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in Scotland (2019 – 2020)

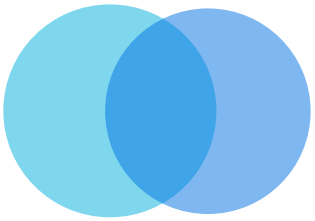


Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), Scotland NUTS1 Region

Employment in digital sector: 95k

Residents in digital occupations: 89k



Total digital employment in Scotland: c. 145k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations, Scotland NUTS1 Region

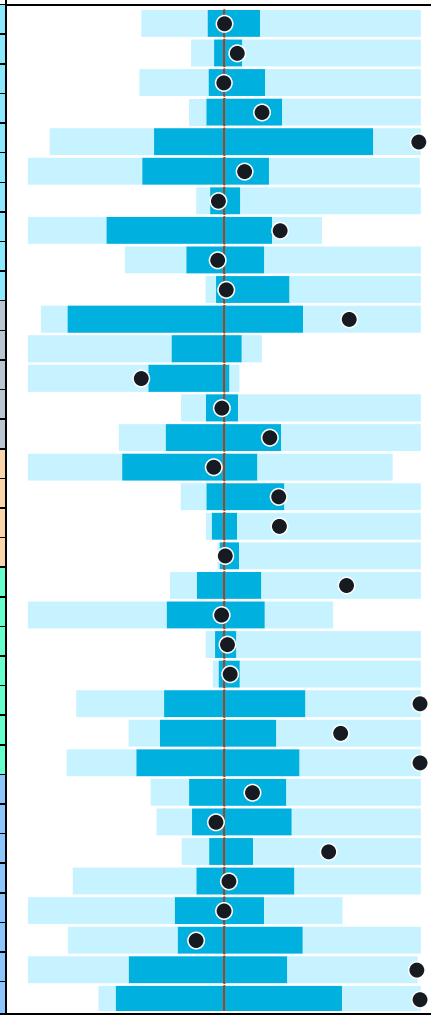
- This table shows digital occupations by demand for Scotland. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, Data Engineers, Embedded Software Engineers and Business Analysts. Similar to Embedded Software Engineers, IT Architects make up a relatively large share of occupation adverts and have relatively high comparative demand.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Embedded Software Engineer	10,600	7.6%	1.58
Test Automation Engineer	2,604	1.9%	1.15
Test Analyst	4,194	3.0%	1.12
IT Architect	8,814	6.3%	1.05
Software Developer	28,899	20.8%	1.04
Database Administrator	1,819	1.3%	1.02
Full Stack Developer	2,217	1.6%	1.02
DevOps Engineer	3,832	2.8%	1.01
Technical Author	2,343	1.7%	1.01
Cyber Security Analyst	5,023	3.6%	0.99

Source: Geek Talent, 2021

Scotland Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for Scotland and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator
- The box plot below the table indicates visually where Scotland (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, Scotland is above the median value on this indicator.

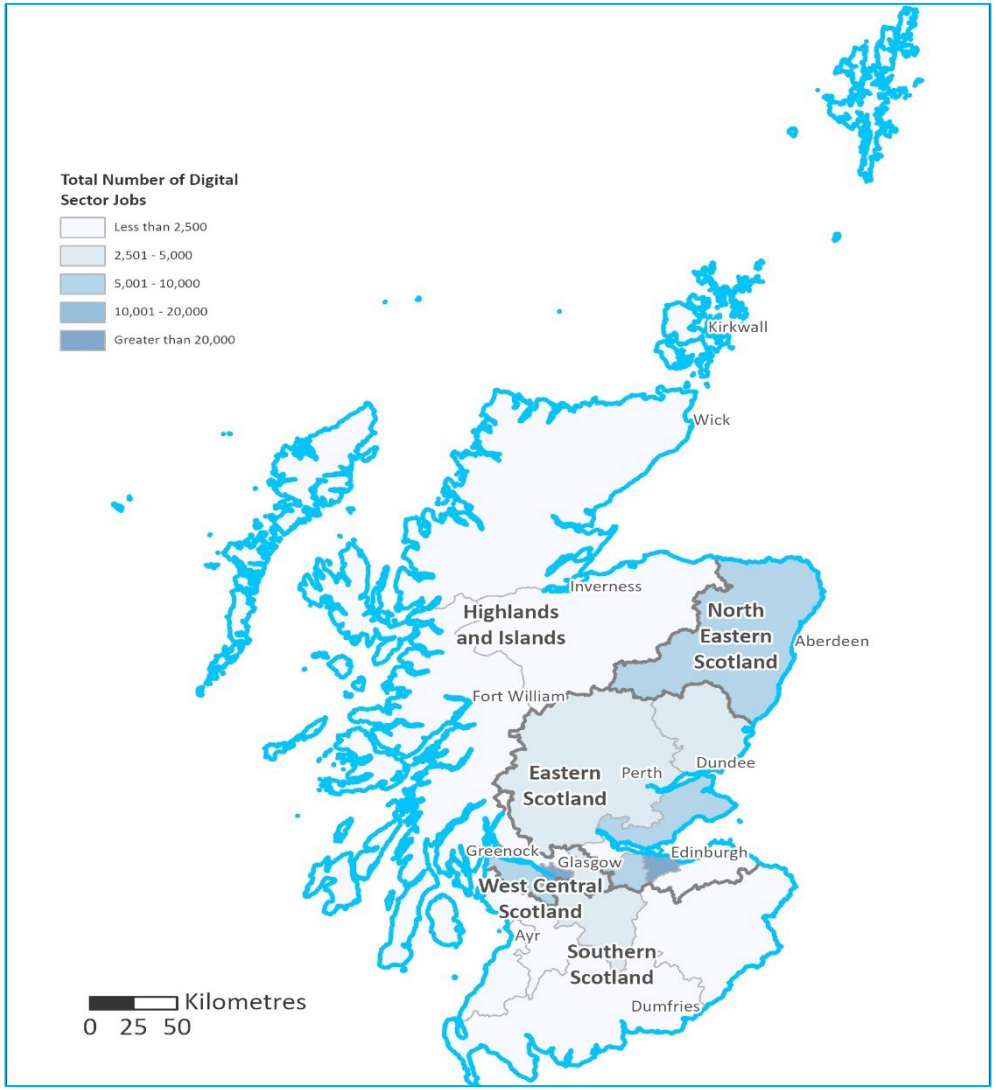
Indicator name	Period	Scot.	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**6.3**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**3.4**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**4.2**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**7.3**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**8.2**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**6.0**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**4.3**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**6.7**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**40.0**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.3**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**18.3**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	*		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**92.8**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**19.1**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**42.7**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**61.6**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**2.8**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**39.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**52.2**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**309.9**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**24.9**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**20.0**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**21.4**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**7.3**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.6**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**1.7**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**36.7**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**38.8**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**49.3**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**91.3**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**94.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**39.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**87.8**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**2.6**		1.3	1.4	1.8	2.3	2.6

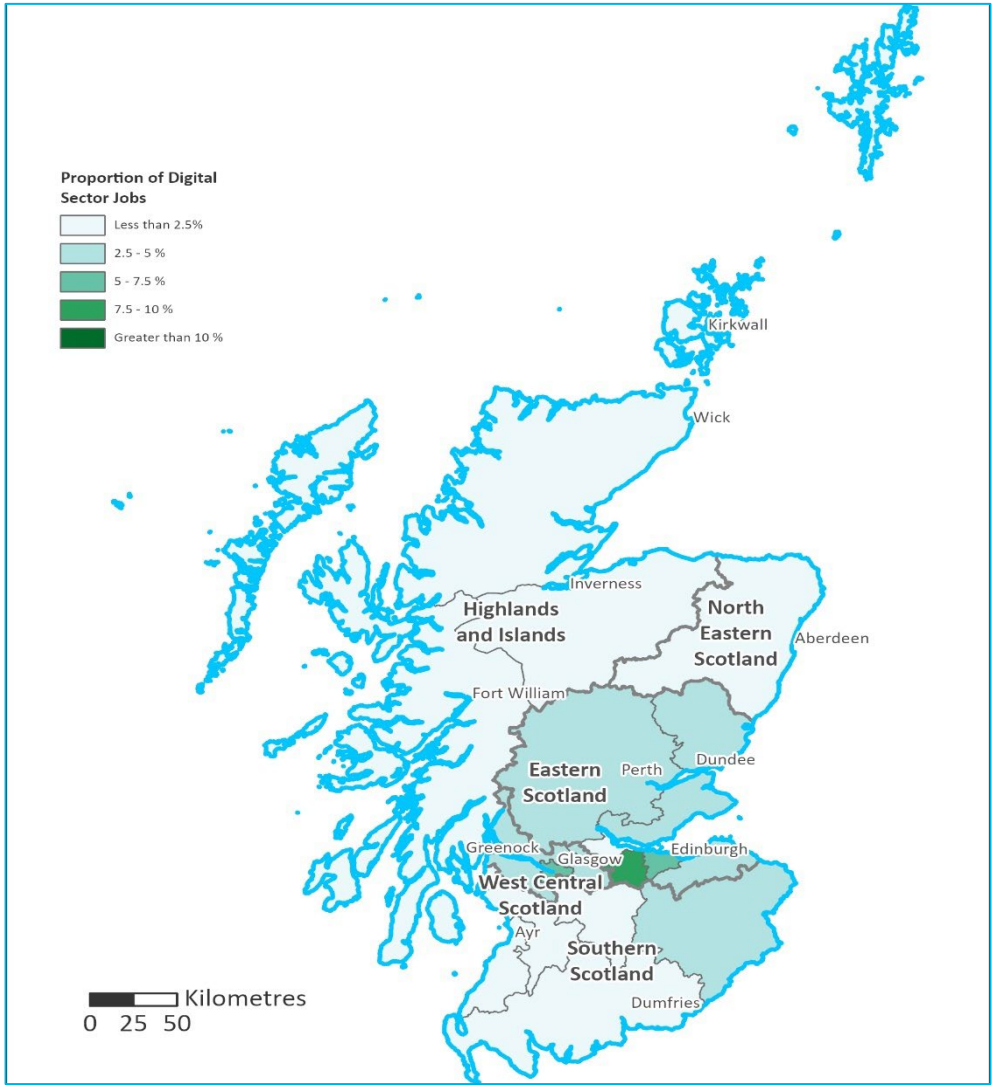
Source: Steer-ED and various datasets – See Appendix B *not accessed for Scotland

Scotland - Digital Sector's spatial distribution

Digital Sector Employment Total, and as a percentage of Total Employment by NUTS3 (2019)

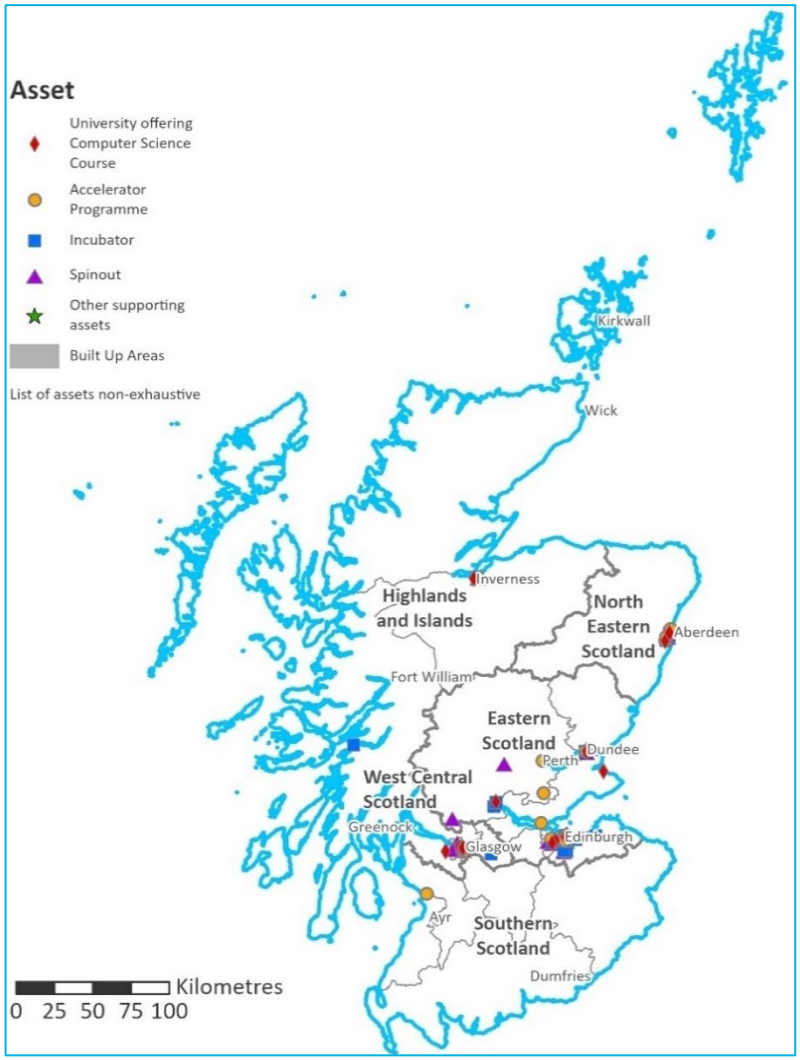
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

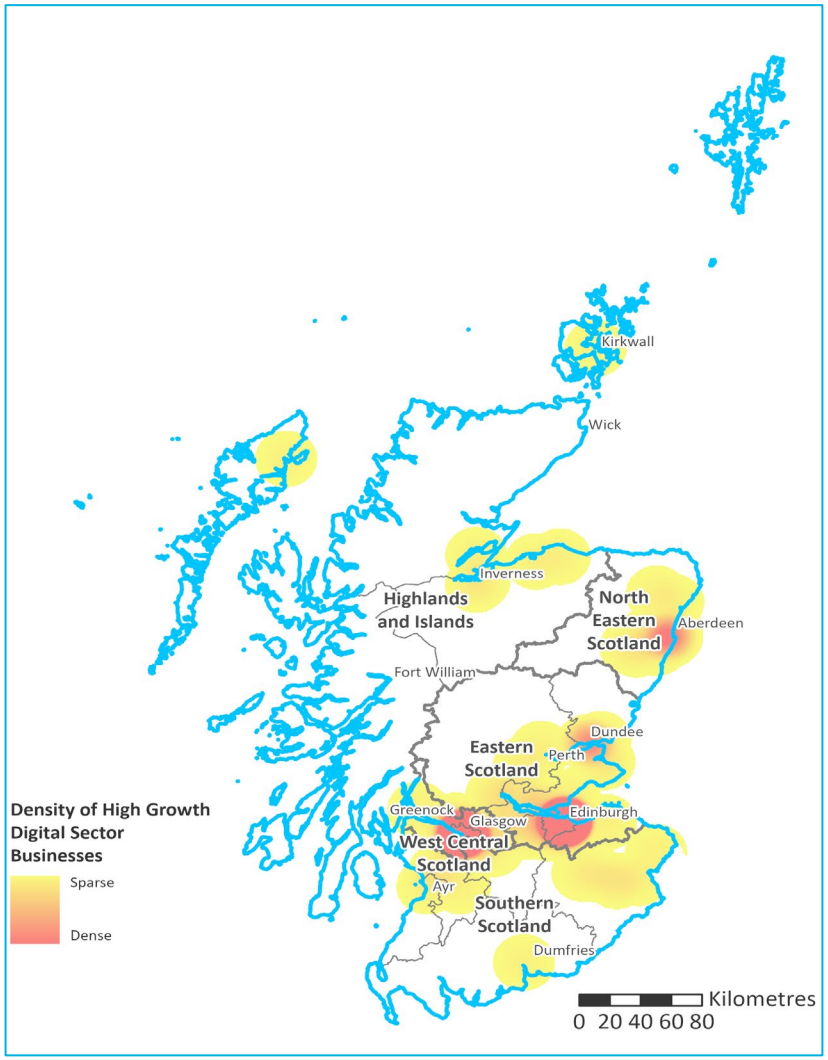




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in Scotland, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in Scotland. It highlights how high growth businesses are concentrated in larger urban areas.



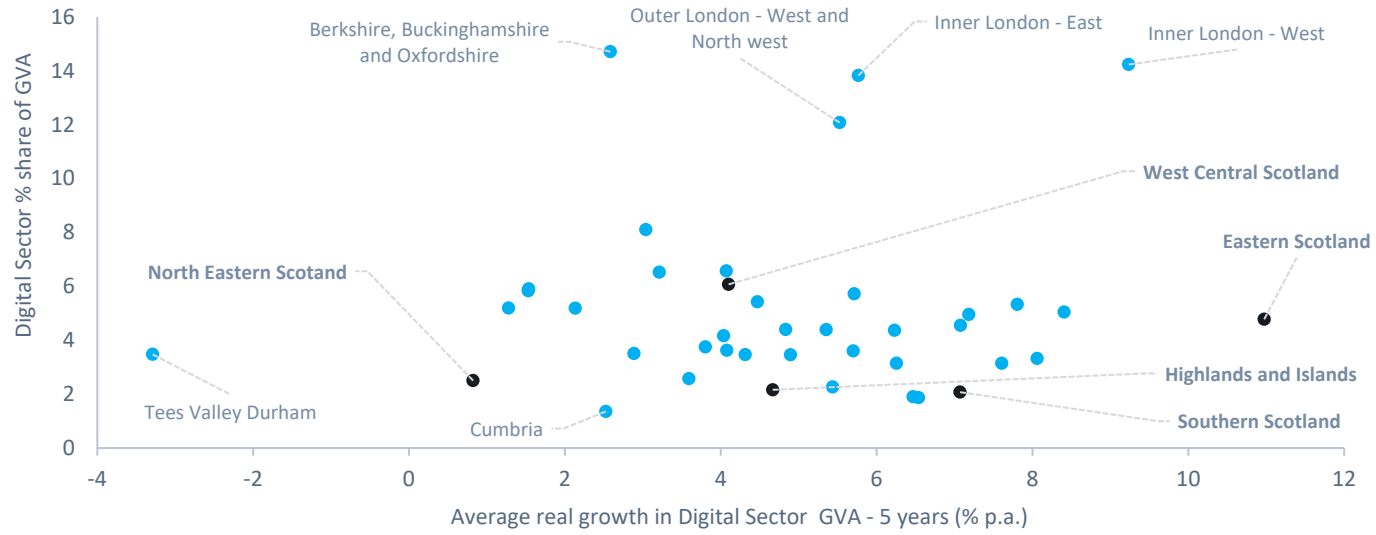


Scotland – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in Scotland, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. Scotland are indicated in black. Key outliers outside Scotland are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in Scotland.

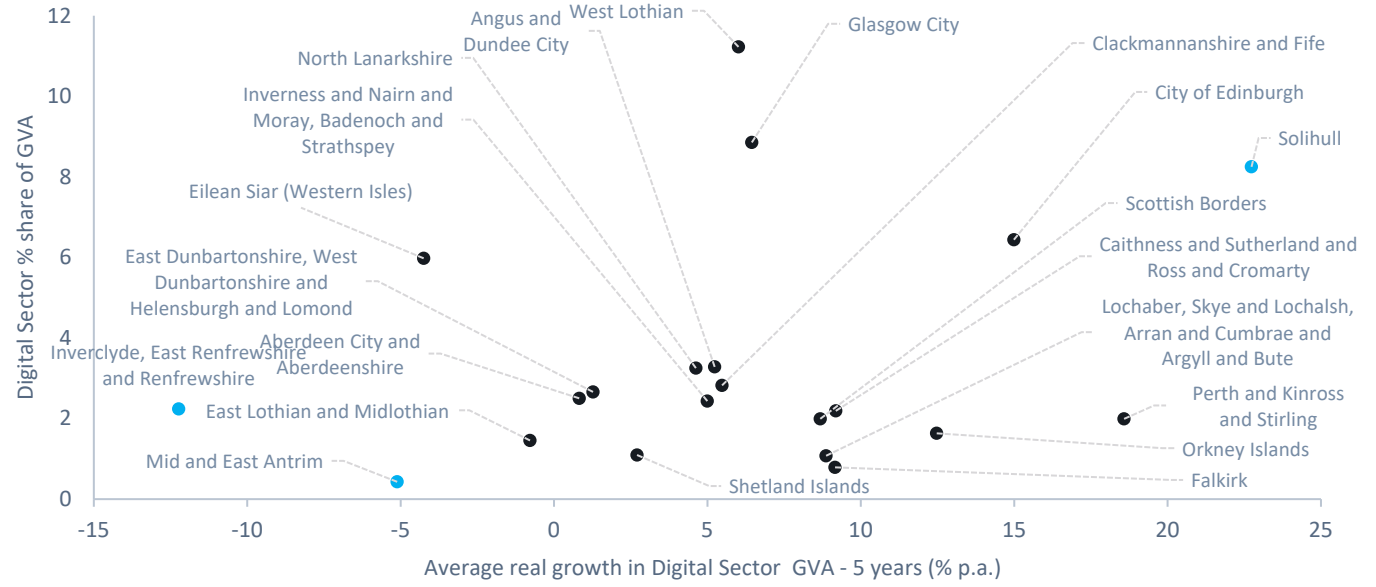
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

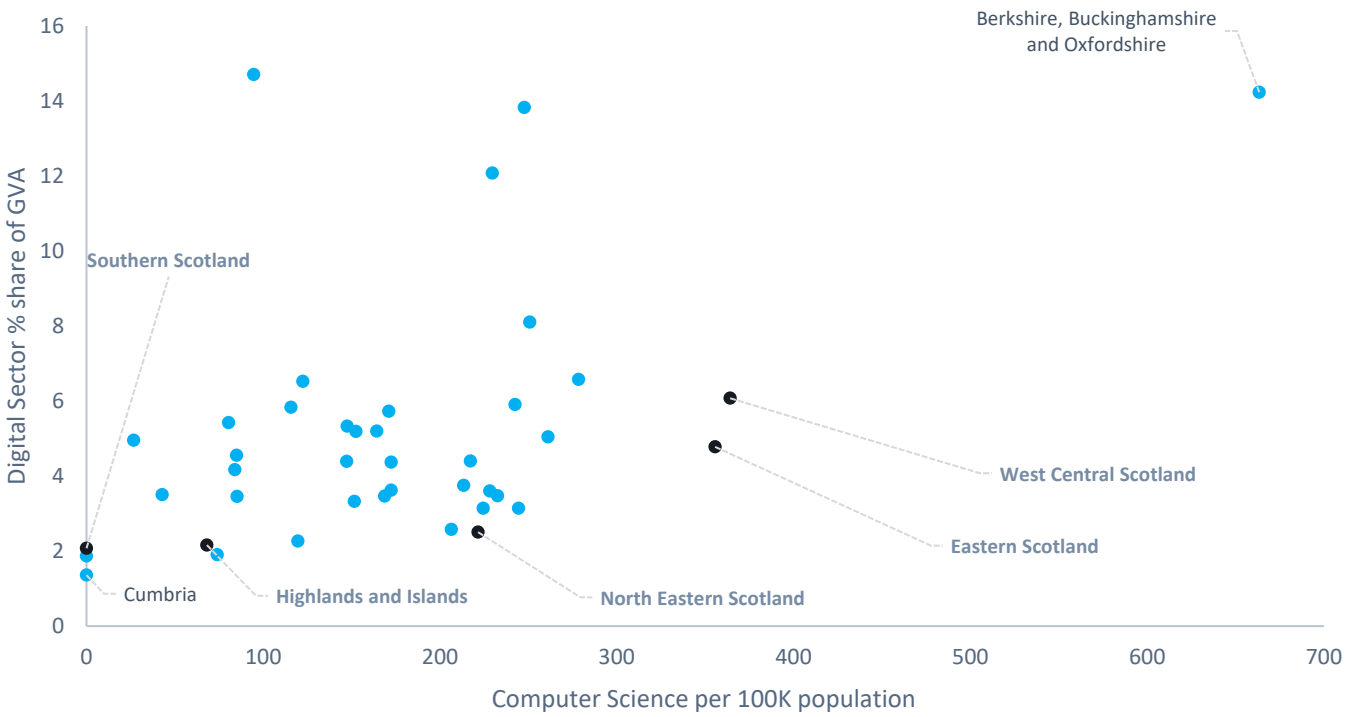
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – Scotland NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in Scotland's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

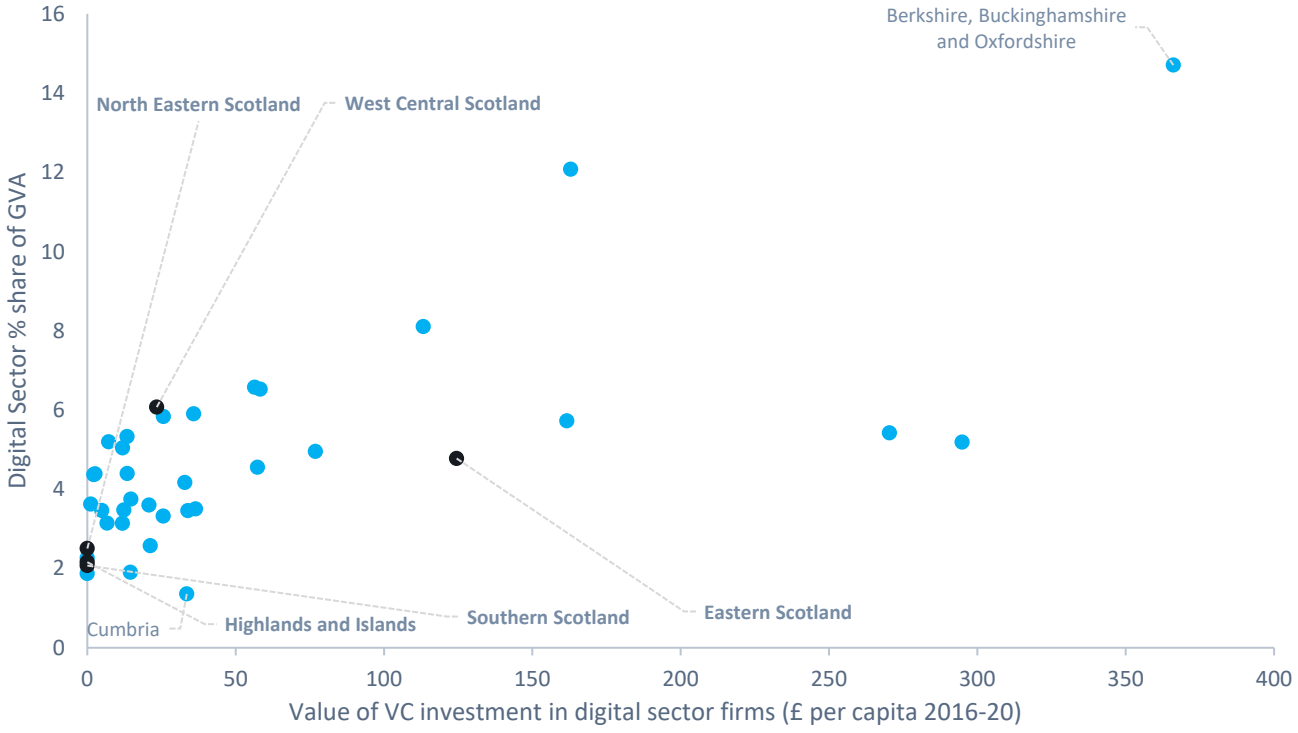
Digital Sector GVA % plotted against HE Computing Students per 100k population (NUTS2 regions)



Source: HSEA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

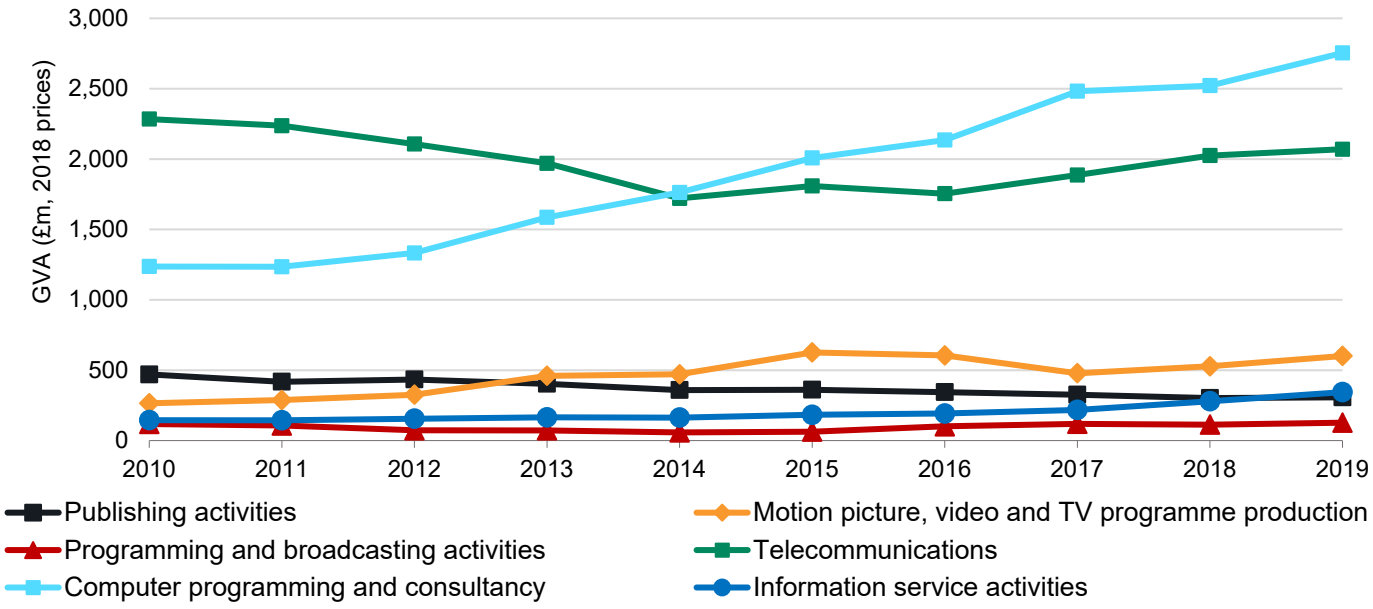
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector. Inner London East and West have been excluded as significant outliers.

Scotland – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of Scotland, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



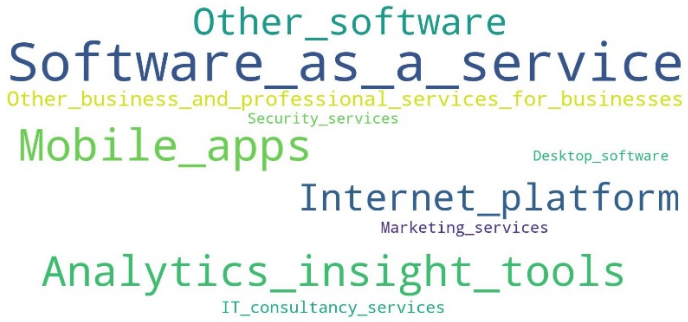
Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that there has been significant growth in computer programming and consultancy (CAGR of 9.33%), it is also the largest subsector. Programming, and broadcasting activities and Information service activities saw the largest growth at 16.97% and 16.11% CAGR (2104-2019) respectively. Although these subsectors are comparatively small, they are where the growth potential for Scotland is. Publication activities has steadily declined over the period.

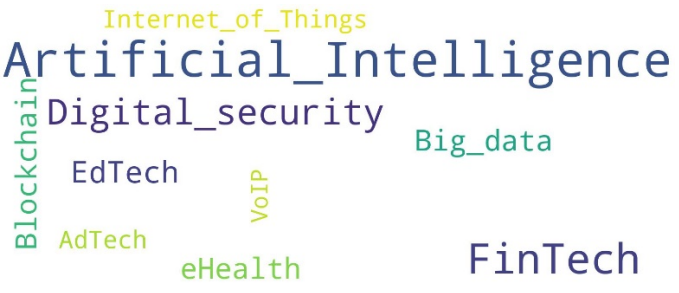
High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which Scotland's potential for further economic growth lie. There were 326 high growth businesses in the digital sector in Scotland in 2021, equating to 2.8% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms which these high growth businesses operate in are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which Scotland's high growth firms operate in, and "buzzwords" that relate to their business operations. It shows significant expertise in providing software as a service, the development of mobile apps, analytics insight tools, internet platforms and other software, with key specialisms in Artificial Intelligence and FinTech.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst



World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

Scotland's Digital Ecosystem in Summary

Strengths

- Very strong growth in the digital sector in recent years. The recent growth in digital sector employees (8.2% per annum) was highest of any region/nation, and the growth in digital sector GVA (6.7% per annum) is in the top quartile.
- Performance has been particularly strong in Edinburgh, which features in the top quartile of NUTS3 areas for many metrics, including digital sector share of employees (6.4%), average digital sector employee growth (10% per annum) and average digital sector GVA growth (15% per annum). Glasgow also has a strong digital sector, and is in the top quartile of NUTS3 areas for digital sector share of employees (5.1%) and digital sector employee growth (8.8% per annum).
- Although the organic growth of Scotland's tech sector goes back to the 1980s, the high profile recent successes of Skyscanner and FanDuel have had considerable impacts on Scotland's tech community. These unicorns demonstrated that it is possible to build billion-dollar digital companies in Scotland, and were instrumental in raising the profile of Scotland's tech sector. Founders and management from these and other tech success stories have been catalysts for further growth in the sector, investing in and advising new tech businesses.
- The development of Scotland's digital ecosystem has been underpinned by the nation's universities, which have considerable strengths in both teaching and research in the digital arena. In REF 2014, for example, the University of Edinburgh submitted many more Category A FTE staff in the Computer Science and Informatics topic area than any other university (95, with the next highest being the University of Oxford at 74), and had 40% of its research in this area judged to be world-leading. While it submitted fewer staff in this Unit of Assessment, the University of Glasgow also performed very well in REF 2014, with 36% of its research rated 4*. Normalised to its population, Scotland has the highest number of active digital sector university spinouts of any UK nation/region, according to the data tracked by Beauhurst.
- In 2019/20 Scotland had 15,515 students enrolled on Higher Education computing-related courses, with nearly half of these being accounted for by the universities of Edinburgh Napier (2,010), Edinburgh (1,950), Abertay (1,490) and Glasgow (1,480). Per head of population, Scotland has more Higher Education computing students than any other UK region/nation (2.6 per 1,000 people).
- Scotland also benefits from a relatively high proportion of Working Age people with degree-level qualifications (49%), and the highest rate of graduate retention of any UK nation/region: of the 2016/17 cohort of Scotland-domiciled first degree leavers in employment, 88% were based in Scotland.
- Over several years, considerable emphasis has been put on collaboration between the universities and industry, through initiatives such as Edinburgh's Data Driven Innovation programme, the Glasgow City Innovation District based at University of Strathclyde, and The Data Lab which has hubs in Aberdeen, Edinburgh, Glasgow and Inverness. The impacts of the universities on the digital ecosystem are further strengthened through the Scottish Informatics and Computer Science Alliance (SICSA), where all of the 14 Scottish departments of computer science & informatics collaborate together in research, education, and knowledge exchange related to technology and data science.
- Scotland's enterprise agencies – Scottish Enterprise (SE) and Highlands and Islands Enterprise (HIE) – have also played an important role in fostering the growth of Scotland's digital sector over several years, helping entrepreneurs access resources they wouldn't otherwise have been able to access. This includes SE/SDI's GlobalScot network, which has been effective at bringing in tech talent, advisors and brokering connections for Scottish companies across the world. Three-year survival rates for digital sector firms (62%) are in line with the regional median.
- Scotland's most successful tech incubator, CodeBase, is widely seen to have played a critical role in nurturing the growth of the digital tech sector. It now has three sites in Scotland (Edinburgh, Stirling, and Aberdeen).
- CodeClan is also widely recognised to have been a major success in widening the pool of people available for the digital sector and digital occupations. This digital skills and coding academy, with virtual classrooms as well as physical bases in Glasgow and Edinburgh, now has more than 1,700 graduates. Of the 1,062 graduates from the Professional Software Development course between 2015-2020, 84% are known to have gained relevant employment after completing the course.
- Various events have been established which provide opportunities for people within Scotland's digital ecosystem to network, bringing people together, and helping to link entrepreneurs with support and funding. These include EIE, DataFest, Turing Fest, and regular ScotlandIS events. These activities are enhanced by active engagement by District Councils with businesses.
- There are strong personal networks within Scotland's digital ecosystem. This is seen to be an important factor in supporting the growth of tech in Scotland.

Opportunities/Specialisms

- In 2020, the Scottish Government commissioned Mark Logan (formerly COO of Skyscanner) to undertake the Scottish Technology Ecosystem Review (STER). The output of this review is arguably the clearest and most coherent proposed policy approach to the tech sector of any we have seen in the UK. With a focus on software engineering-intensive start-ups and scale-ups that exhibit – or aspire to exhibit - characteristics common to successful tech start-ups internationally, it proposes a set of 34 recommendations across three areas: Education and Talent; Infrastructure; and Funding. These included: the creation of a Tech-Scaler national backbone of enhanced incubation facilities; treating Computing Science

like Maths or Physics at secondary school level, and following through on the consequences of that decision (e.g. in attracting more computing science teachers, curriculum re-design, and formally teaching the subject from first year); providing support for Scotland's major tech conferences, to internationalise them; and Scottish VCs partnering with the Scottish Government on various joint initiatives, including exploring the possibility of a Series A fund. The Scottish Government has accepted the report's recommendations and is currently working to take them forward.

- Amongst Scotland's 327 digital sector companies identified as high growth, prominent sub-sectors include Software-as-a-Service (31% of firms), mobile apps (20% of firms) and analytics, insight, tools (19%). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (10% of firms), FinTech (7%), and digital security (5%).
- FinTech is a particular strength in Scotland, as can also be seen from data on major digital occupation advertisers and skills requirements. Large financial services businesses such as Lloyds Banking Group and JP Morgan Chase have substantial digital activities based in Scotland, and the cluster organisation FinTech Scotland lists more than 160 FinTech start-ups and scale-ups. A variety of other tech specialisms have been identified by the Scottish Government, SE/HIE, ScotlandIS, university-industry collaboration initiatives and others. These include: cyber; data companies; travel tech/ smart mobility; GovTech/CivTech; Health Tech; Climate/Green Tech; Agri-tech; gaming; space tech; and digital manufacturing.
- However, from a policy perspective the STER report argues that, while it is valuable to select domains of interest, a domain-specific approach should not be the core strategy. It notes that '… *it is unlikely that a highly prescriptive national domain-support strategy would have identified Skyscanner or FanDuel (two of Scotland's most successful tech start-ups and then scale-ups) as worthy of support or attention, for example*.'

Barriers to Growth

- Availability of talent, and the ability to attract talent (particularly experienced talent) to Scotland, place critical constraints on the growth of Scotland's digital ecosystem.
- As highlighted in the data around digital sector GVA, growth rate, concentration of HE computing students, and VC investment, there is significant inequality across Scotland, which poses challenges for delivering nation-wide prosperity. Recruitment of people with digital skills remains challenging.
- While the growth of the tech sector has been substantial in recent years, it has not yet reached the tipping point where somebody considering relocating their family for a tech job in Scotland sees lots of other high-quality career opportunities available. Scotland still needs a greater variety of digital businesses, large and small, to ensure that those who relocate to Scotland can readily find another job if one does not work.
- Although it compares well to other UK nations/regions in terms of the numbers of people studying computing-related subjects at university, there are still too few young people emerging from the school system with a basic competence in computing. The number of secondary school teachers whose main subject is computing has fallen by 17% since 2010, and the number of student entries for Computing Science at National 5 level (broadly equivalent to GCSE) has reduced by 22% since 2016, and only 20% of the entries in 2020 were female students [sources: Scottish Teachers Census and SQA Annual Statistics Report]. These concerning trends are the opposite of what will be required to provide sufficient numbers of home-grown talent into digital businesses and occupations and the tech-competent entrepreneurs of the future.
- There was also concern at the roundtable discussion that the majority of university students who want to start a tech business are from overseas, and that these people may be subject to visa caps and may take their ideas elsewhere.
- Education for tech business leaders was also highlighted as an issue by STER, with too few founders and managers in Scotland's tech sector being exposed to the sorts of world-class formal education available in Silicon Valley in how to start and grow a tech business.
- In common with many other parts of the UK, investment deal flow of growth capital is low, and this is a further constraint. While there are active angel networks in Scotland, getting some venture capital providers to understand that credible multi-year tech investments can be made outside London and the South East can reportedly be difficult. In the period 2016 to 2020, funds raised by Scottish digital companies amounted to 1.8% of the UK total, according to Beauhurst data, compared to Scotland's 8% share of UK population.

Achieving Prosperity

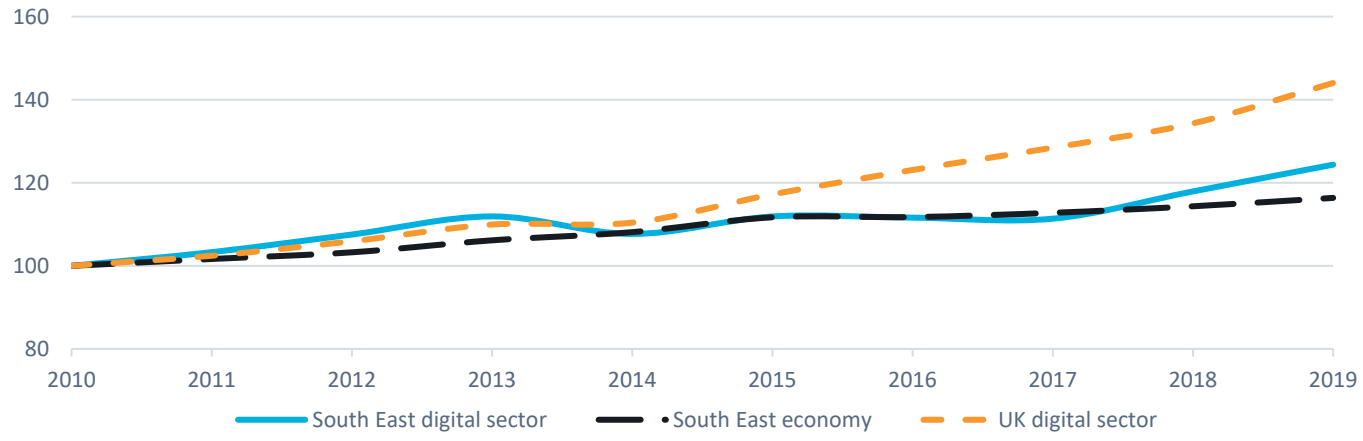
- On the basis of Steer-ED's indicative modelling (see Section 2 of the Main Report), the digital sector in Scotland has the potential to grow by **at least £2.2 billion in annual GVA by 2025** (an increase of 35% on the 2019 value), creating an additional 34,300 jobs (an increase of 39% on the employment in 2019).
- In working to achieve the prosperity prize, Scotland has in-place many of the necessary enablers, capacities, and capabilities to make quick and substantive progress. The two pressing constraints to be addressed relate to the ever-present issue of the quantity and quality talent, in which Scotland's school education system has a vital role to play, and access to external funding.
- The STER Review provides a very well thought through route map for developing Scotland's tech ecosystem in the round. The strategic framework it is built around has direct application in helping to make the nation's digital economy and its ecosystem world-class.

South East – Summary Dashboard

Region

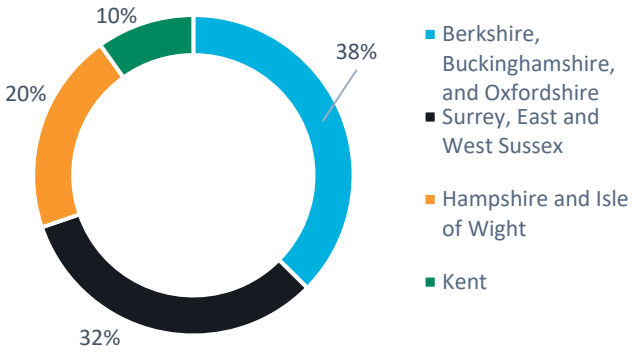
- **Component NUTS2 regions:** Berkshire, Buckinghamshire, and Oxfordshire; Surrey, and East and West Sussex; Hampshire and the Isle of Wight; and Kent.
- **Key Statistics:** 19,095km^2, 9.2m population, £285bn total GVA (2019), 1.5% total annual GVA growth (2014-2019).
- The South East region is a large mixed area, with major urban populations (in city and semi-rural locations), including several cities. The largest concentrations of the region's population are in Brighton and Hove, Milton Keynes, Southampton, Portsmouth, Slough, Reading, and Oxford. The region is a prosperous economic hub – the largest economy of all UK regions after London, with close proximity to the capital, a globally leading university and the UK's two busiest airports.
- The South East has high levels economic output from the Finance, Business and Professional Service sector, with 15% of total GVA coming from Real Estate and 8% from Professional, Scientific, and Technical activities. The region has a smaller Production sector and a larger Service sector, relative to the UK.
- The digital sector contributes a significant proportion of total output for the region (9.2%), but growth of the sector has lagged other regions over the last five years (2.9%, 2014-2019), which is a faster rate of growth than for the South East economy overall, but a significantly slower rate of growth than the UK's digital sector as a whole over this period.
- Digital employment (estimated at 435k in 2019) is both in the digital sector directly, and in digital occupations not traditionally in the digital sector. In the South East, demand for digital occupations is high in industries including Energy, Transport, IT, Engineering, Retail, Technology, Aerospace, and Recruitment.
- The highest levels of demand for digital occupations come from Berkshire, Buckinghamshire, and Oxfordshire (38% of digital occupation online job postings for the 2019-2020 period, as well as Surrey and East/West Sussex (32%).
- There is relatively high demand for Network Engineers and Field Service Engineers (location quotient above 1.0, the UK average), although the largest absolute demand for occupations is Software Developers, making up 20.4% of digital occupation job adverts in the 2019-2020 period.

Digital Sector GVA growth 2010-2019 (indexed to 2010), South East NUTS1 Region



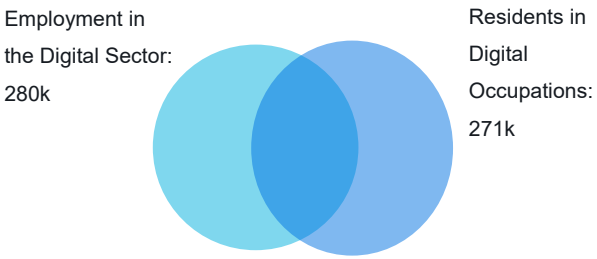
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in the South East (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), South East NUTS1 Region



Total digital employment in the South East: c. 435k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations, (2019-2020), South East NUTS1 Region

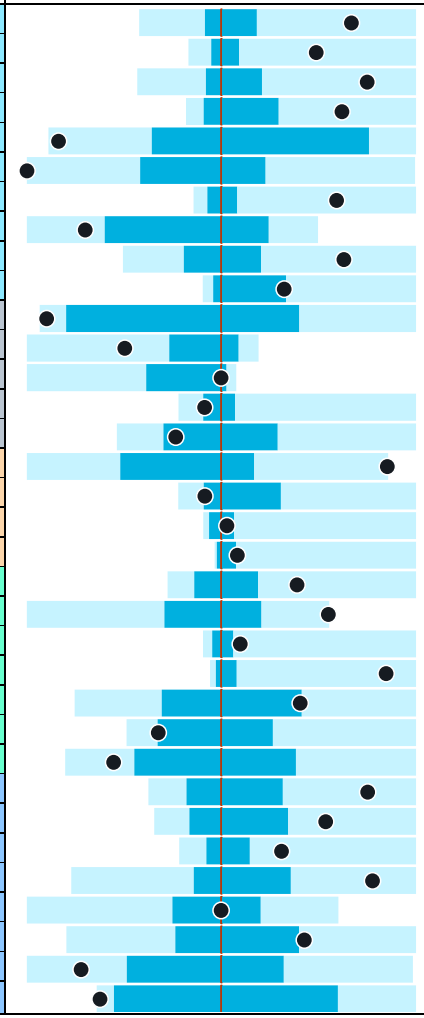
- This table shows digital occupations by demand for the South East. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers and Data Engineers, but comparative demand is highest for Network Engineers and Field Service Engineers. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Network Engineer	12,675	2.6%	1.22
Field Service Engineer	11,265	2.3%	1.15
System Administrator	7,162	1.5%	1.12
IT Support Analyst	27,609	5.7%	1.12
IT Service Manager	9,526	2.0%	1.10
Test Analyst	13,946	2.9%	1.07
IT Project Manager	19,985	4.1%	1.04
Software Developer	98,632	20.4%	1.02
Data Engineer	47,436	9.8%	1.01
IT Manager	21,281	4.4%	1.00

Source: Geek Talent, 2021

South East - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for the South East and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator
- The box plot below the table indicates visually where the South East (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, the South East is above the median value on this indicator.

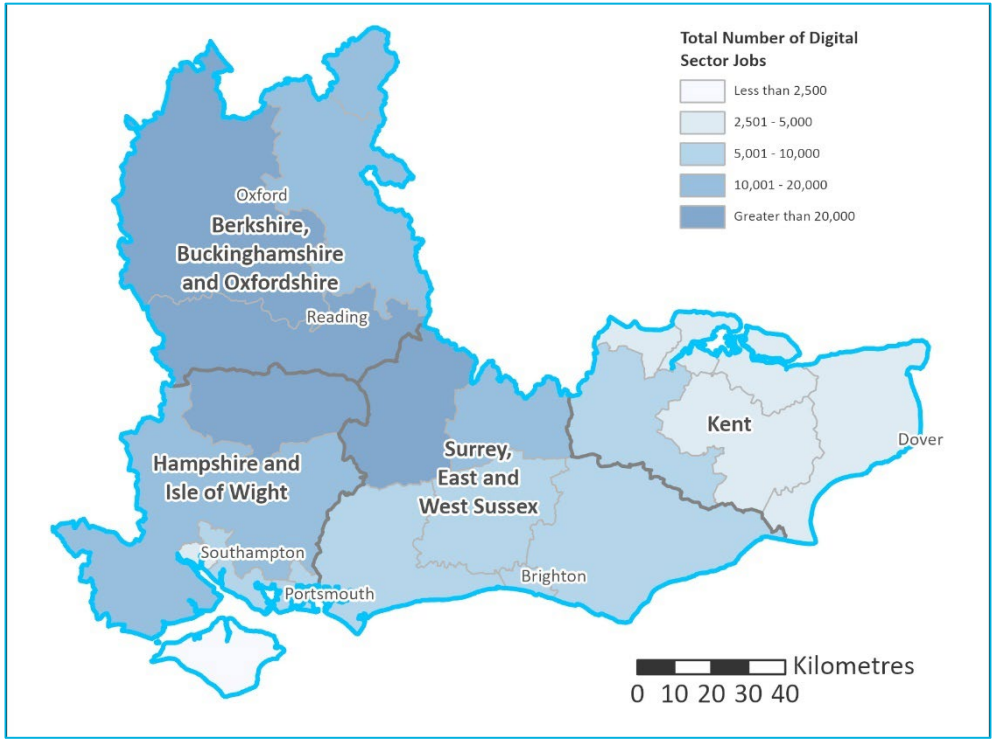
Indicator name	Period	SE	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**11.5**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**5.7**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**6.4**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**10.2**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**-1.7**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**1.8**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**9.2**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**2.9**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**54.4**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**1.3**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**9.5**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**10.5**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**95.6**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**16.0**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**23.2**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**64.9**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**1.4**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**14.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**146.4**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**245.3**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**33.4**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**24.6**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**200.1**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**5.2**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.3**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**0.8**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**44.3**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**45.9**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**44.9**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**94.3**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**94.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**53.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**56.8**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**1.3**		1.3	1.4	1.8	2.3	2.6

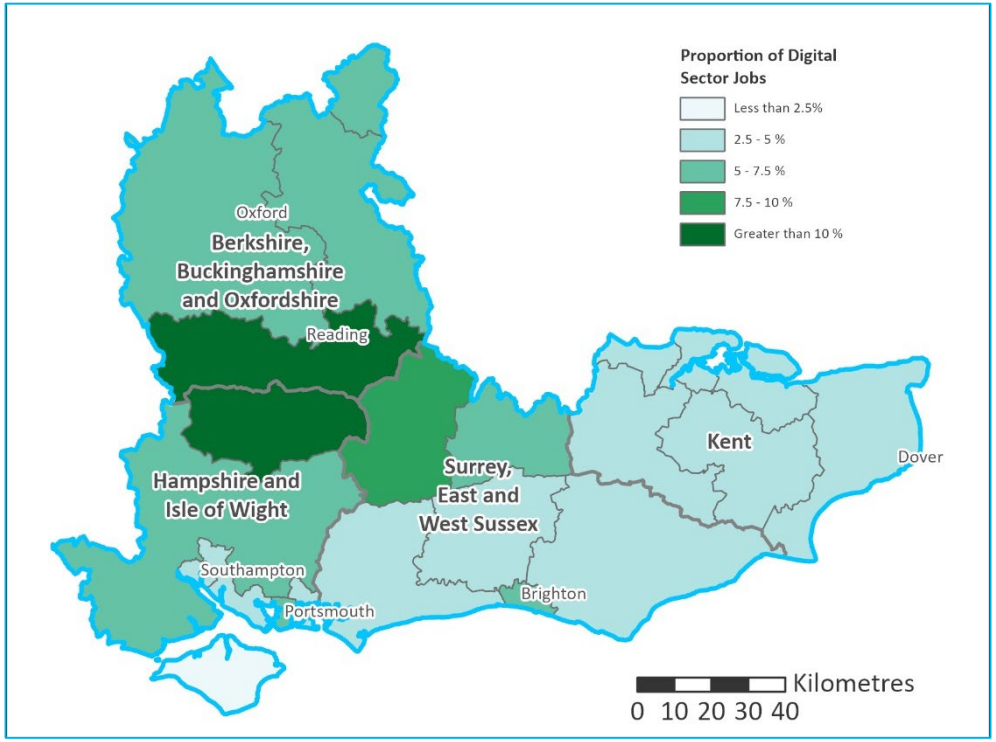
Source: Steer-ED and various datasets – See Appendix B

The South East - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

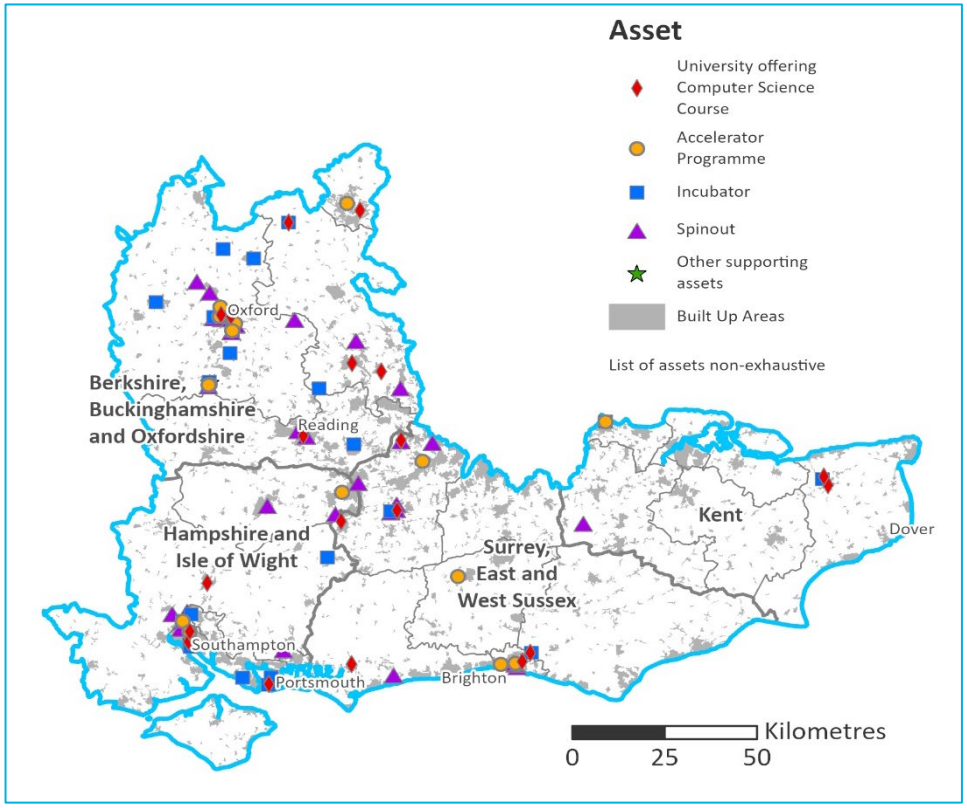
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters

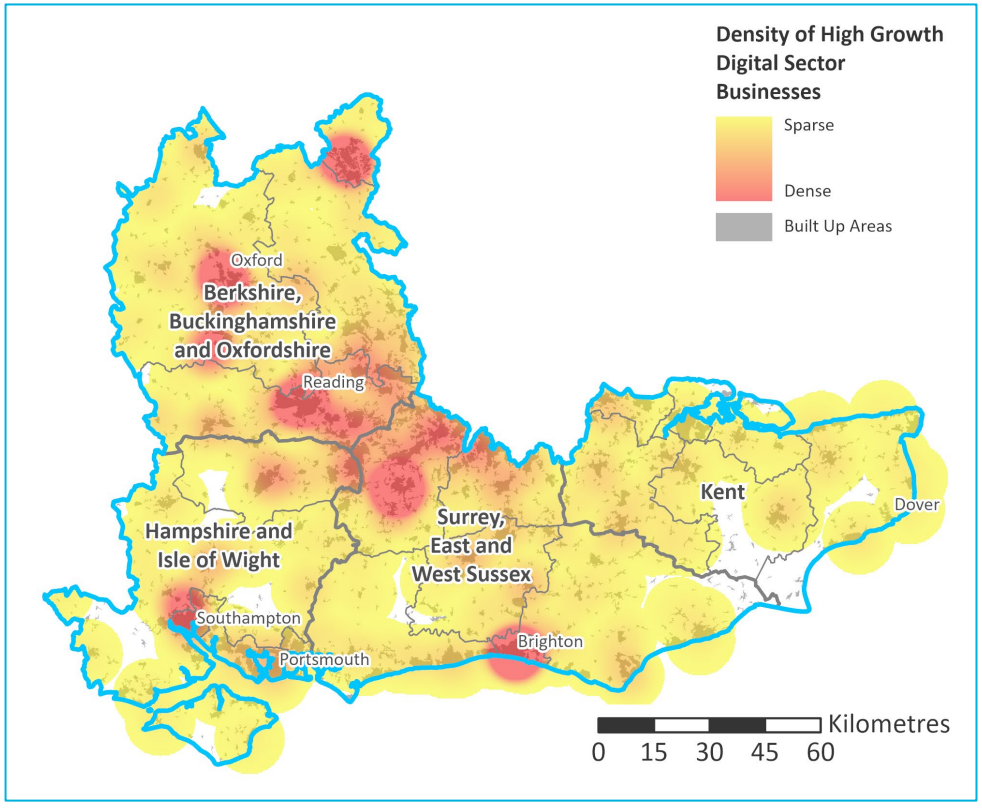




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in the South East, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in the South East. It highlights how high growth businesses are concentrated in larger urban areas.



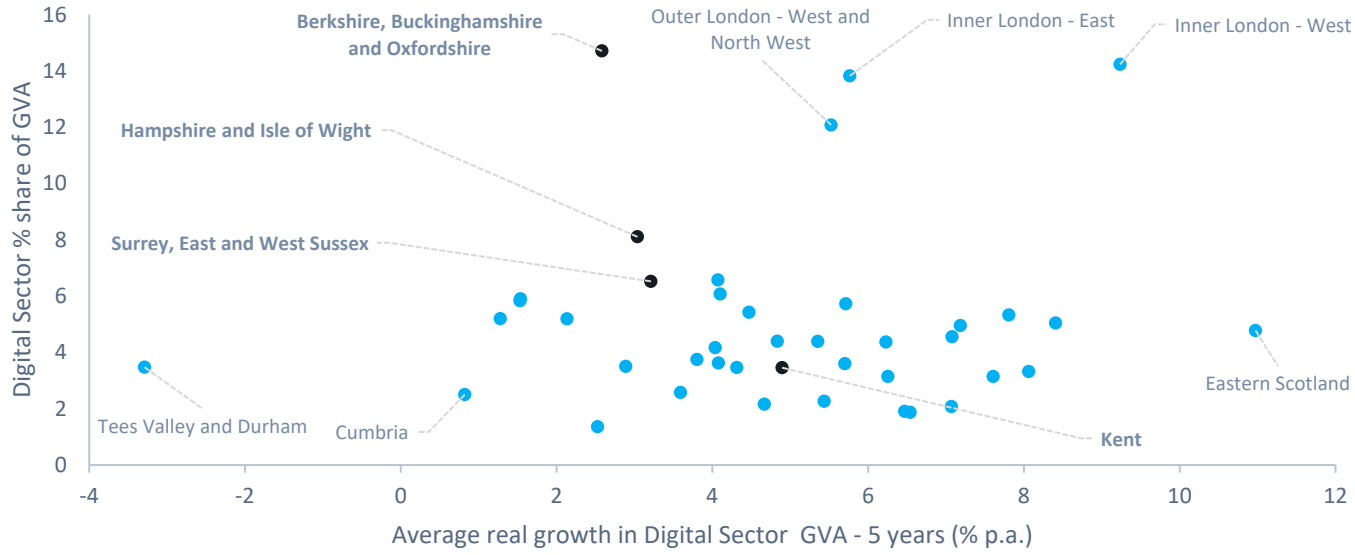


The South East – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in the South East, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. The South East are indicated in black. Key outliers outside the South East are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in the South East.

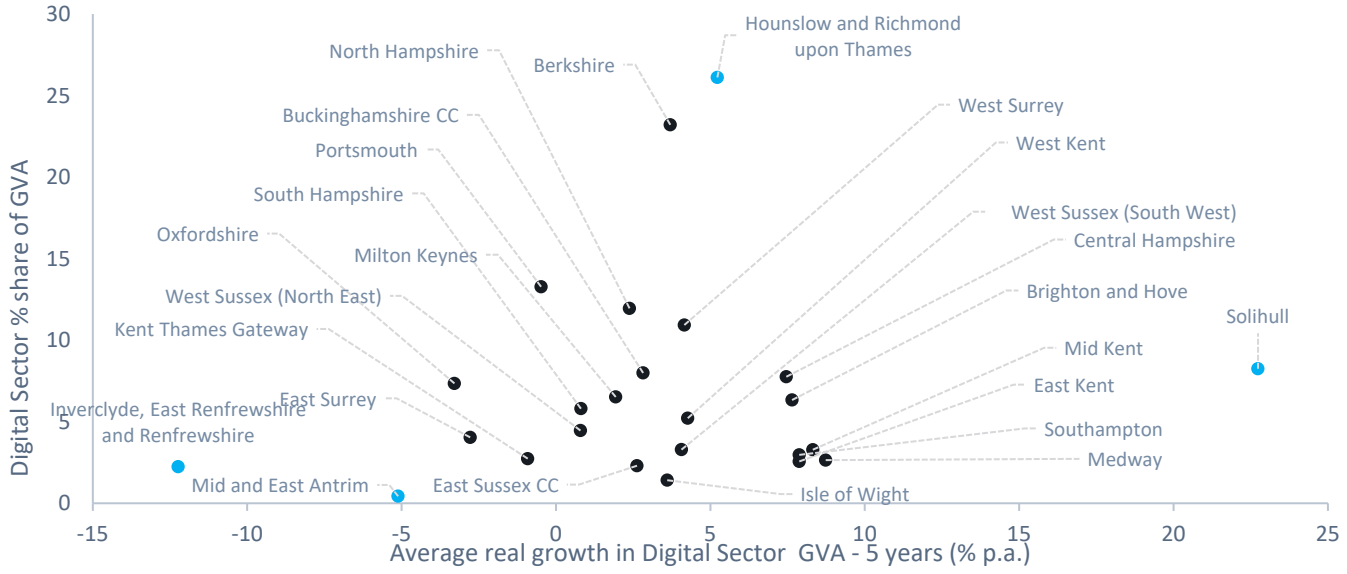
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021:

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

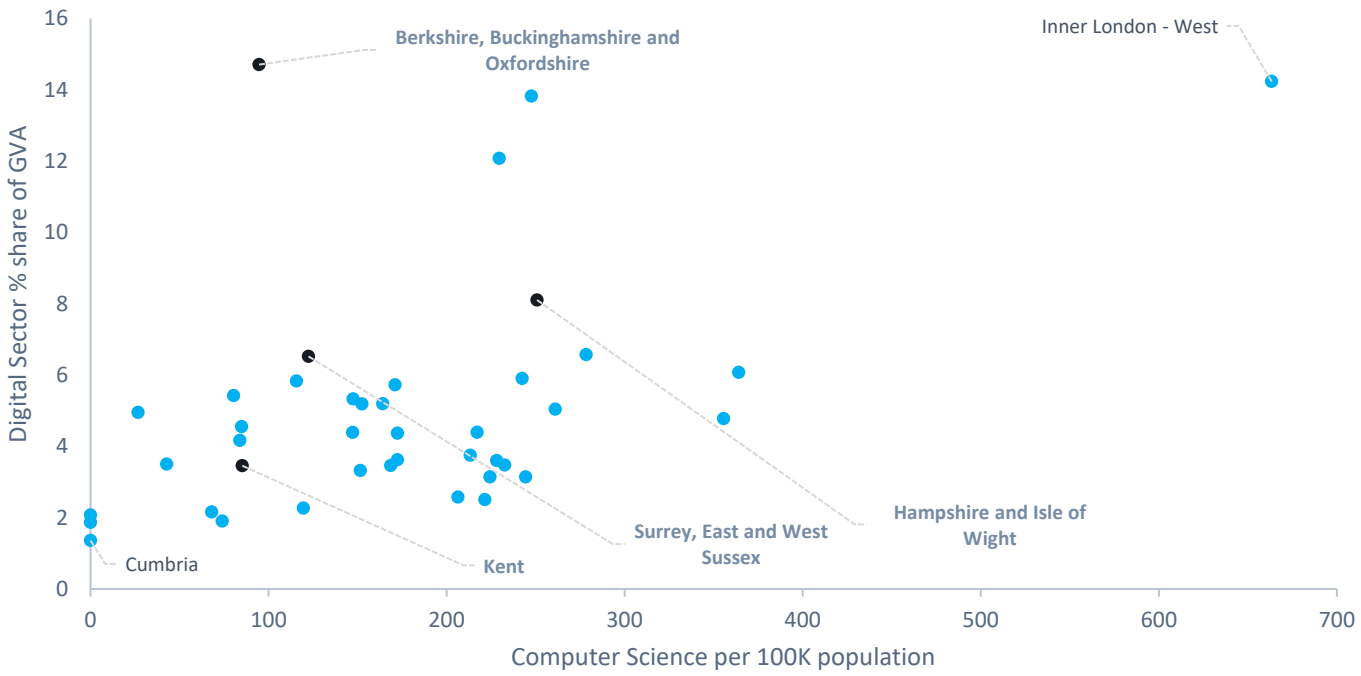
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – the South East NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in the South East's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

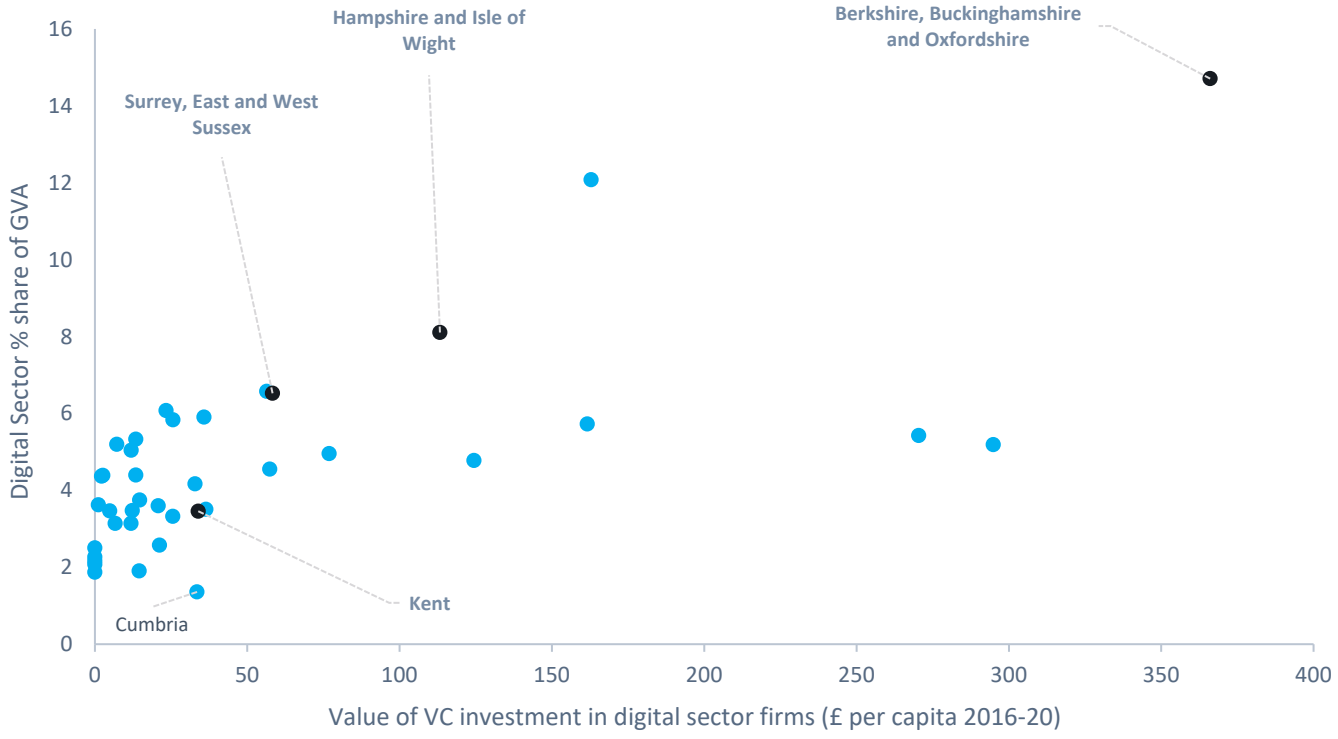
Digital Sector GVA % plotted against HE Computing Students per 100k population (NUTS2 Regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 Regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

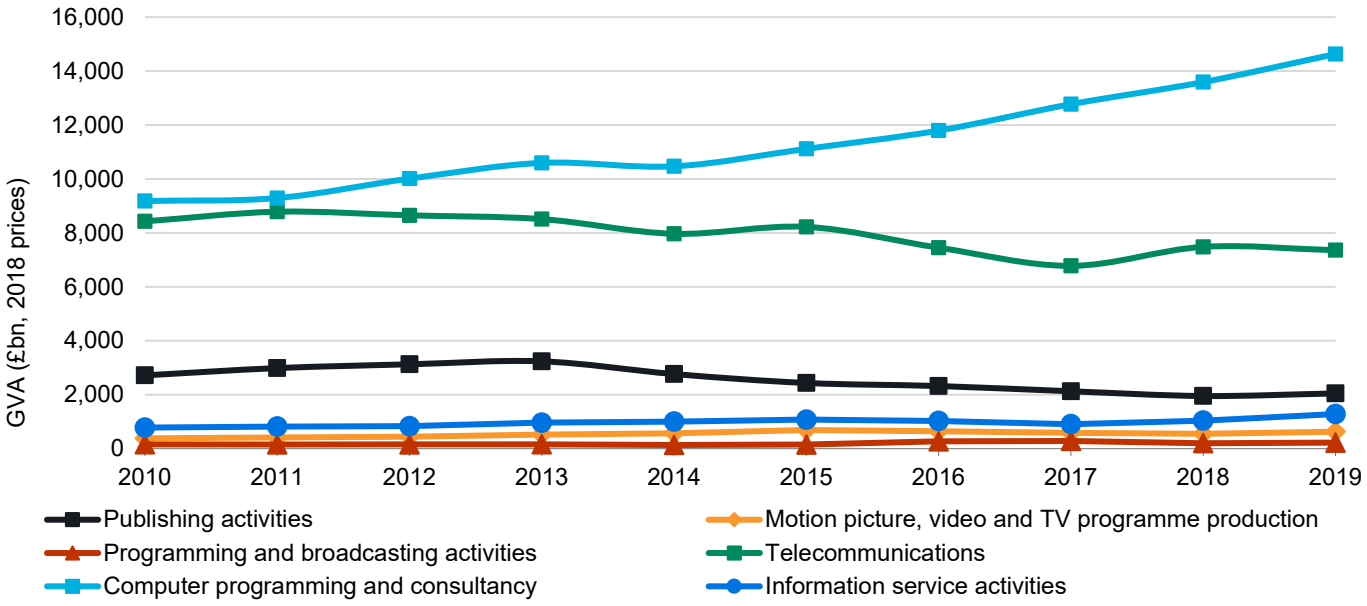
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector.

The South East – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of the South East, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

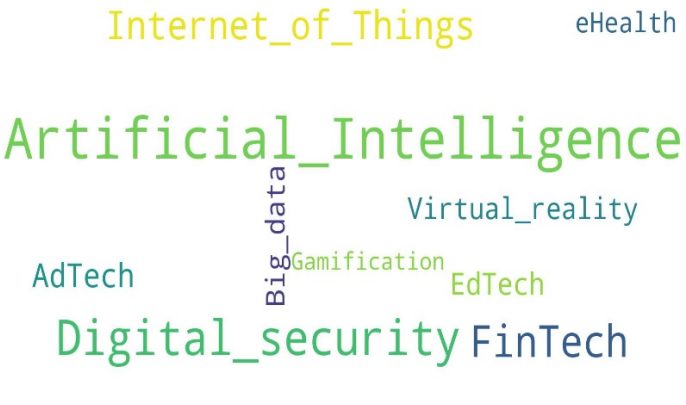
- The chart above shows that there has been significant growth in Computer programming and consultancy digital sub-sector which is the largest of the digital sub-sectors across the South East. These sub-sectors are where the growth potential for the South East is. Telecommunications is the second largest sub-sector across the South East, but the sub-sector has experienced steady decline over the 2010-2019 period.

High Growth businesses and specialisms

- The activities of high growth digital sector businesses help to identify in more detail the specific market areas in which the South East's potential for further economic growth may lie. There were 693 high growth businesses in the digital sector in the South East in 2021, equivalent to 1.4% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

The South East's Digital Ecosystem in Summary

Strengths

- Across a broad range of metrics, the region is the best or second best (mainly after London) in terms of the performance of its digital economy ecosystem.
- The digital sector is spread broadly across the region, although it is particularly concentrated to the west of London, in Berkshire, Buckinghamshire, and Oxfordshire, and parts of Hampshire. Particular hotspots include the M4 Corridor, with well-established digital sector agglomerations evident in Oxford (and its adjacency to the Harwell Campus), Milton Keynes, Southampton, and West Kent.
- Digital businesses as a share of total enterprises, digital sector employment as a share of all employment, digital occupations as a share of all occupations, and digital sector starts as a proportion of all enterprise births are all well into the upper quartile for UK NUTS1 regions.
- With 48,000 digital sector enterprises registered in the region, the sector is primarily one of micro and small firms, with 87% of the business population comprising these types. Alongside these smaller businesses, the region hosts over 600 of domestic and internationally-owned medium and large-sized businesses, many of whom are headquartered operations with decision-making autonomy.
- The digital sector accounts for almost a tenth of the wider economy's GVA, rising to about 15% in the Burke show, Buckinghamshire, and Oxfordshire area. GVA per hour worked is strong (at £54.43, compared with £62.34 for the best performing region). The strong productivity of digital sector workers flows through into renumeration, with mean wages for workers just short of £45k per annum.
- Across the digital sector overall, Computer Programming and Consultancy activities generate 56% of the sector's output. Over the period 2014-2019, this sub-sector grew strongly, at an average of 6.9% per annum.
- Success in accessing public funding in the form of UK innovate grants to support 'AI and Data Economy activities' has been strong, reflecting the strength of computing excellence across the region's higher education institutions. The region achieves the best performance of all regions for Average Percentage Computer Science Research rated '4*' in REF2014, with strong individual performances from the Universities of Oxford and Southampton, both of whom have substantial research groups of international standing. HE links with research partners in the region's private sector are reported to be strong and productive.
- The area is very well served with incubators and accelerators. On the former, these include innovation centres at Culham, Oxford, Cranfield, and Henley, with accelerator programmes operated by the Fab Accelerator, the Oxford Foundry, the Milton Keynes Hatchery, and a regionally-delivered PI Labs programme.
- Initiatives such as The South East Digital Skills Partnership (funded by DCMS) play important roles in linking within/across the sector. Events such as the Guildford Games Festival help to draw attention to place-based capabilities and capacities.

Opportunities/Specialisms

- Amongst the region's 693 digital sector companies identified as high growth, prominent sub-sectors include Software-as-a-Service (27% of firms), mobile apps (18%), Other Software (18%), and Analytics/Insight/Tools (16%). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (10% of firms), Digital Security 7(%), FinTech (6%), Internet of Things (4%), and AdTech (4%).
- Over the last five years much of the sector's performance has been down to digital economic growth in Berkshire, Buckinghamshire, and Oxfordshire. There is clear scope for the economies in Hampshire/Isle of Wight, Surrey and East/West Susses, and Kent to increase their performance. Indeed, over the last five years, Kent's economies (East Kent, West Kent, and Medway), although this is from a small base.
- Technology coverage across the region is strong and diverse, ranging from creative in Brighton/Hove and gaming in Guildford to parallel computing in Southampton and BioTech in Oxford, and onto space and satellite technologies in the west. The depth and reach of this capability allows the region to compete at scale on a wide range of digital economy fronts.
- The new UK's National Quantum Computing Centre (NQCC) is to be located at Harwell Science and Innovation Campus, the NQCC will bring together academia, business, and government to address the key challenges to quantum computing, such as its scalability.
- The area's proximity to London provides it with access to a very large, diverse, and competent labour force to drive further growth. This does however have the potential to flow the other way, that is the region losing its workers to London where salary premiums are in play.
- Recognising the region's cost of living and housing price issue, some gaming businesses are reported to be providing support for affordable housing as part of their offers of employment, this to help attract and retain key digital workers.
- The 5G Innovation Centre (5GIC) testbed covers four square kilometres of the University of Surrey campus and offers 5G infrastructure, including 4G and 5G core network, and mobile edge computing. This provides the region with a real-world environment to test 5G applications, cyber security on 5G technology, and 5G network slicing.

Barriers to Growth

- Growth rates – for digital sector employees, digital occupations, and digital sector real GVA - are all in the lower quartile. Importantly, the average growth in digital sector employees has been negative, at -1.7% per annum over the last five years.
- The region is expensive for both domestic and business properties. This, coupled with high wage rates of digital sector workers, means the region is an expensive location for business, especially those in start-up or scaling phases.
- Higher education postgraduate Computing students and wider Higher Education postgraduate Computing, Engineering and Technology, and Mathematics students as a share of the population are both low, adding to the well-known issues of higher-level skills shortages across the sector.
- The risk of the loss of skilled workers, especially to London, is a key barrier; this is a particular issue for graduate retention, with the region ranking well into the bottom 25th percentile for this metric. Thinking through how graduates might be induced back to the region and its digital ecosystem once they reach appropriate stages in their careers is important.
- Whilst proximity to London confirms many benefits, it can mean that the identity and brand of the South East's digital sector is overshadowed. Working to retain a distinct presence and profile remains crucial.

Achieving Prosperity

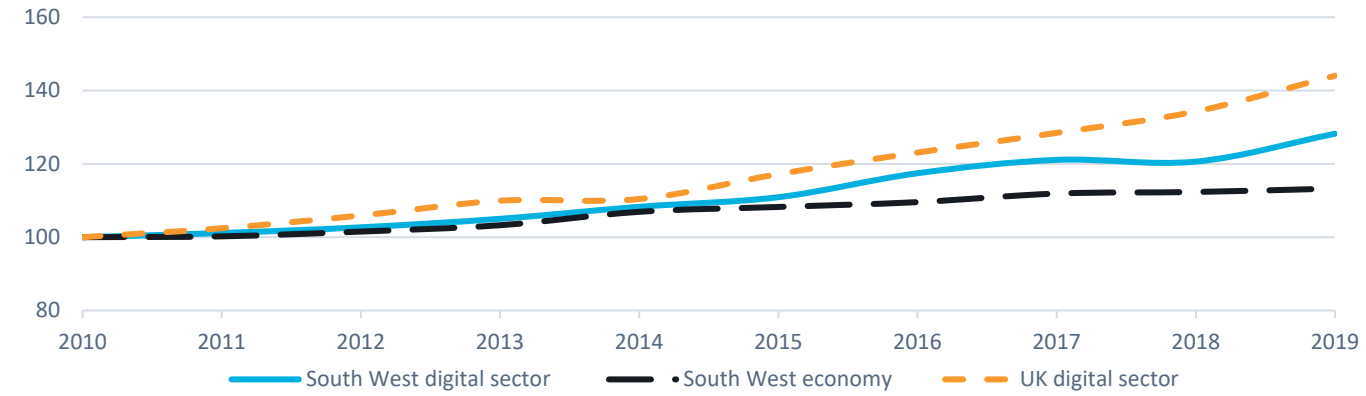
- On the basis of Steer-ED's indicative modelling ((see Section 2 of the Main Report), the digital sector in the South East has the potential to grow by at least £8.8 billion in annual GVA by 2025 (an increase of 34% on the 2019 value), creating an additional 129,500 jobs (an increase of 46% on the employment in 2019).
- The South East already has a rich, diverse, and thriving digital ecosystem, which outside London is arguably the best performing in the UK. Both its scope and scale are impressive, and to a very large extent the factors, capacities, and capabilities are in place to grow the digital economy further to achieve the 'prosperity prize' highlighted above. The digital economy's diversity – in terms of activity, pan-regional distribution, and end markets - is well developed, endowing the sector with high levels of resilience and durability.
- There are key barriers to address. The region is an expensive location, both domestically and for business, reflecting the high level of capacity the overall economy is working at, and developing new models for affordability, especially for digital sector workers, is important. Recent growth rates for the digital economy have been sluggish, in part reflecting the maturity of the sector; returning to strong growth should be a key intent.
- The wider assets – international transport nodes, and major centres of 'big' digital science, and well-developed supply chains - that present in the region as a whole provide the digital economy with major competitiveness advantages, which can be applied to both national and international market contexts. These assets are largely unrivalled amongst UK NUTS1 regions, and can be worked still further to ensure the digital economy delivers on its full potential for the South East.

South West – Summary Dashboard

Region

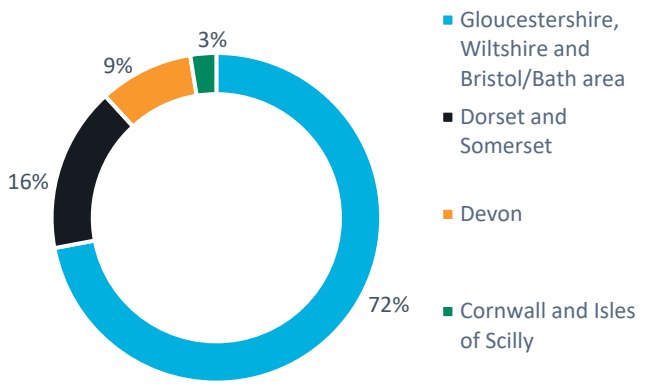
- **Component NUTS2 regions:** Gloucestershire, Wiltshire and Bath/Bristol area, Dorset and Somerset, Cornwall and Isles of Scilly and Devon.
- **Key Statistics:** 23,800km^2, 5.7m population, £140bn total GVA (2019), 1.2% total annual GVA growth (2014-2019).
- The South West is a multi-centred region, with main population centres in Bristol, Bath, Cheltenham, Exeter, Gloucester, Plymouth, and Swindon.
- The region continues to perform strongly relative to the UK in Security and Investigation activities, Information Service activities and Advanced Manufacturing.
- The digital sector is relatively small as a percentage of total output for the region (4.2%), and growth in economic output (3.4%, 2014-2019) is relatively weak, slower than the UK's Digital Sector, however, considerable faster than the South West's economy as a whole.
- Digital employment (estimated at 160k in 2019) is weighted towards digital occupations in businesses not traditionally in the digital sector, indicative of higher demand for digital skills in non-digital sector industries, such as Aerospace, Energy, and the Public Sector, all large employers of digital occupations.
- Demand for digital occupations is dominated by Gloucestershire, Wiltshire and the Bath/Bristol area, accounting for 72% of digital occupation online job postings over the 2019-2020 period. This is followed by Dorset and Somerset, with these two NUTS2 regions constituting 88% of the remaining demand.
- There is relatively high demand for Embedded Software Engineers (location quotient above 1.0, the UK average) although the largest absolute demand for occupations is Software Developers, making up 20% of digital occupation job adverts in 2019-2020, indicating increasing demand for innovative software and accelerating growth in technology.

Digital Sector GVA growth 2010-2019 (indexed to 2010), South West NUTS1 Region



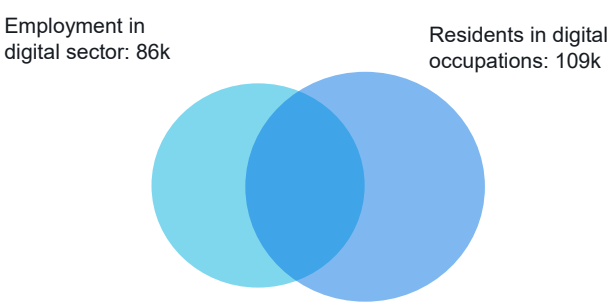
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in the South West (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), South West NUTS1 Region



Total digital employment in the South West: c. 160k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations, South West NUTS1 Region

- This table shows digital occupations by demand for the South West. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Data Engineers and Business Analysts, but comparative demand is highest for Embedded Software Engineers, Field Service Engineers, and Test Automation Engineers. Most notably, there is a relatively strong demand for Cyber Security Analysts, which is underpinned by the area's strong focus on defence and cyber security.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Embedded Software Engineer	18,221	7.3%	1.53
Field Service Engineer	7,211	2.9%	1.43
Test Automation Engineer	4,933	2.0%	1.22
Test Analyst	7,824	3.2%	1.17
Cyber Security Analyst	10,374	4.2%	1.15
Data Engineer	26,479	10.7%	1.10
System Administrator	3,590	1.4%	1.09
Network Engineer	5,594	2.3%	1.05
Web Developer	11,253	4.5%	1.04
IT Support Analyst	12,798	5.2%	1.01

Source: Geek Talent, 2021

South West - Digital Ecosystem Metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for the South West and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where the South West (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, the South West is above the median value on this indicator.

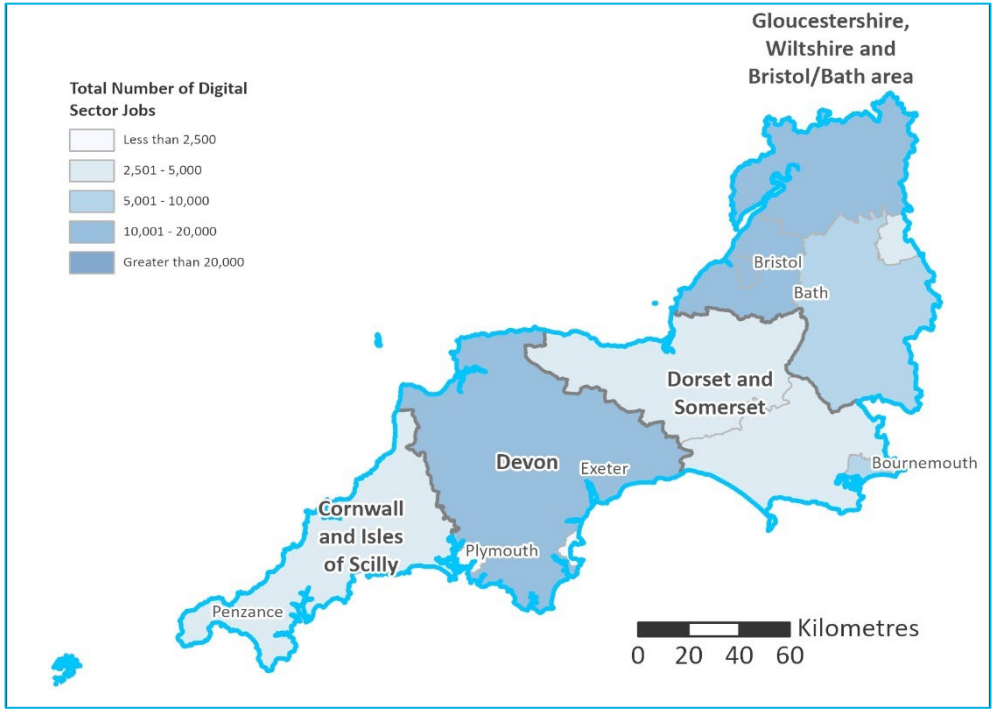
Indicator name	Period	SW	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**7.3**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**3.1**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**4.7**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**7.9**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**2.4**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**4.5**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**4.2**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**3.4**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**39.6**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.2**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**10.2**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**14.1**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**92.0**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**22.1**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**22.1**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**62.1**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**1.8**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**18.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**138.2**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**102.8**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**21.0**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**13.8**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**21.0**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**3.0**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.3**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**0.7**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**36.0**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**39.7**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**40.5**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**93.4**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**95.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**57.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**62.4**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**1.4**		1.3	1.4	1.8	2.3	2.6

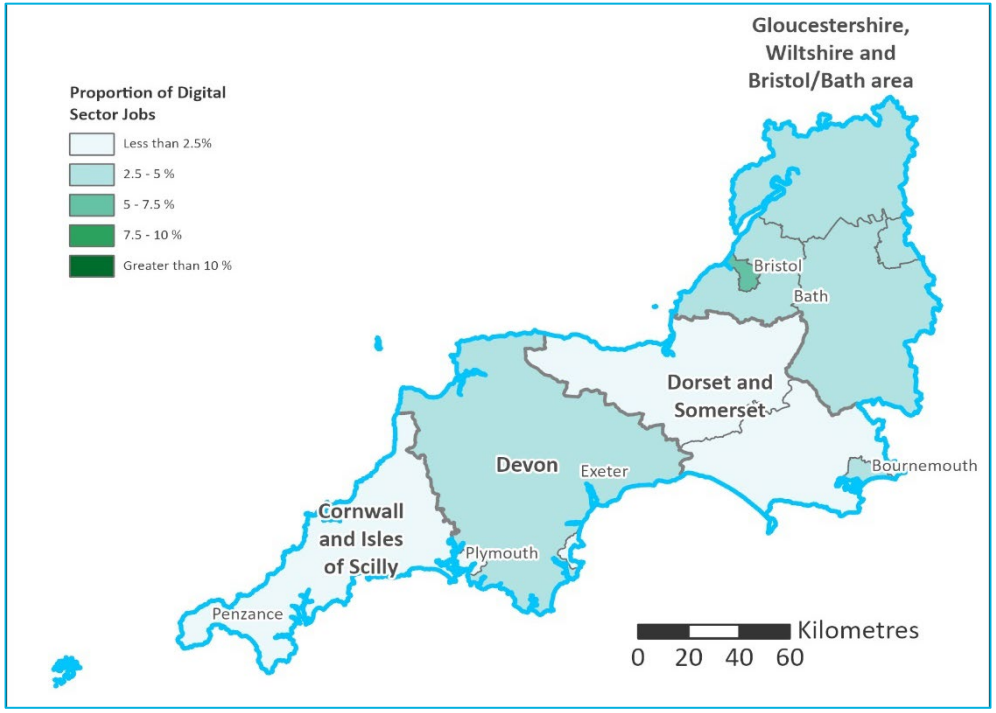
Source: Steer-ED and various datasets – See Appendix B

South West - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

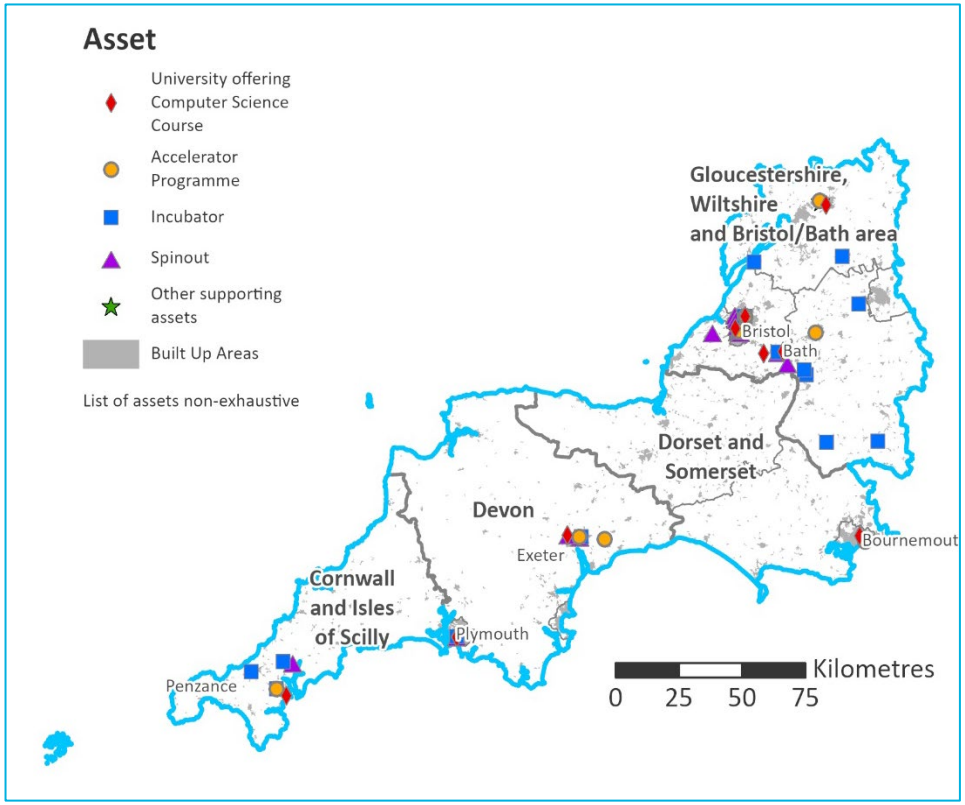
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

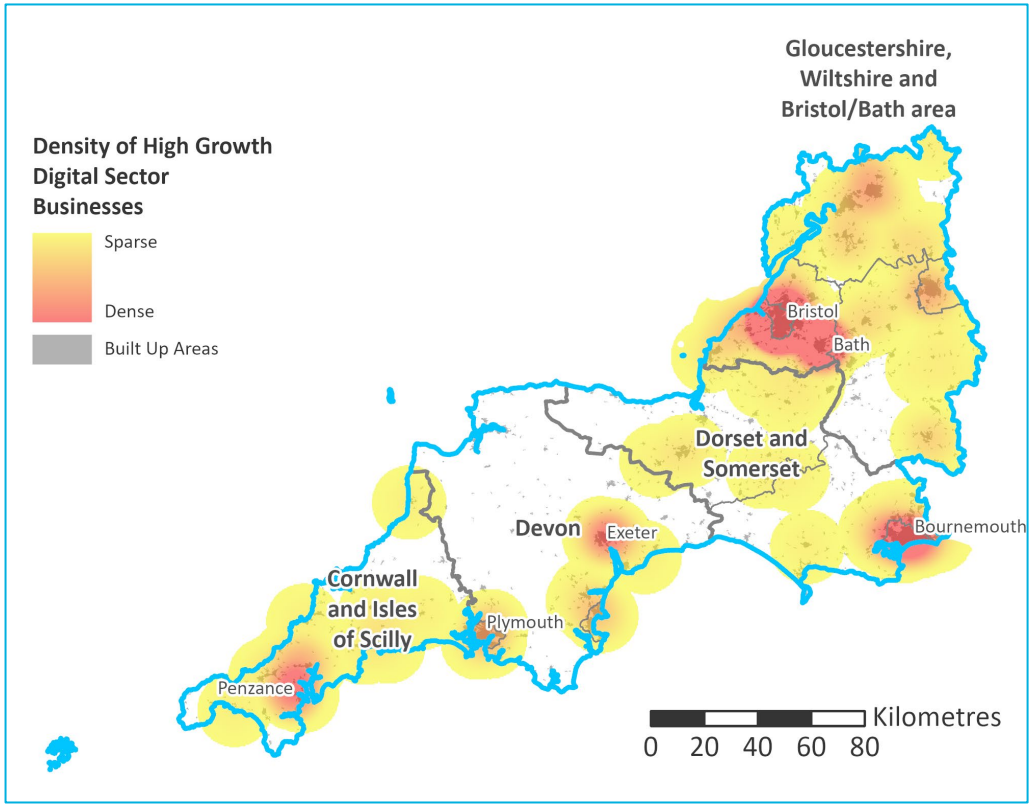




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in the South West, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in the South West. It highlights how high growth businesses are concentrated in larger urban areas.



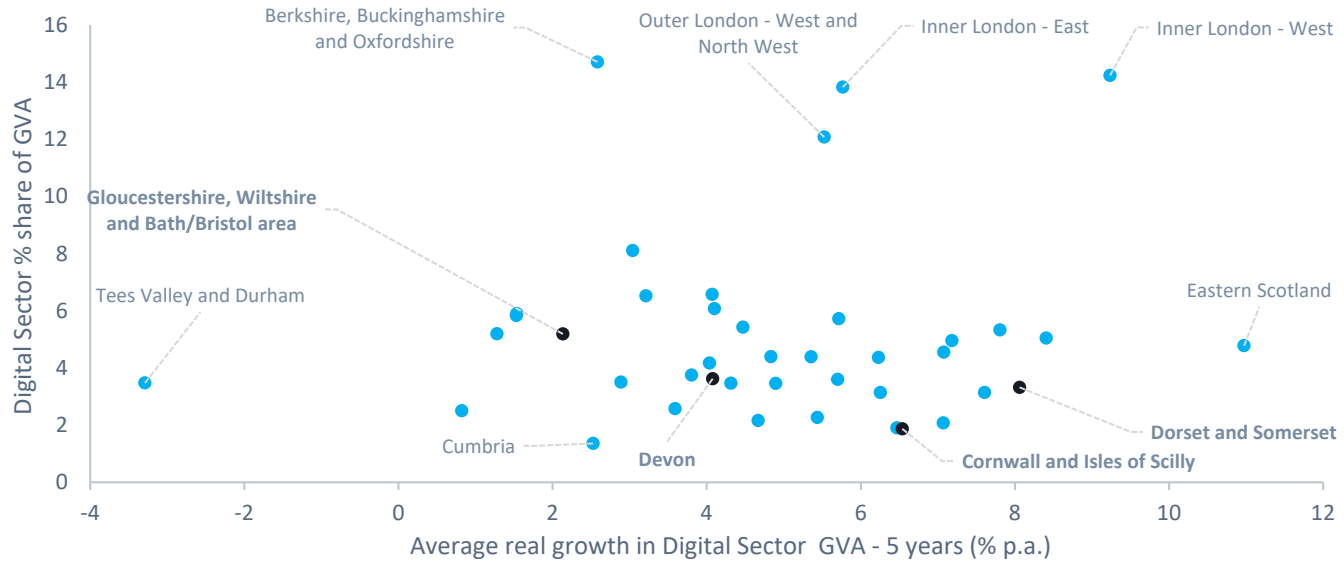


South West – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in the South West, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. The South West is indicated in black. Key outliers outside the South West are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in the South West.

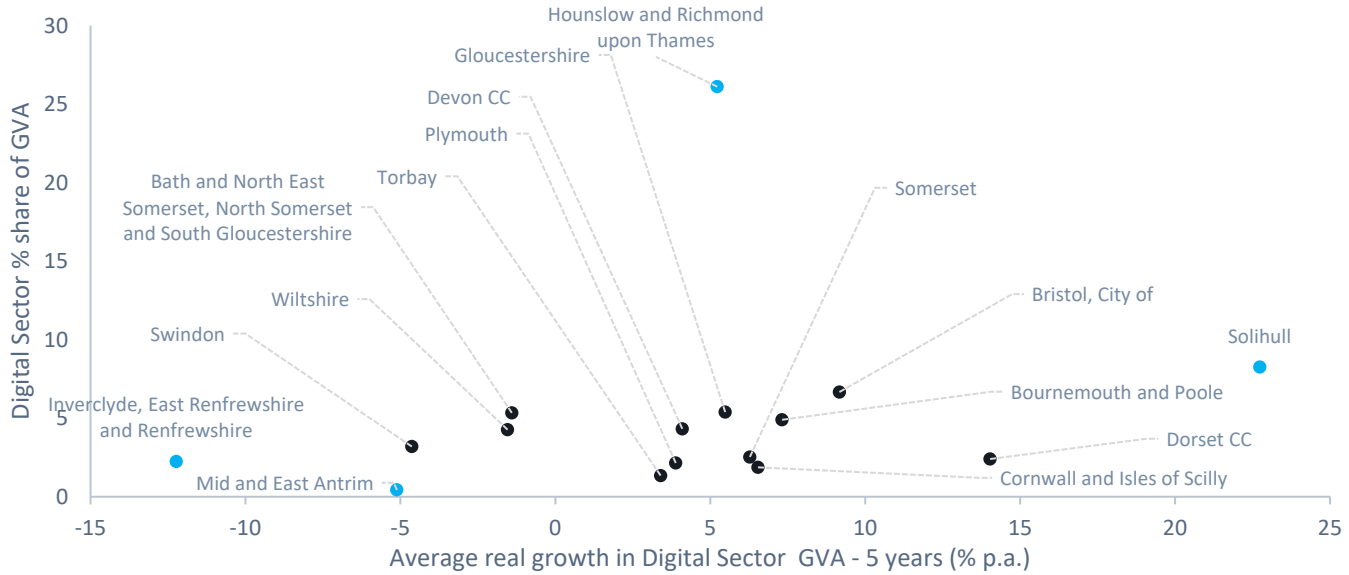
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

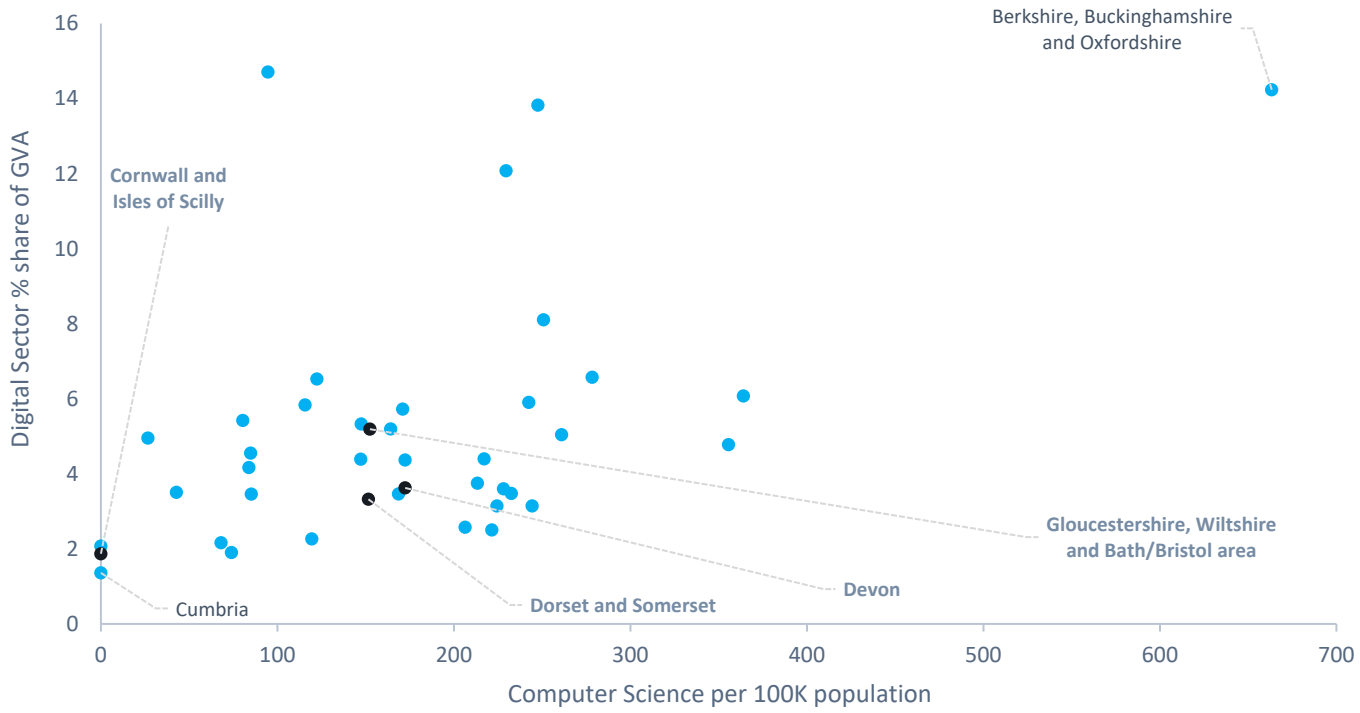
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – South West NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in the South West's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

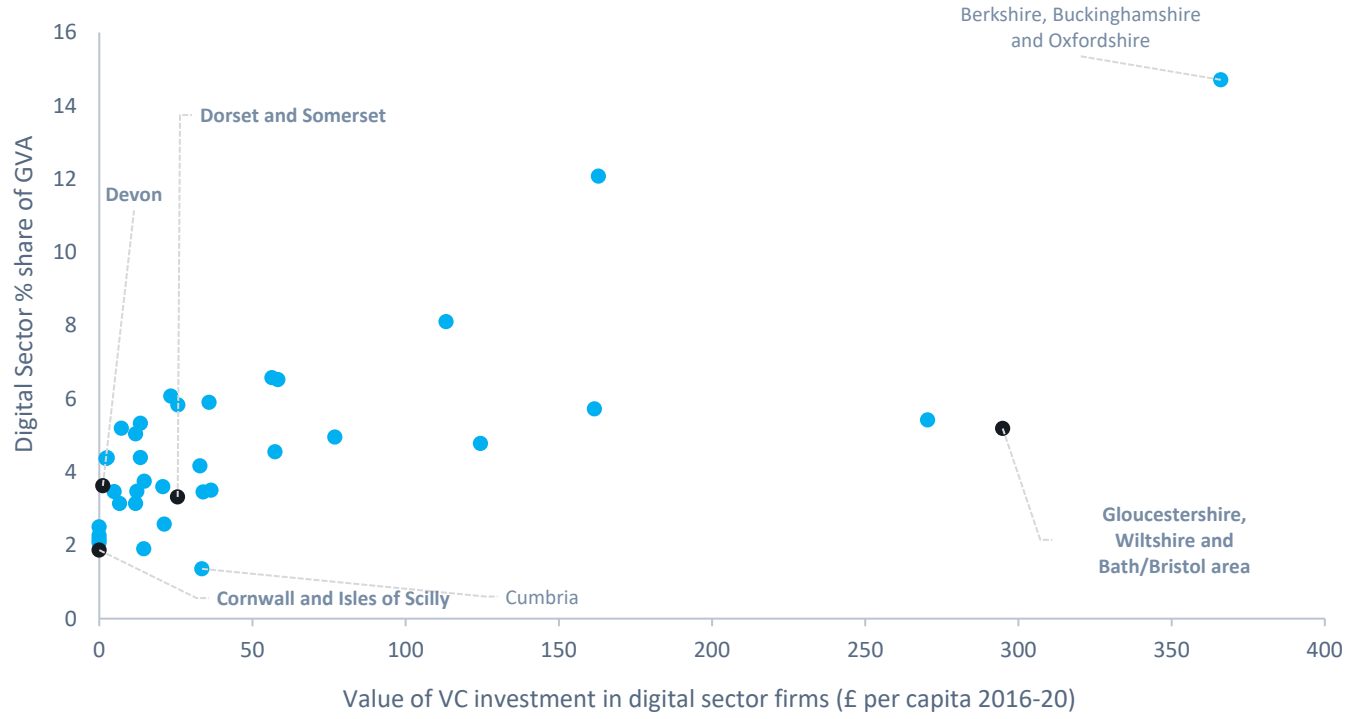
Digital Sector GVA % plotted against Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

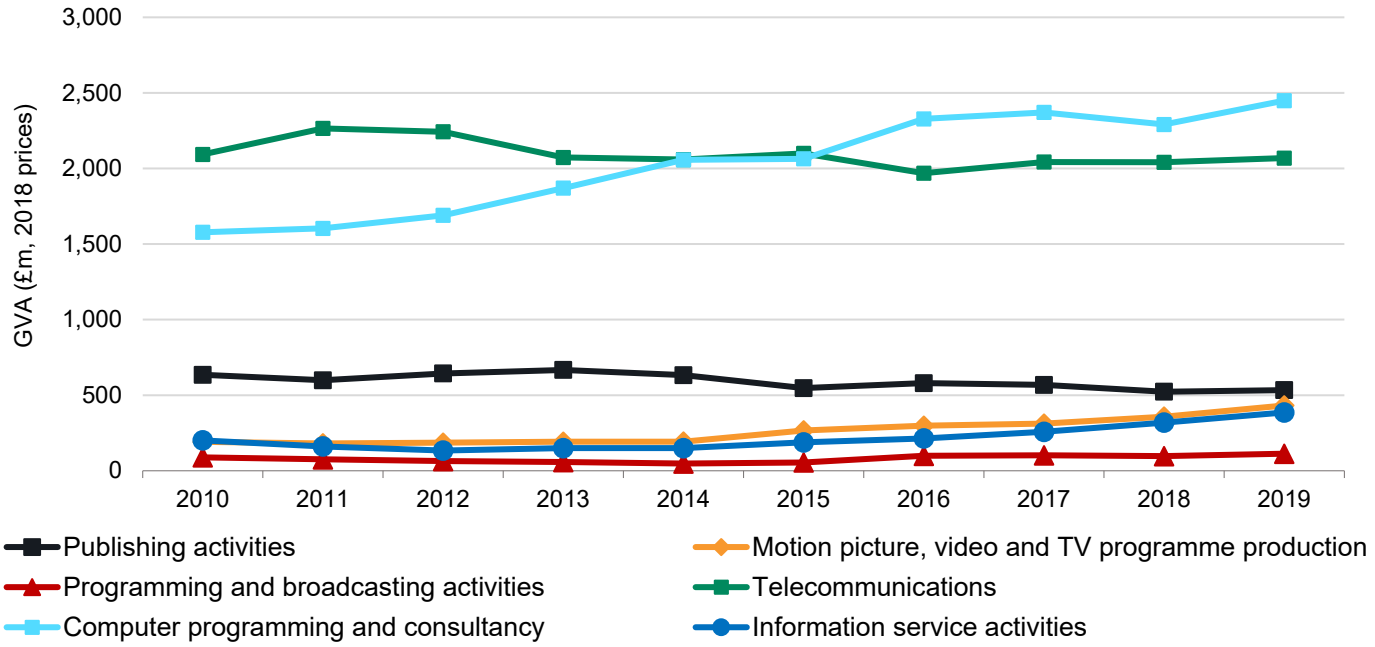
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector.

South West – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of the South West, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

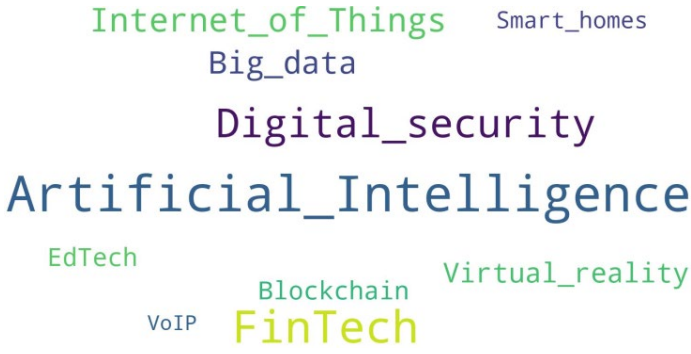
- The chart above shows that there has been significant growth in Information service activities (CAGR of 16.3%). These sub-sectors are where the growth potential for the South West is. Computer programming and consultancy is the largest sub-sector in the South West, and it showed steady growth 2010-2019.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which the South West's potential for further economic growth lie. There were 314 high growth businesses in the digital sector in the South West and the Humber in 2021, equating to 1.8% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

South West's Digital Ecosystem in Summary

Strengths

- Above average digital share of total enterprises (7.3%) and digital share of total business births (7.9%). Above average digital occupations as a share of total employment (4.7%).
- Strong digital cluster in Bristol/Bath. Bristol is ranked by The Data City as a top 10 UK tech city and by Tech Nation as a top 20 European city for tech investment. Smaller clusters around Gloucester and Cheltenham in the north of region. To the south, there are smaller clusters around the cities of Bournemouth and Exeter, as well as in southern Cornwall.
- Well established tech hubs, incubators, and accelerator programmes with strong clusters in Bristol (e.g. SetSquared Centre, Bristol VR Lab, the Old Market Incubator, and Runway East) and Cheltenham (CyNam).
- Initiatives such as Tech South West (based in Exeter) and the South West Investment Activator Programme are taking a pan-regional approach to strengthen networks, delivering support and advice to help digital firms grow, and advocating for the needs of digital firms in all part of the region.
- Significant digital operations from Airbus, GKN, BAE Systems, Rolls-Royce and Boeing, which work alongside R&D assets including local universities, the National Composites Centre, the Bristol Robotics Lab, and the Institute for Advanced Automotive Propulsion Systems. Fourteen of the world's 15 major aerospace firms have bases in the South West.
- The significant Government Communication Head Quarters (GCHQ) presence in Cheltenham gives the region an internationally leading position in cyber and digital security and has created an associated business cluster in the area.
- Levels of Angel and VC deal flow and investment are both relatively high in the region, putting the South West in the upper quartile of UK regions for both these measures.
- Initiatives such as Heart of the South West's and Cornwall and the Isles of Scilly Digital Skills Partnerships (funded by DCMS) can play important roles in linking within and across the sector

Opportunities/Specialisms

- Amongst the South West's 314 digital sector companies identified as high growth, prominent sub-sectors include 'Software as a Service' (30% of firms) and software (18% of firms). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (8% of firms), FinTech (6%), Digital Security (5%), Internet of Things (3%) and Big Data (3%).
- GCHQ's large presence in Cheltenham, and the R&D intensive industrial cluster that has grown up around it (including firms such as BAE Systems Applied Intelligence, Thales, Sheerwater Group, and QinetiQ), makes the area an international leader in cyber and digital security.
- Creative industries, particularly in the Bristol area which is home to a dynamic cluster that includes Aardvark Animation, the BBC, Open Bionics, and a Channel 4 Creative Hub, is key strength with opportunities for further growth.
- Advanced manufacturing is another strength, including in aerospace, composites and digital engineering, with exciting opportunities related to new industry 4.0 technologies.
- Opportunities exist in digital linked to environmental intelligence (the region is home to the Met Office), Agri-Food (building on the region's concentration of farmers, fishers and food producers), and marine geo-spatial data (building on the UK Hydrochartic Office in Taunton).
- Spaceport in Cornwall, funded by local and national government with industry partners, is aiming to provide horizontal satellite launch capacity from Cornwall Airport Newquay from 2022 and stimulate a high-tech space cluster across the region.

Barriers to Growth

- The availability of digital talent in the region is a key barrier to future growth. Average house prices are amongst the most unaffordable in the UK at ten times annual earnings.
- The number of under-graduate and post-graduate students studying computing is amongst the lowest per 1,000 population in the UK. Graduate retention rates are significantly below the national average. Regional stakeholders report that lack of diversity in the region's workforce is a barrier to investment.
- In common with most other regions, the South West has low levels of international trade (digital services trade represents 0.2% of GVA, significantly below the 3.5% seen in London).
- Despite the concentration of R&D assets, core measures for the scale and impact for digital innovation lag the UK average, including for FTE workers in Computer Science and the percentage of Computer Science research rated as 'world class'. Digital sector R&D spending per enterprise is the lowest of any UK region.
- The South West's digital infrastructure risks becoming a brake on digital prosperity, particularly the availability of superfast broadband where coverage is in the bottom quartile of regions in the UK.

Achieving Prosperity

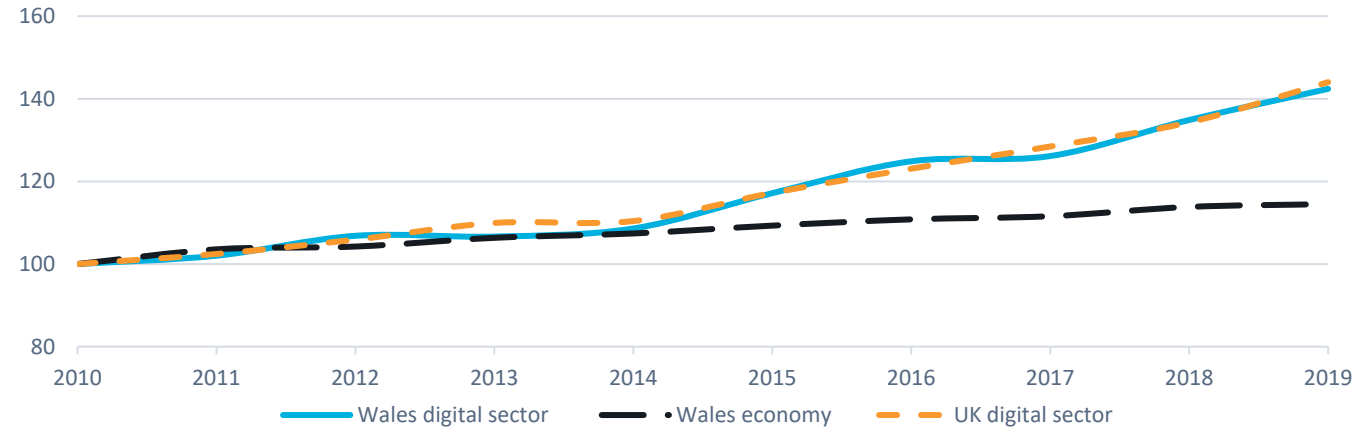
- On the basis of Steer-ED's indicative modelling (see Section 2 of the Main Report), the South West's Digital Sector has the potential to grow by at least £1.4 billion in annual GVA by 2025 (an increase of 23% on the 2019 value), creating an additional 36,600 jobs (an increase of 37% on the 2019 value).
- In realising this 'prosperity prize', there is a need to address the imbalanced performance across the five enabling domains of the digital ecosystem at a pan-regional level, and between the different parts of the South West at a local level.
- The relatively slow level of digital sector GVA growth over the past five years, alongside both slow digital sector and occupation growth and lower than average productivity (as measured by GVA per hour worked) highlight the challenge in securing the prosperity prize. Transforming performance in the region's digital innovation economy, and increasing engagement with international markets, will be important in realising accelerated growth and prosperity.
- The region's specialisms in areas as diverse as advanced engineering, cyber security, cultural and creative industries, agri-food, and space together provide further routeways to regional prosperity. Critical to achieving the growth potential of these sub-sectors will be transforming the region's ability to develop, attract and retain a diverse and talented workforce.

Wales – Summary Dashboard

Region

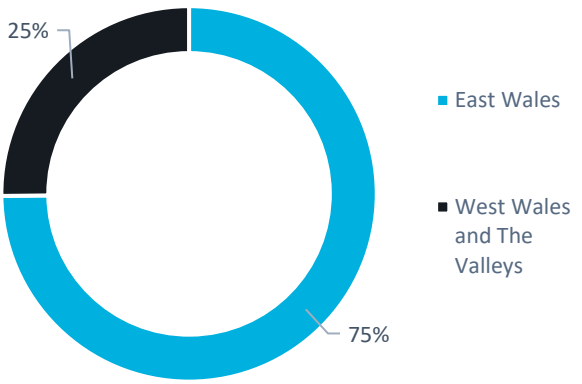
- **Component NUTS2 regions:** West Wales and The Valleys, and East Wales.
- **Key Statistics:** 20,779km^2, 3.2m population, £66bn total GVA (2019), 1.3% total annual GVA growth (2014-2019).
- Wales is a largely coastal and rural country, which is home to city regions on the South Coast (Cardiff, Swansea and Newport) and Wrexham in the North, and which acts as the country's main population centres.
- This region continues to perform strongly relative to the UK in manufacturing, with 17% of all GVA output coming from manufacturing industries. Construction, Wholesale and Retail, Real Estate and Health also constitute a large portion of Wales' economic output.
- The digital sector is relatively small as a percentage of total output for the region (3.4%), but it is showing strong growth in economic output (5.6%, 2014-2019), which is just less than the UK average growth for the sector overall.
- Digital employment (estimated at 65k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector, indicative of higher demand for digital skills in non-digital sector industries, such as Consulting, Legal and Accounting, and Finance and Insurance, where Wales has large employers of digital occupations.
- Demand for digital occupations is dominated by East Wales, accounting for 75% of digital occupation online job postings in 2019-2020.
- There is relatively high demand for Field Service Engineers, IT Support Analysts (location quotients compared to the UK of 1.7 and 1.4) although the largest absolute demand for occupations is Software Developers, making up 22% of digital occupation job adverts in 2019-2020.

Digital Sector GVA growth 2010-2019 (indexed to 2010), Wales NUTS1 Region



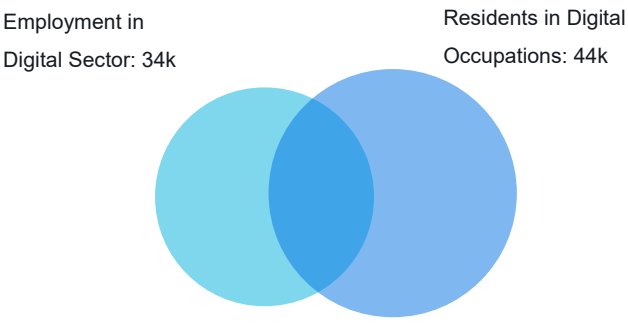
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in Wales (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), Wales NUTS1 Region



Total digital employment in Wales: c. 65k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations (2019-2020), Wales NUTS1 Region

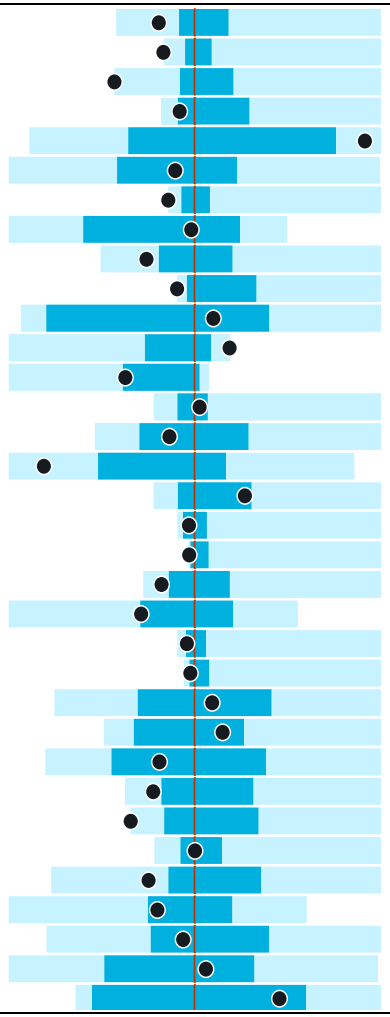
- This table shows digital occupations by demand for Wales. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers (11,516 adverts) then Data Engineers (5,514 adverts), but comparative demand is highest for Test Analysts, Field Service Engineers, IT Support Analysts, and Tech Automation Engineers. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Test Analyst	2,365	4.5%	1.66
Field Service Engineer	1,472	2.8%	1.37
IT Support Analyst	3,457	6.5%	1.28
Test Automation Engineer	1,055	2.0%	1.22
Cyber Security Analyst	2,178	4.1%	1.13
Embedded Software Engineer	2,871	5.4%	1.13
Network Engineer	1,237	2.3%	1.09
Software Developer	11,516	21.7%	1.08
Data Engineer	5,514	10.4%	1.07
Full Stack Developer	846	1.6%	1.02

Source: Geek Talent, 2021

Wales - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for Wales and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where Wales (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, Wales is above the median value on this indicator.

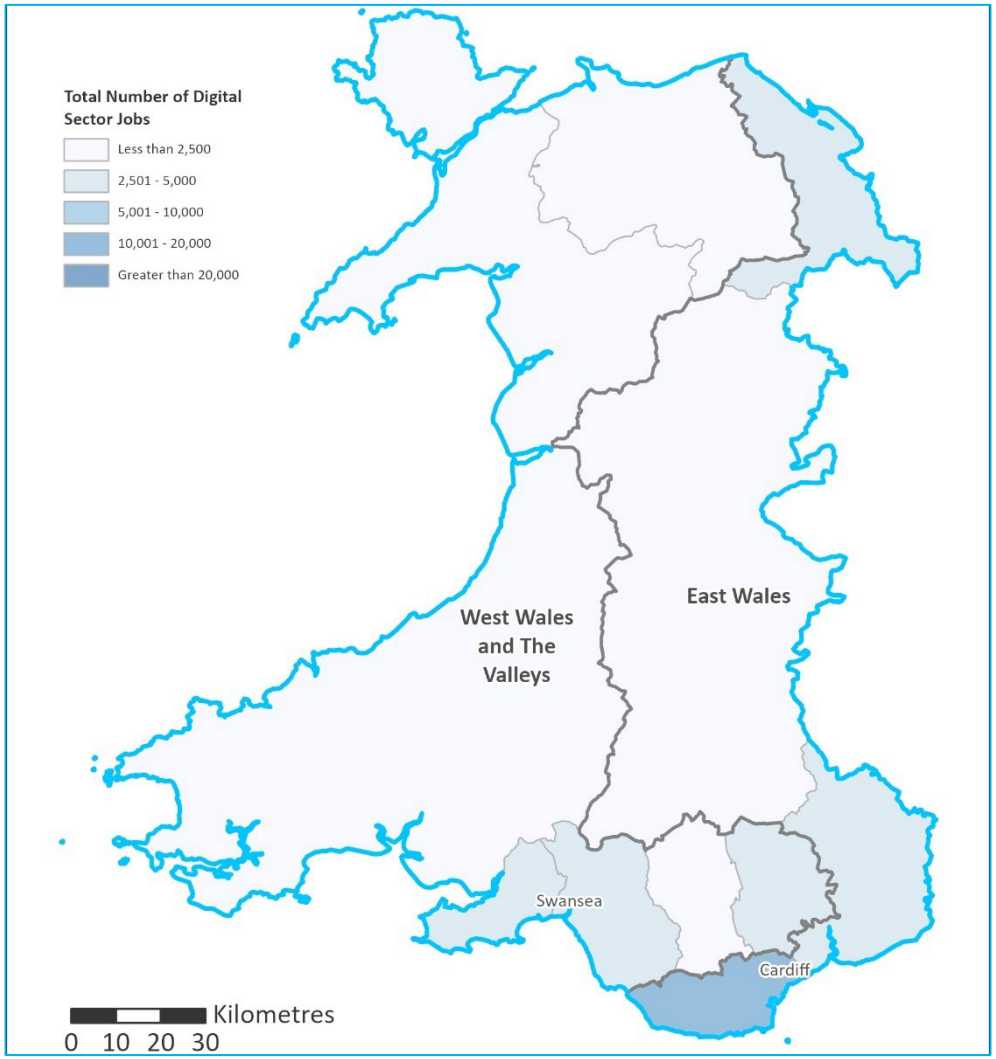
Indicator name	Period	W	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**4.8**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**2.1**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**3.0**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**5.5**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**7.8**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**5.2**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**3.4**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**5.6**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**35.2**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.0**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**15.2**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**19.2**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**93.1**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**20.7**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**27.3**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**58.9**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**2.8**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**8.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**9.7**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**88.0**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**20.8**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**16.6**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**9.6**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**4.1**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.5**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**1.0**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**32.1**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**35.0**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**38.8**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**90.2**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**93.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**41.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**71.0**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**2.2**		1.3	1.4	1.8	2.3	2.6

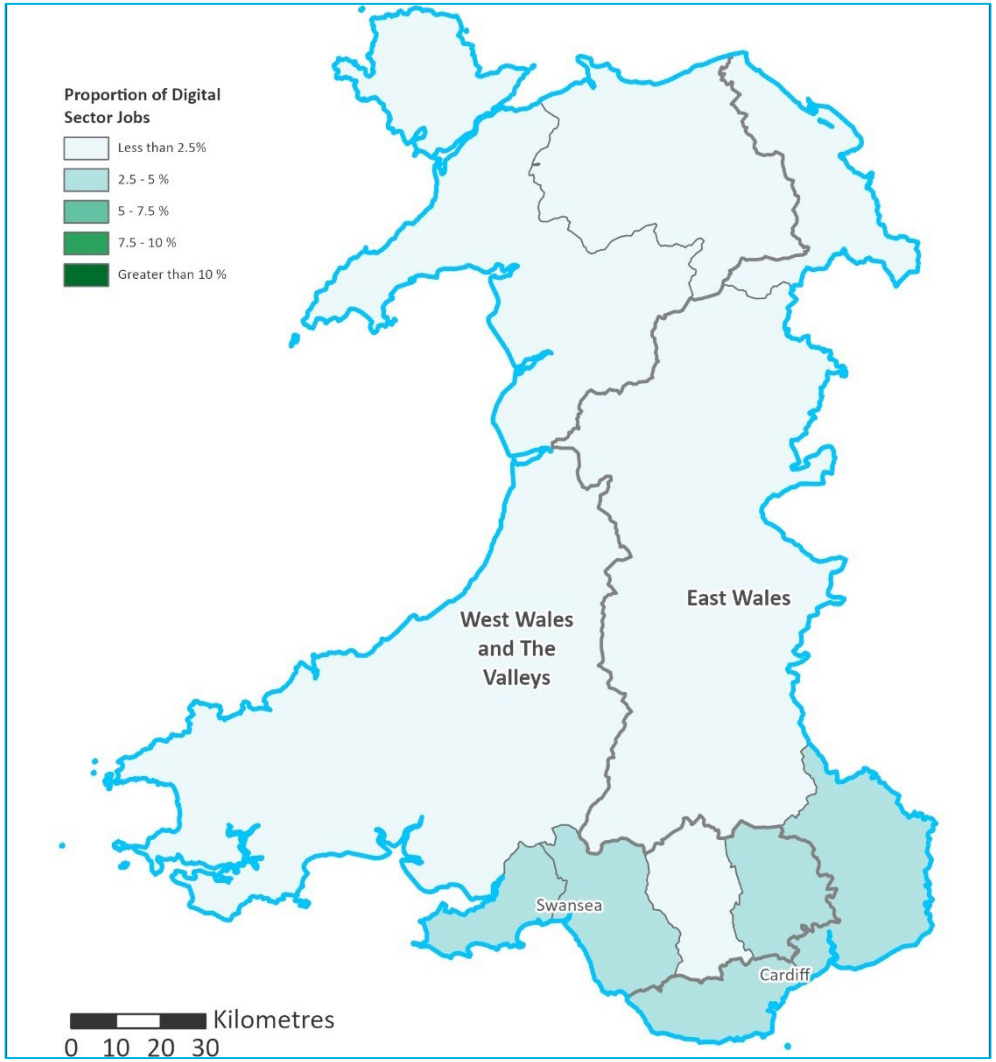
Source: Steer-ED and various datasets – See Appendix B *Not accessed for Wales

Wales - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

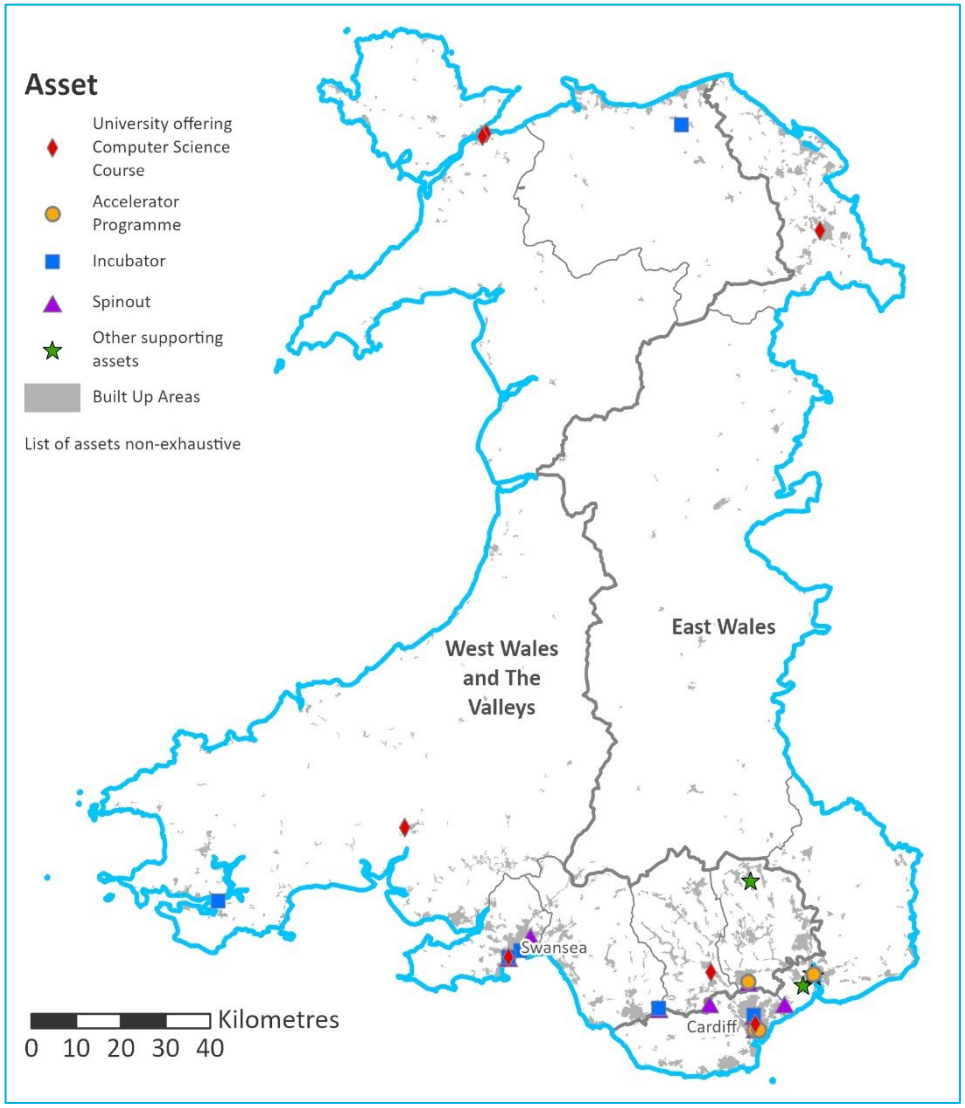
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

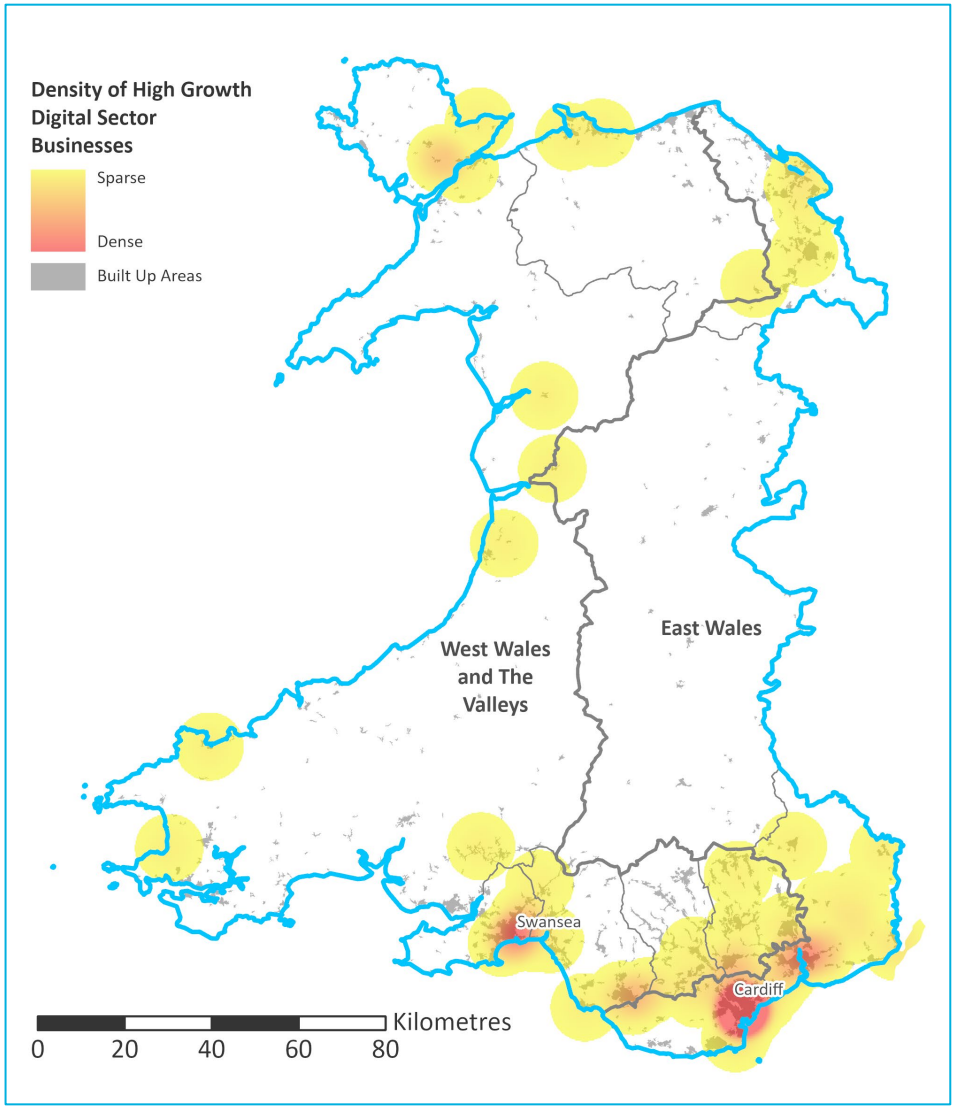




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in Wales, including accelerators, incubators, universities with computer science courses, university spinouts, and additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in Wales. It highlights how high growth businesses are concentrated in larger urban areas.



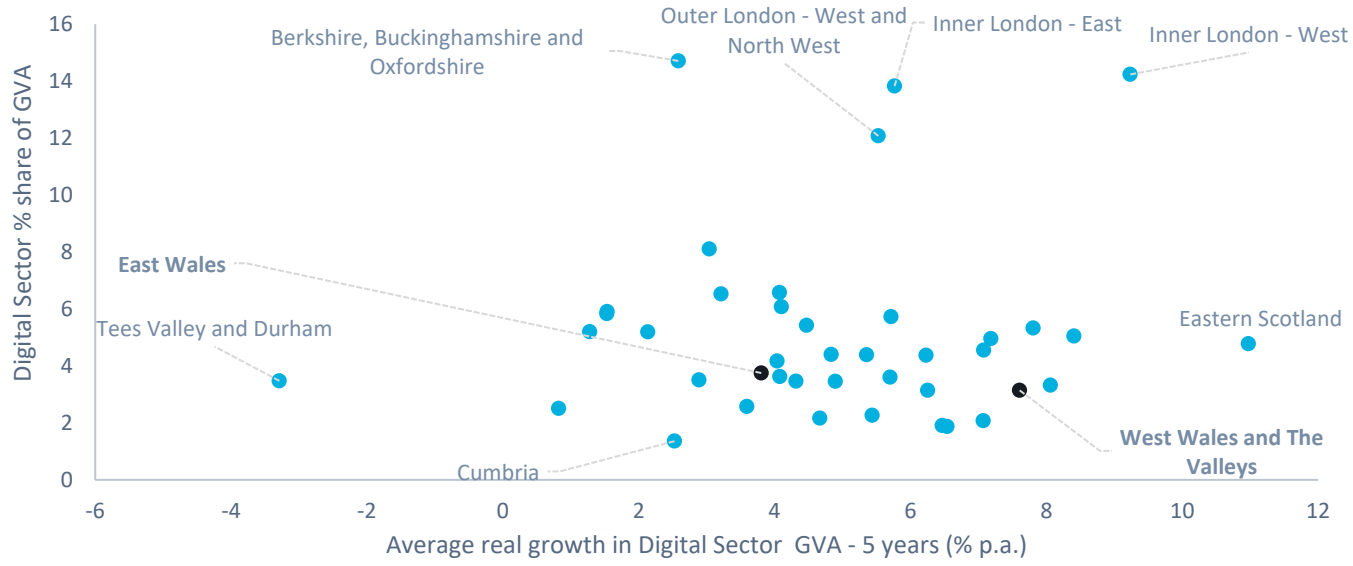


Wales – Sub-Regional Potential

Analysis of Key Metric Combinations, NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in Wales, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. Wales are indicated in black. Key outliers outside Wales are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in Wales.

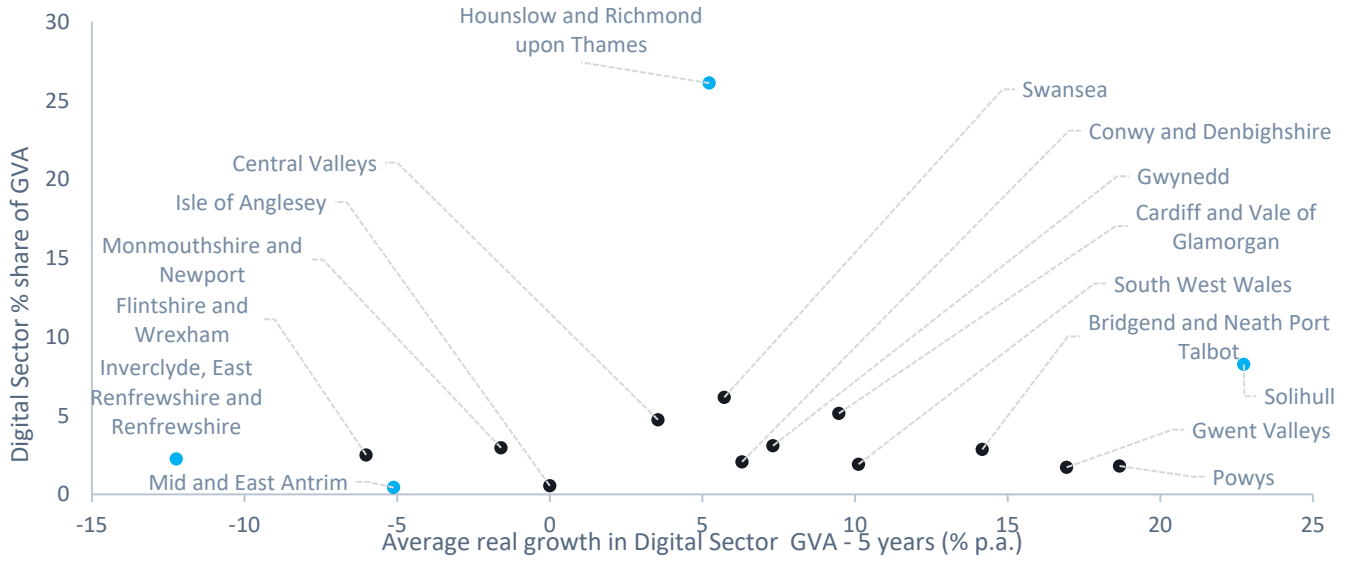
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

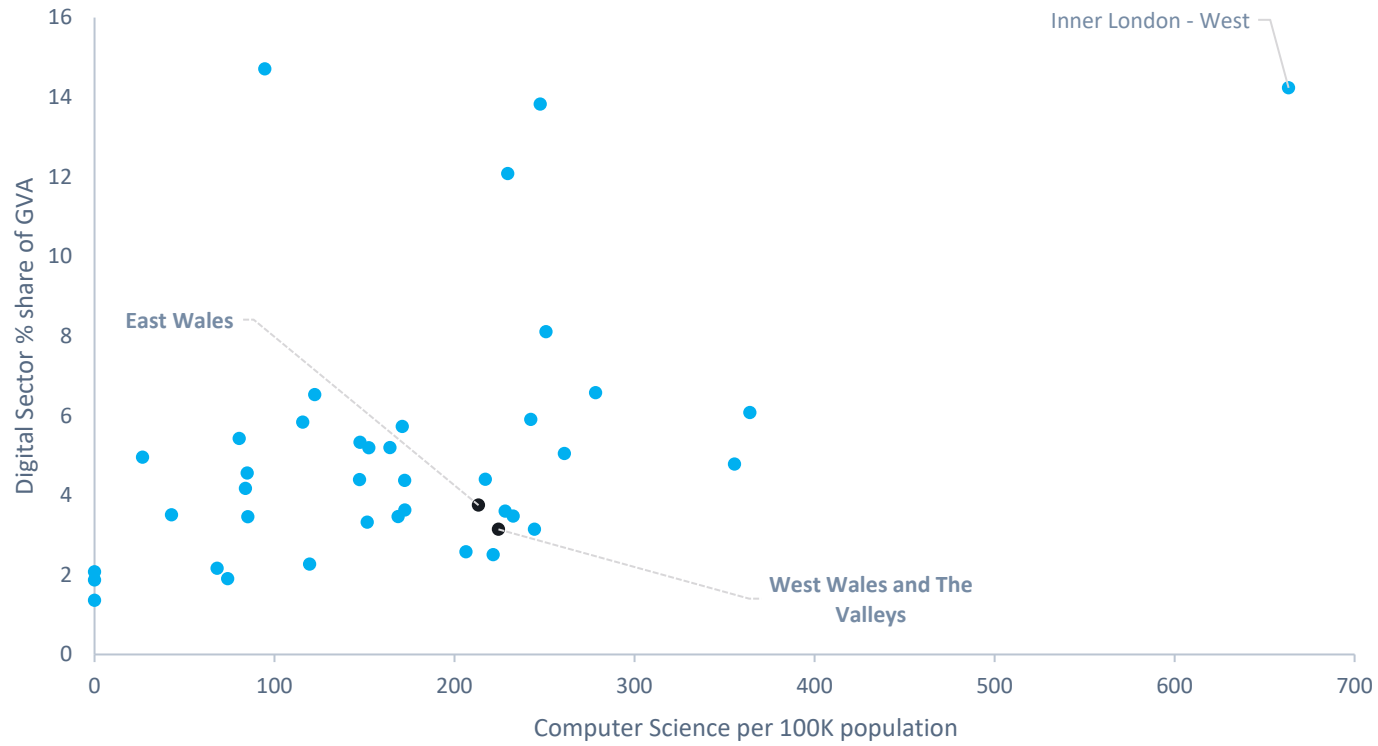
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – Wales NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is corelated with the relative size of the digital sector in Wales' NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

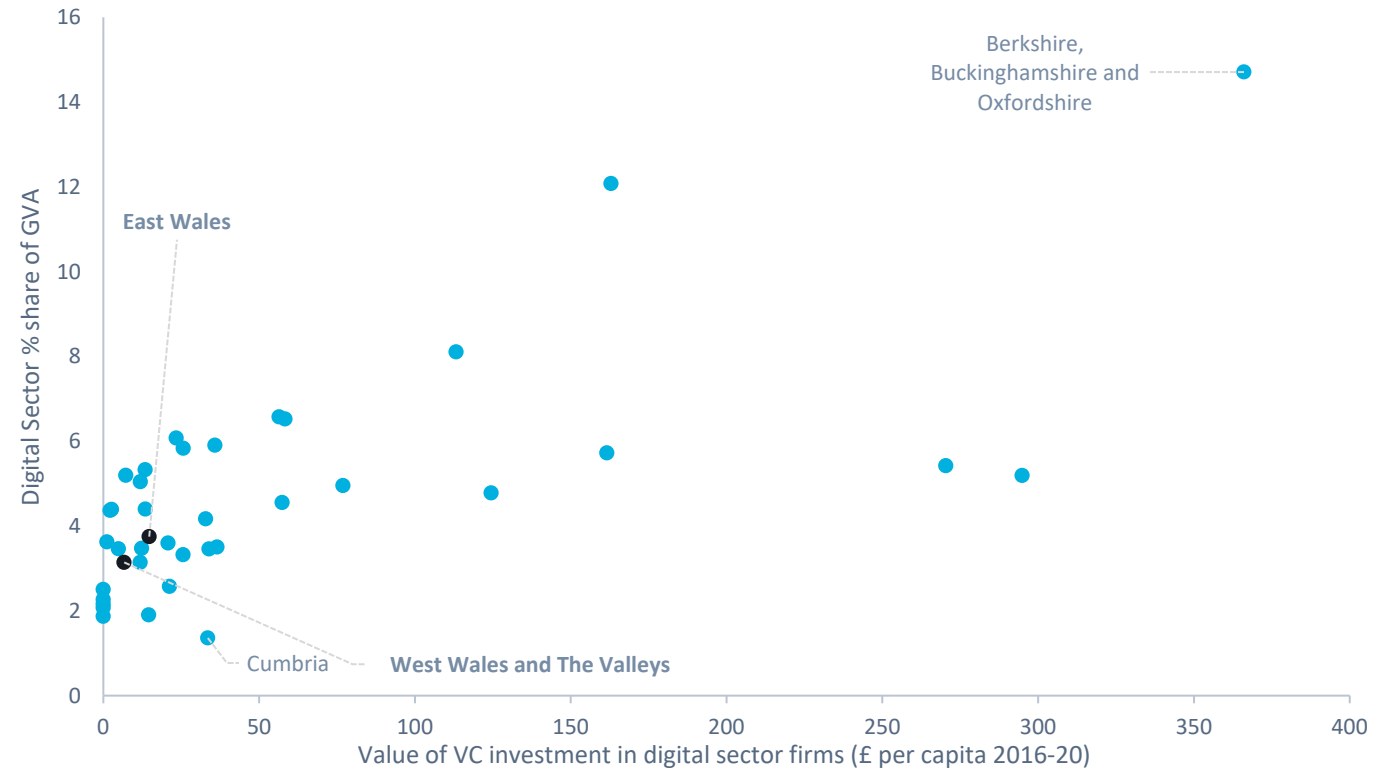
Digital Sector GVA % plotted against Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020) (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

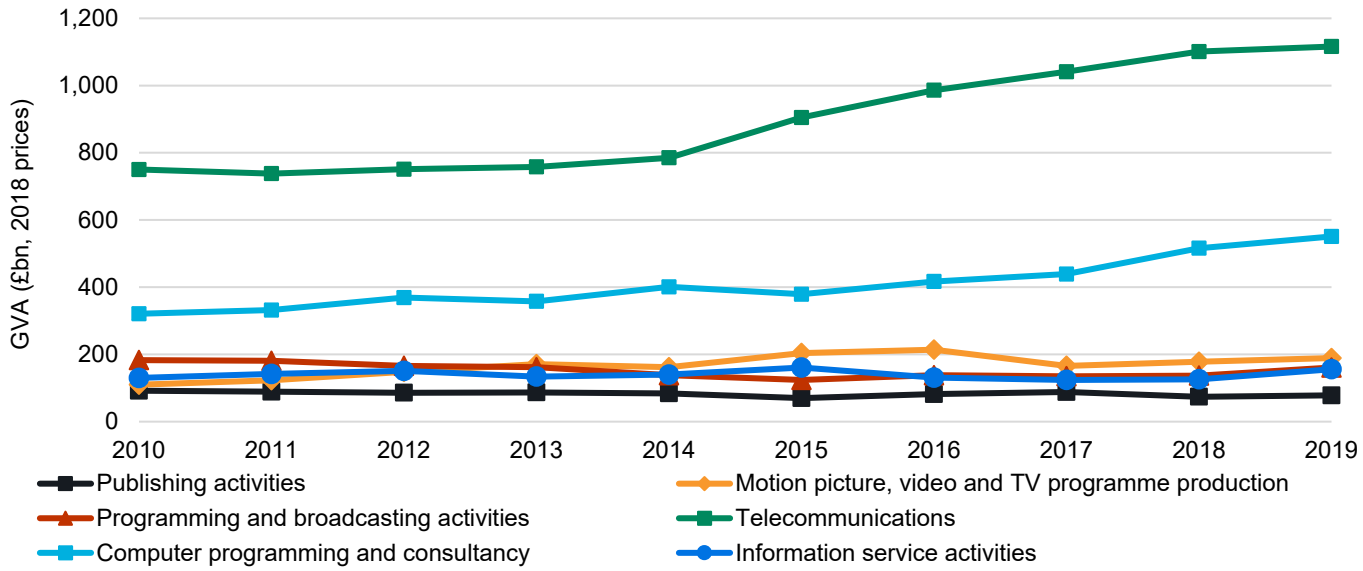
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector.

Wales – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of Wales, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



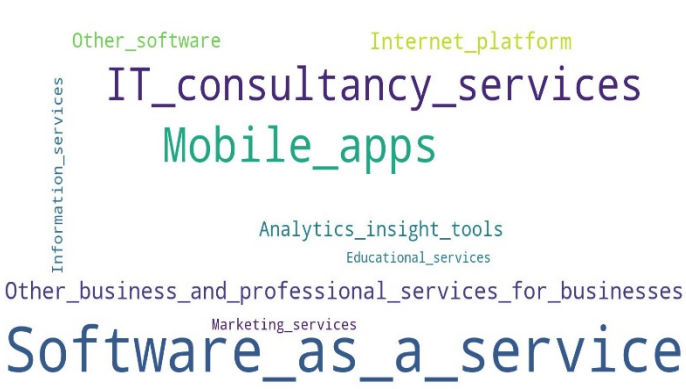
Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that there has been significant growth in Telecommunications over the last 5 years, which is also the largest digital sub-sector in Wales. Computer programming and consultancy bas also experienced some growth as the second largest digital sub-sector.

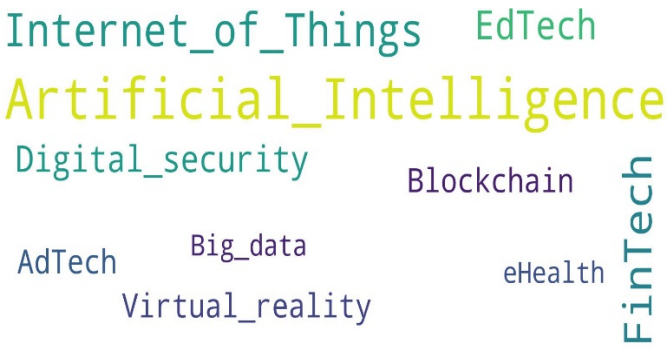
High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which Wales' potential for further economic growth lie. There were 144 high growth businesses in the digital sector in Wales in 2021, equating to 2.8% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst



World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

Wales' Digital Ecosystem in Summary

Strengths

- Strong digital sector employment growth, which increased by 7.8% between 2015 and 2019. Wales is in the top quartile of UK regions for this measure.
- High proportion of 'high growth' digital sector firms. At 2.8% of total business stock, this was significantly higher than the UK average.
- Between 2014 and 2019 Wales' digital economy grew at 5.4% per annum, much faster than the rate of growth in the total economy (<1%).
- Wales has the highest proportion of businesses in any UK NUTS1 area that are SMEs, which provides a diverse business base with opportunities to create fast-growth scale-up.
- Strong clusters of digital business and jobs along the Bristol channel, particularly in the cities of Cardiff, Newport and Swansea, and around Wrexham in North Wales.
- Cluster organisations such as AI Wales (over 700 members), Cyber Wales (one of the largest Cyber clusters in the UK), Py Data Cardiff (over 600 members), and BeTheSpark are strengthening networks and helping to shape Welsh and UK government policy and initiatives.
- Established and new tech hubs/incubators including the AI Centre of Competence in Cardiff, Data Innovation Accelerator scheme in Cardiff, TechHub in Swansea, and Tram Shed in Cardiff.
- Universities and innovation agencies are strengthening their engagement with industry, through centres such as the Compound Semiconductor Applications Catapult, the Advanced Manufacturing Research Centre Cymru, and IMPACT at Swansea University.
- Following the publication of the 'Brown Review' into digital innovation in Wales, the Welsh Government has increased its focus on the digital ecosystem. A new digital strategy for Wales has been published, which has been widely welcomed by public and private stakeholders.

Opportunities/Specialisms

- Amongst Wales' 144 digital sector companies identified as high growth, prominent sub-sectors include 'Software as a Service' (33% of firms), mobile apps (18% of firms), and IT consultancy services (16%). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (9% of firms), Internet of Things (5%), FinTech (5%), and EdTech (4%).
- The UK Tech Cluster Group's '12 clusters of tech' report identifies InsureTech, FinTech, Data and Cyber as areas of existing regional strength, with opportunities for growth.
- In InsureTech, a cluster has developed around the headquarters of household names, such as Admiral Insurance, GoCompare, moneysupermarket, and confused.com. Linked to Wales' InsureTech capabilities, exciting new firms are emerging in FinTech, such as Wealthify, Sonovate, BipSync, and Delio.
- Data assets include the ONS Data Science Campus, Supercomputing Wales, the Centre for Doctoral Training in AI, the Data Nation Accelerator, and Administrative Data Research Wales (ADR Wales), as well as companies like Amplyfi, Configur and Next Generation Data.
- In Cyber, Wales benefits from proximity to Cheltenham, its National Cyber Security Centre and the associated cyber community. Welsh cyber assets include the Cyber Wales cluster organisation, the National Cyber Security Academy, and the National Digital Exploitation Centre.
- Wales' capacity in semiconductor development and manufacturing, particularly given the rapid growth in global demand in recent years, is a major growth opportunity for Wales and the UK. Headquartered in Cardiff, IQE has a 55% global market share in compound semiconductor technology.

Barriers to Growth

- Despite Wales' strengths and specialisms, it had the lowest share for digital sector employment, digital occupation employment, and digital sector GVA of the UK's NUTS1 areas. GVA per hour worked in the digital sector was also in the bottom quartile of UK regions.
- Digital start-up rates, which are critical for introducing innovative new products and services, are amongst the lowest in the UK as a proportion of all business births. The three-year survival rate for new digital start-ups is in the bottom quartile of UK NUTS1 regions.
- Levels of international trade of digital services from Welsh digital businesses are low, suggesting they predominantly serve a regional/local, rather than global, markets.
- Recruitment of digital talent, and ensuring a more diverse and representative workforce, is reported to be a major challenge. Positively, Wales has a good pipeline of digital talent coming through, with relatively high levels of computing students per 1,000 population. Wales is also making progress in educational reform with the new curriculum for 3 to 16-year-olds aiming to mainstream digital for all children and young people.

- Access to finance is also reported to be a barrier, with access to Angel fund and VC investment per capita both amongst the lowest in the UK. While the Development Bank of Wales and Finance Wales have filled important gaps in the market, this lack of growth finance acts as a brake on growth potential.

Achieving Prosperity

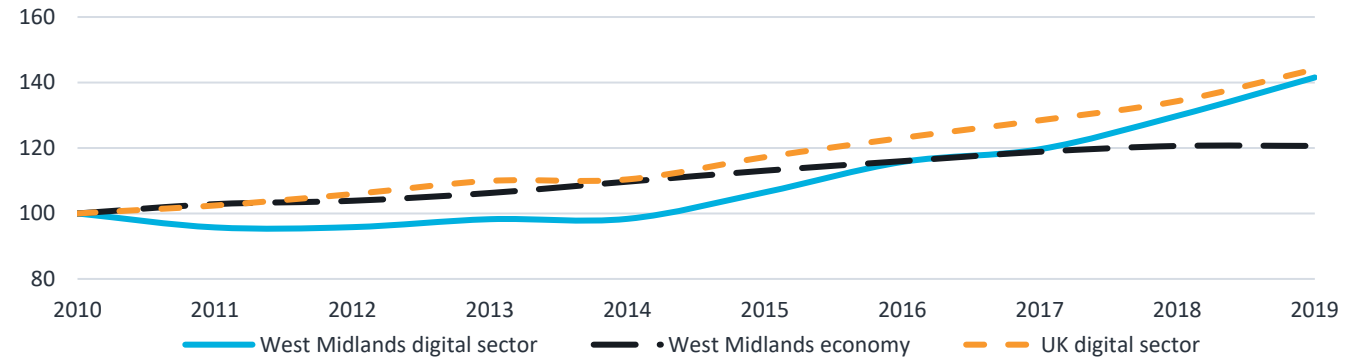
- On the basis of Steer-ED's indicative modelling (see Section 2), the digital sector in Wales has the potential to grow by at least £0.4 billion in annual GVA by 2025 (an increase of 16% on the 2019 value), creating an additional 11,300 jobs (an increase of 30% on the employment in 2019).
- In realising this 'Prosperity Prize', it is important to recognise that the digital economy ecosystem in Wales is relatively under-developed and, despite nationally and internationally significant niche strengths, overall the sector lacks critical mass and scale. Fully capitalising on opportunities, and addressing gaps and weaknesses, across all five enabling domains of the ecosystem will be needed to close the gap with leading digital regions in the UK and internationally.
- The strong recent growth in digital sector employment, and the high proportion of digital firms that are classed as high growth, are highpoints and work is needed to maintain these positions. The low level of productivity in the digital sector itself, and low levels of digital occupations across the economy as a whole, are related challenges and work is needed to transform performance in these areas.
- Wales' specialisms and opportunities in leading-edge sectors such as InsureTech and FinTech, cyber, advanced manufacturing, semi-conductors, and data, offer good routeways to regional prosperity. The increasingly coordinated pan-Wales approach focused on these areas, alongside complementary academic and innovation assets, incubators, accelerator programmes, education and skills programmes, and an aligned inward investment approach, provide important foundations to capitalise on these opportunities.

West Midlands – Summary Dashboard

Region

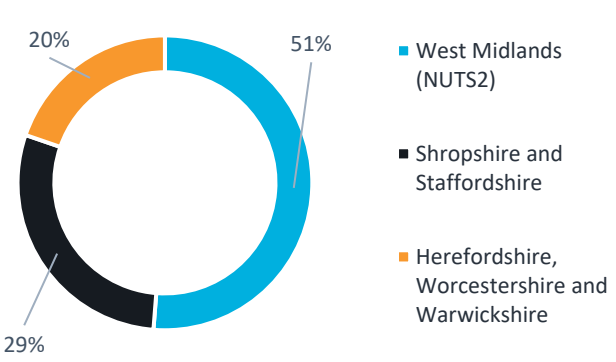
- **Component NUTS2 regions:** Herefordshire, Worcestershire and Warwickshire, Shropshire and Staffordshire, and the West Midlands.
- **Key Statistics:** 13,000km^2, 5.9m population, £141bn total GVA (2019), 1.9% total annual GVA growth (2014-2019).
- The West Midlands region is geographically diverse, running from the urban central areas of the Birmingham conurbation to the rural western counties of Shropshire and Herefordshire, which border Wales. The largest city and main population area is Birmingham, home to 1.1m people.
- This region continues to perform strongly relative to the UK in manufacturing, constituting 15% of the West Midland's total GVA output (location quotient 1.6 compared to the UK), with specialisms in Metal Products, Electrics, and Automotive. The Services sector contributes 74% of total GVA with the Real Estate, Retail, Health, and Education sectors providing large proportions of the region's total GVA.
- The digital sector is relatively small as a percentage of total output for the region (4.7%), but it is showing strong growth in economic output (7.6%, 2014-2019), significantly faster than the UK's Digital Sector, and much faster than West Midland's economy as a whole.
- Digital employment (estimated at 155k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector; this is indicative of the high demand for digital skills in non-digital sector industries, such as in Finance, Retail, Energy, Recruitment, and Professional, Technical and Business Support Services.
- Demand for digital occupations is dominated by the West Midlands NUTS2 Region, accounting for 51% of digital occupation online job postings in the 2019-2020 period.
- There is relatively high demand for Network Engineers, Field Service Engineers and IT Support Analysts (location quotient above 1.0, the UK average) although the largest absolute demand for occupations (numbers of online job postings) are for Software Developers (19%), Data Engineers (9%), and Business Analysts (8%).

Digital Sector GVA growth 2010-2019 (indexed to 2010), West Midlands NUTS1 Region



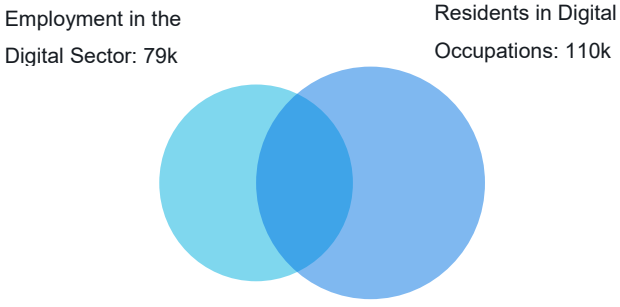
Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in the West Midlands (2019 – 2020)



Source: Geek Talent, 2021

Digital Sector and Digital Occupation Employment (2019), West Midlands NUTS1 Region



Total digital employment in the West Midlands: c. 155k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations (2019-2020), West Midlands NUTS1 Region

- This table shows digital occupations by demand for the West Midlands. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, Data Engineers, and Business Analysts, but comparative demand is highest for Network Engineers, Field Service Engineers and IT Support Analysts. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Network Engineer	5,456	3.0%	1.41
Field Service Engineer	4,947	2.8%	1.36
IT Support Analyst	11,590	6.5%	1.26
IT Project Manager	8,378	4.7%	1.18
IT Service Manager	3,743	2.1%	1.16
Cyber Security Analyst	7,457	4.2%	1.14
Database Administrator	2,583	1.4%	1.13
Business Analyst	15,040	8.4%	1.12
IT Consultant	3,963	2.2%	1.10
Data Analyst	5,220	2.9%	1.07

Source: Geek Talent, 2021

The West Midlands - Digital Ecosystem metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for the West Midlands and how this compares to the lowest and highest NUTS1 region values, to enable assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where the West Midlands (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, the West Midlands is above the median value on this indicator.

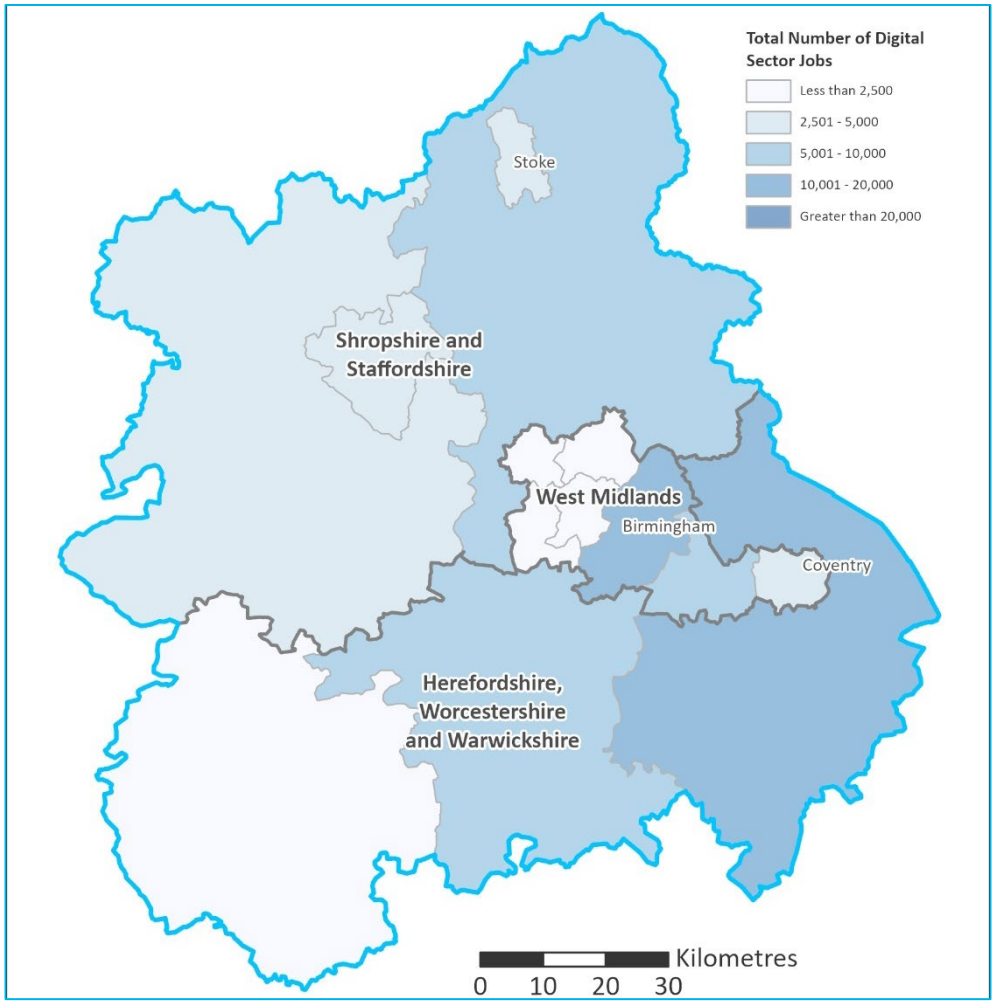
Indicator name	Period	WM.	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	6.2		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	2.6		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	4.5		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	4.8		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	1.6		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	6.9		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	4.7		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	7.6		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	51.1		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	1.4		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	14.0		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	16.9		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	95.7		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	20.0		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	51.6		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	60.8		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	1.3		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	6.0		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	19.7		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	116.4		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	25.6		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	16.9		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	13.4		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	3.0		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	0.3		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	1.1		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	38.5		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	43.0		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	37.1		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	91.0		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	97.0		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	36.0		23.0	36.8	42.5	52.3	67.0
% of first-degree graduates that remain in the region	2016/17	67.1		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	1.9		1.3	1.4	1.8	2.3	2.6

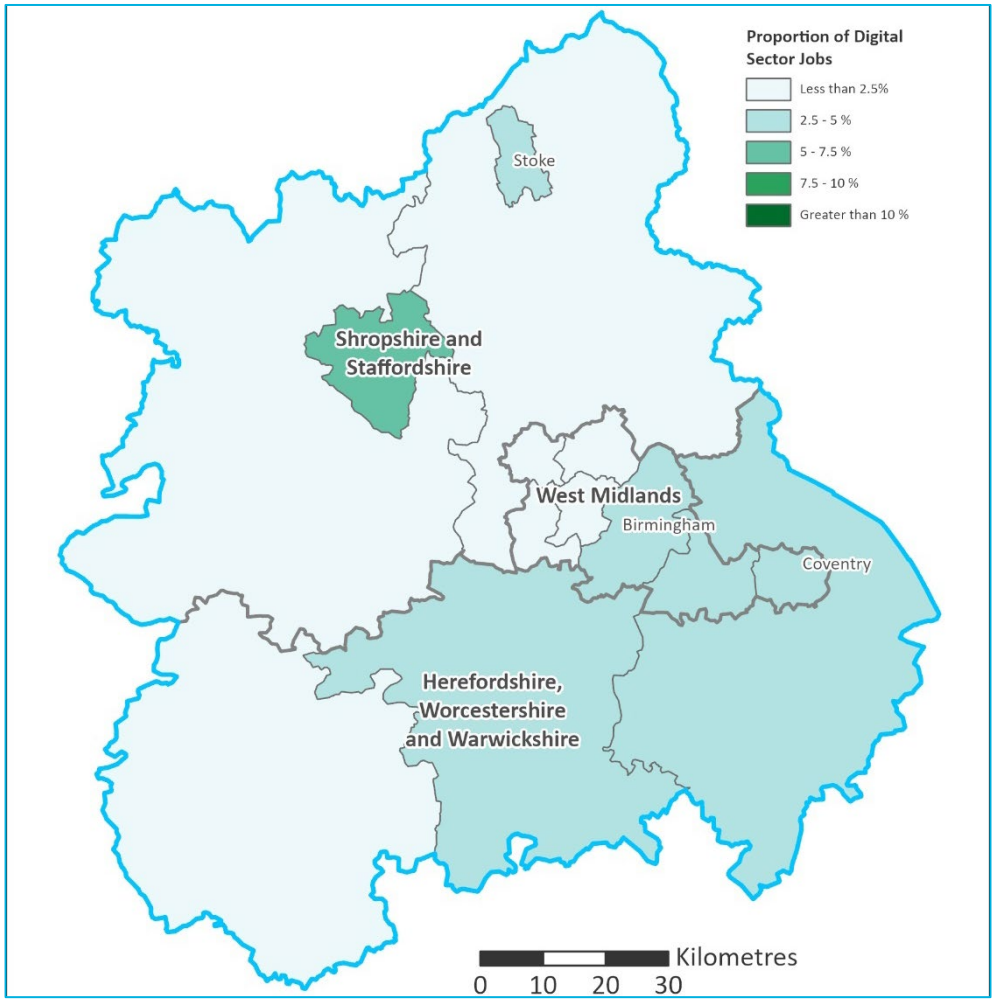
Source: Steer-ED and various datasets – See Appendix B

The West Midlands - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

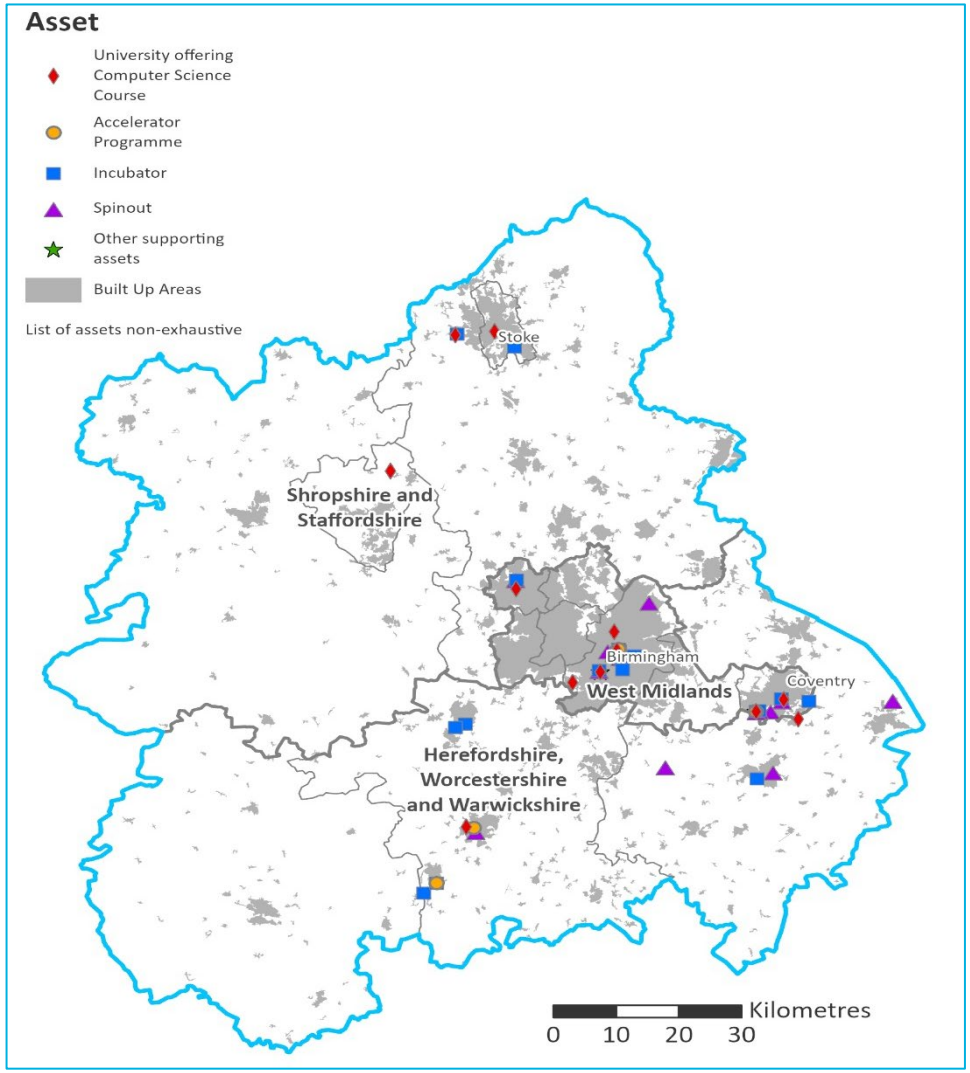
The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 region. They highlight where employment is concentrated and where there are relatively large employment clusters.

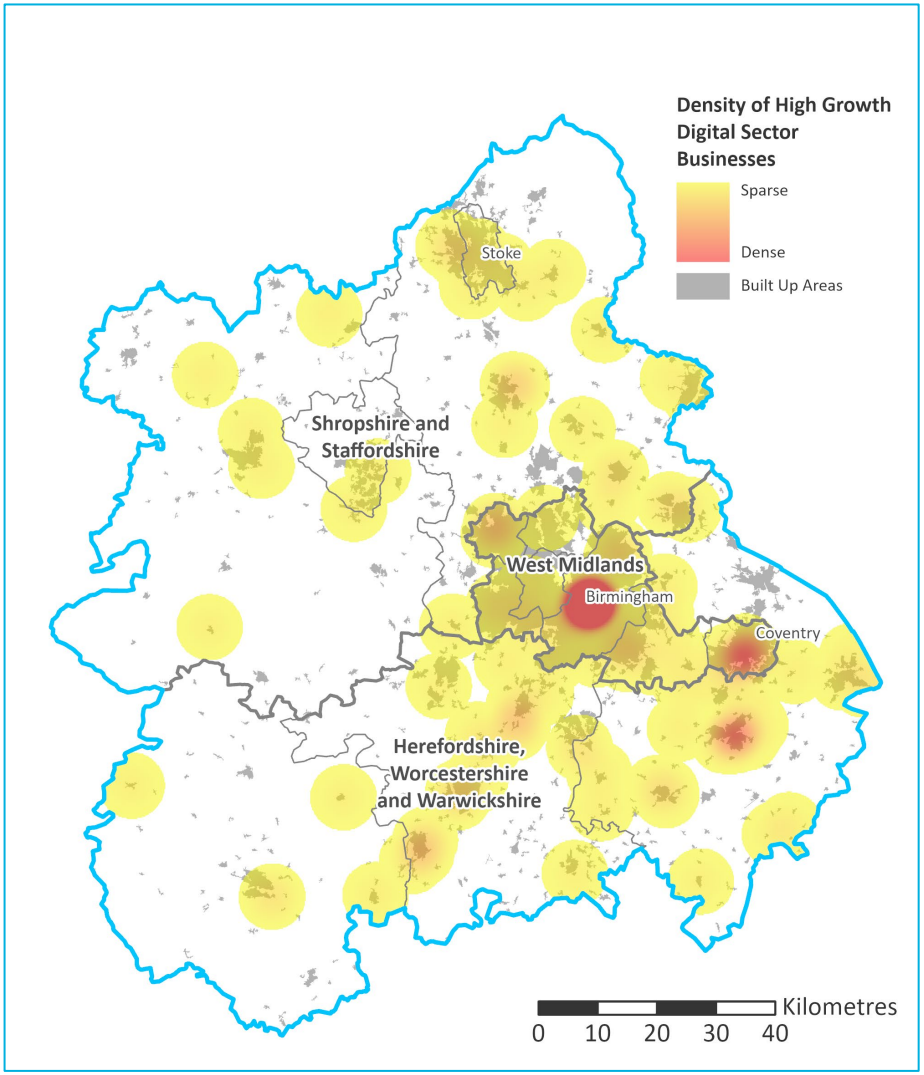




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in the West Midlands, including accelerators, incubators, universities with computer science courses, university spinouts, additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in the West Midlands. It highlights how high growth businesses are concentrated in larger urban areas.



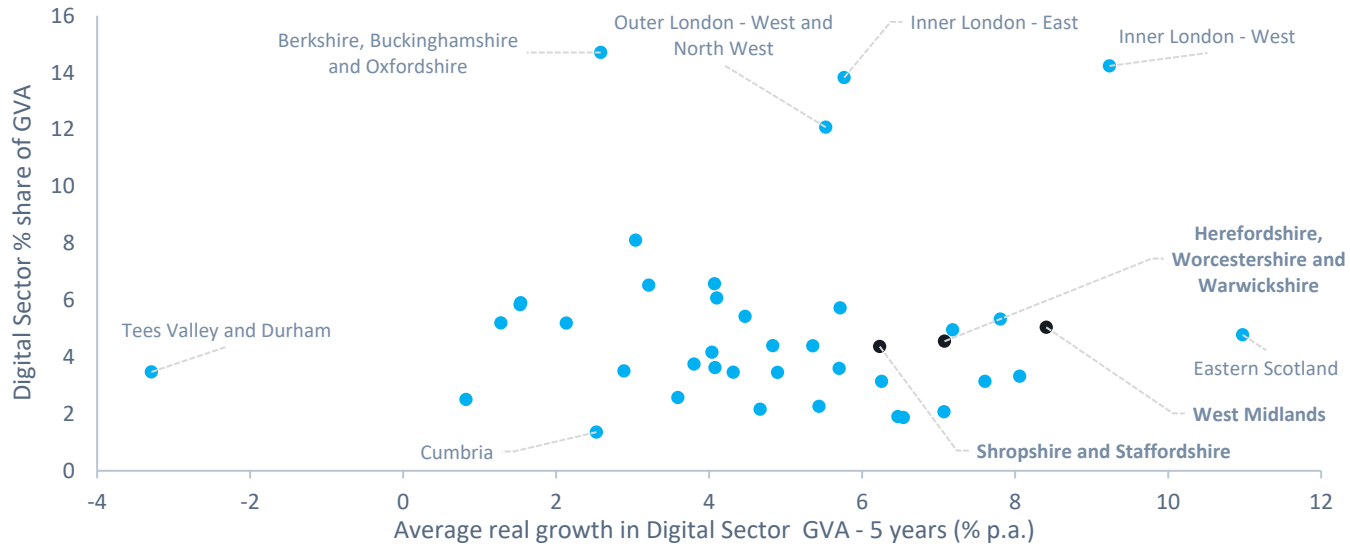


The West Midlands – Sub-Regional Potential

Analysis of Key Metric Combinations at NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in the West Midlands, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. The West Midlands are indicated in black. Key outliers outside the West Midlands are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in the West Midlands.

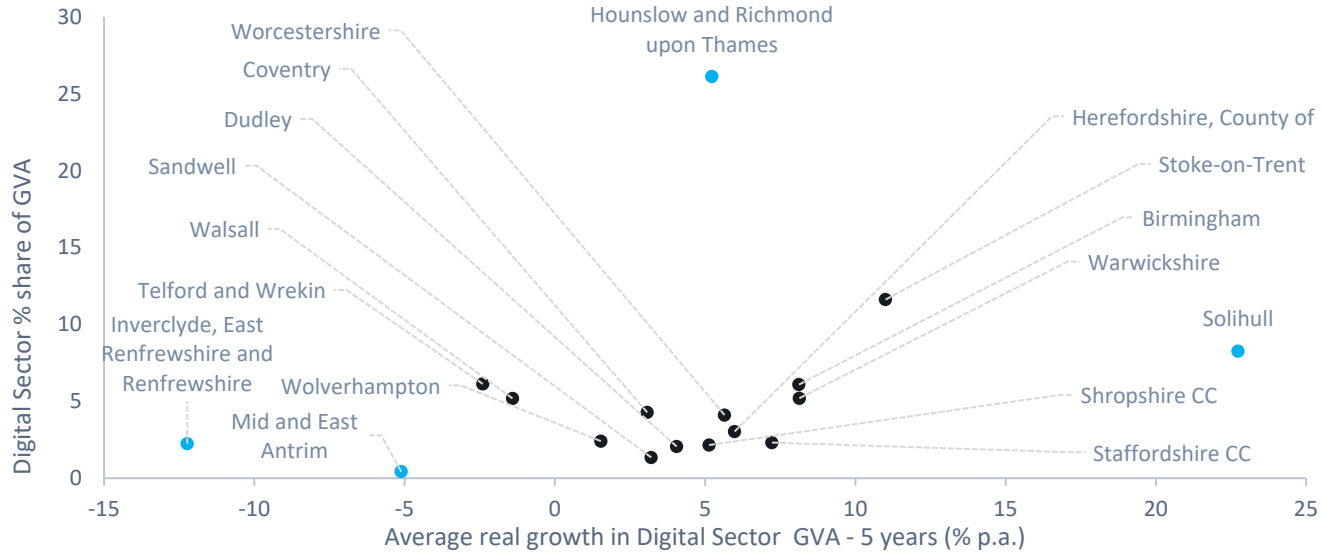
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

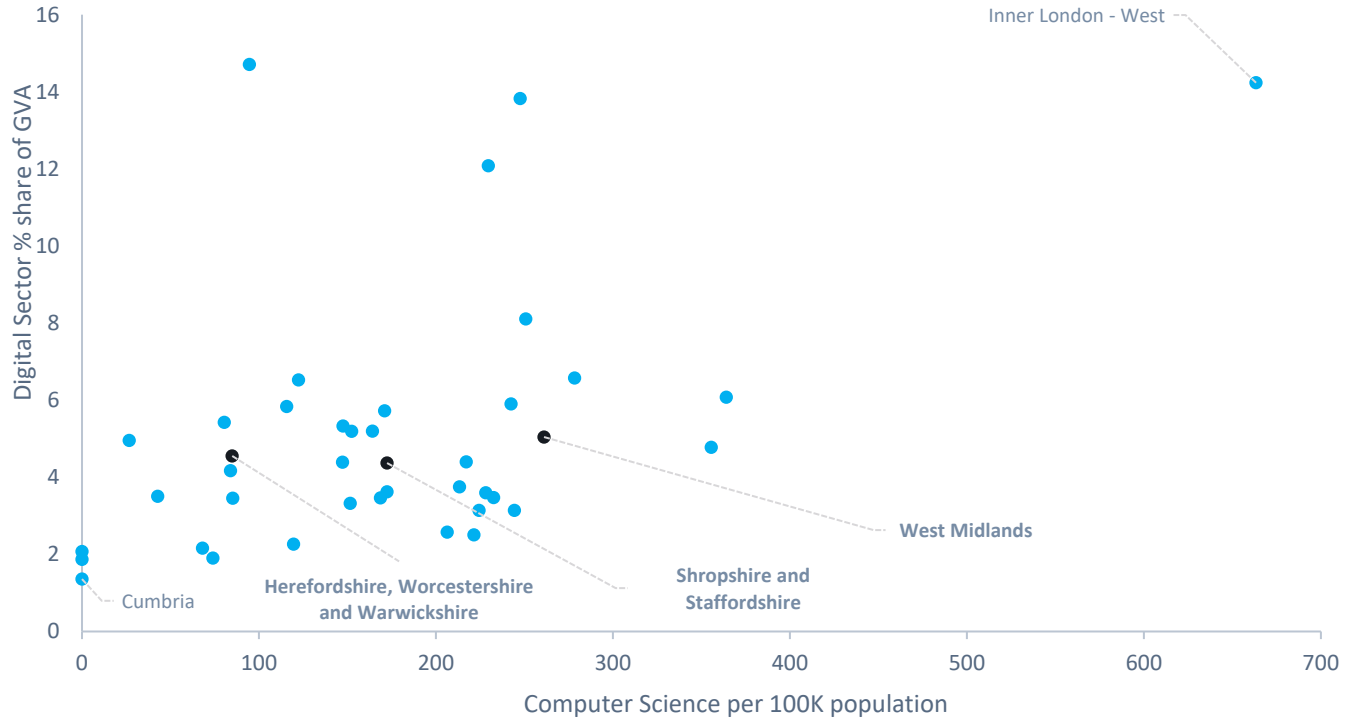
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – The West Midlands NUTS3 regions and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is correlated with the relative size of the digital sector in the West Midland's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

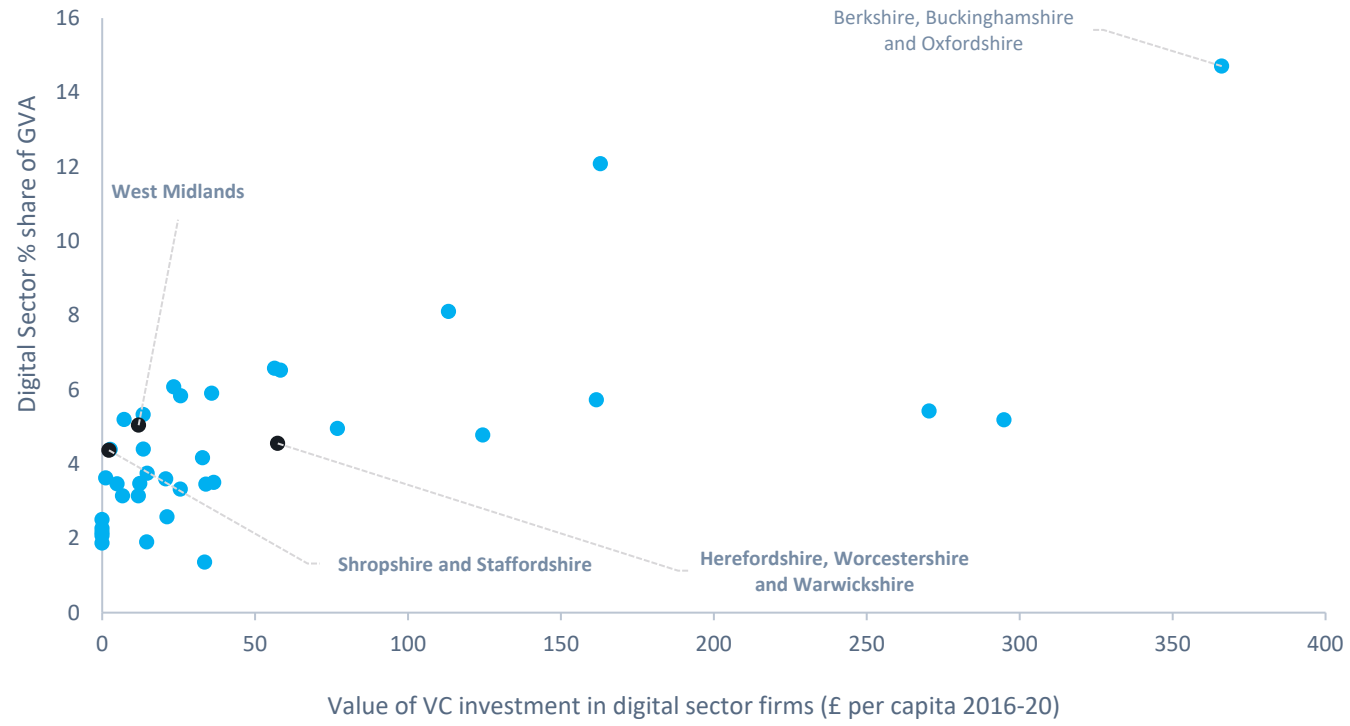
Digital Sector GVA % plotted against Computing Students per 100k population (NUTS2 Regions)



Source: REF, 2014, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 Regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

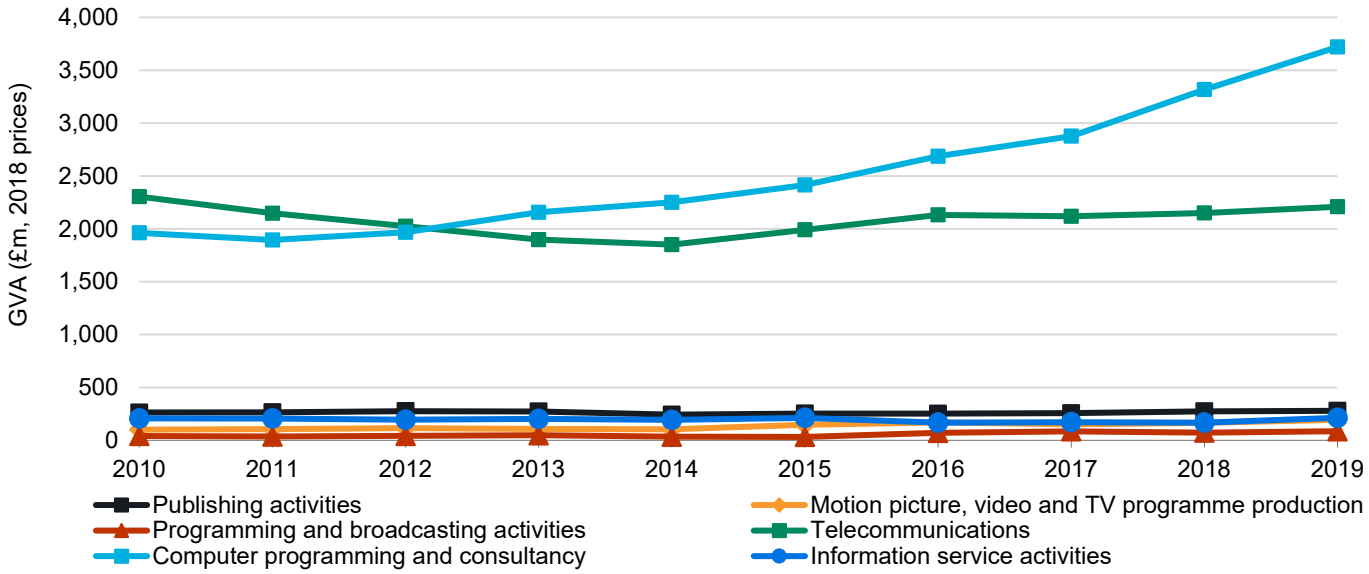
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector.

The West Midlands – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of the West Midlands, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

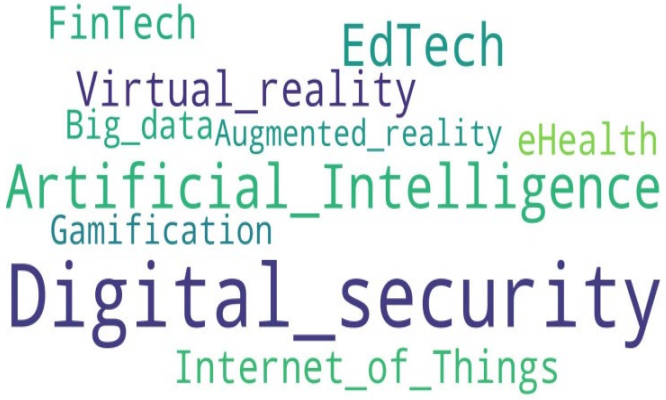
- The chart above shows that there has been significant growth in Computer programming and consultancy, which has remained the largest digital sub-sector in the West Midlands since 2013. These sub-sectors are where the growth potential for the West Midlands is. Telecommunications is the second largest sub-sector in the West Midlands, but hasn't experienced growth in the last decade.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which the West Midland's potential for further economic growth lie. There were 188 high growth businesses in the digital sector in the West Midlands in 2021, equating to 1.3% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) which the region's high-growth firms operate in, and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

The West Midlands Digital Ecosystem in Summary

Strengths

- The profile of the digital economy ecosystem in the region follows broadly that of the UK NUTS1 region average.
- Rapid real GVA growth (7.6% per annum, between 2014 and 2019), which was been driven primarily by the 'Computer programming and consultancy' (10.6% per annum) sub-sector.
- Similarly, strong growth in digital occupations (6.9% per annum between 2014 and 2019), with digital employment (sector and occupations) at 155k workers (5.6% of the overall regional workforce).
- Digital sector GVA per hour worked is strong (£51.13).
- International trade in digital services as a percentage of regional GVA is at 1.4%, and in the upper quartile. Provides a strong base from which to grow and develop the digital sector, especially post the UK's exit from the European Union.
- Gigabit capable coverage is strong, with almost 52% of premises in the region having access. Similarly, the proportion of households with Internet access is 97%, the best of all UK NUTS1 regions.
- Median performance on generating REF2014 '4*' research at the regional level masks strong institutional performance by the Universities of Birmingham and Warwick.
- Clear success in attracting and retaining large digital economy employers – e.g. Codemasters at Leamington, and HSBC (UK headquarters), Goldman Sachs (Northern Office), Deutsche Bank and Lombard Risk (new Technology Centre), all in Birmingham.
- A well-regarded infrastructure for digital and associated tech incubators and workspaces, including Innovation Birmingham (at Aston, and home to over 170 technology-facing companies) Birmingham's WeWork and STEAMhouse, Spark Wolverhampton, and Warwick Enterprises (on campus at Warwick University, and at Leamington Spa).
- Well-coordinated promotional effort for the region's digital economy at home and abroad, led by the West Midlands Growth Company and InvestWM.
- Whilst Birmingham continues as the main centre, the digital economy is increasingly multi-centred in its distribution, with already strong nodes of digital sector employment around, for example, Leamington Spa (Gaming), Worcester, Warwick (linking with the subregion's expertise in Advanced Manufacturing), and Nuneaton.
- Initiatives such as West Midlands Digital Skills Partnership (funded by DCMS) can play important roles in linking within/across the sector.

Opportunities/Specialisms

- Amongst the region's 174 digital sector companies identified as high growth, prominent sub-sectors include Software-as-a-Service (34% of firms) and Mobile Apps (21% of firms). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (6% of firms), digital security (6%), Internet of Things (5%), EdTech (4%) and virtual reality (4%).
- The West Midlands Digital Roadmap 2021, endorsed by the Metro Mayor, provides a clear strategy for developing the digital economy through to 2026. Priorities include securing access for everyone to digital, sharing and using data to improve people's lives, becoming the UK's best-connected region, realising the potential of digital to transform the economy and build resilience, and using digital public services to build a fairer/greener/healthier region.
- The nexus of expertise in manufacturing and the digital economy offers the region the opportunity to become a major centre for digital-enabled Advanced Manufacturing technologies and methods. This will be tested by the region's recently announced Made Smarter Technology Adoption Pilot, helping SME manufacturers to introduce digital tools and technologies to boost productivity and growth in the face of Industry 4.0. Subject to the success of the Pilot, there could be opportunities to scale-up such support up to make substantial impacts on the region's productivity growth.
- Facing internationally, the region is promoting three High Performing Opportunities (HPOs), these focused on Birmingham and Solihull (Data Driven Healthcare and Technologies), Coventry and Warwickshire (Connected and autonomous vehicle modelling and simulation), and Leamington Silicon Spa (Gaming).
- The region has been selected to host the UK's first multicity 5G testbed, making the region the first in the UK to trial 5G at scale.
- The region's public sector will become an increasingly important customer for, and component of, the region's digital sector. Existing public sector components of the digital economy include the West Midlands Police Force (national leaders in data-led policing and data ethics), and the West Midland's Health Data Research Centre (with its hub in central Birmingham and federated locations at Leicester, Nottingham, and Warwick).

Barriers to Growth

- Despite the size of the sector in the region, annual growth (1.6 per annum over 2015-19) has been modest.
- Three-year survival rates of digital sector firms are weak. The region's current performance (60.8%) is some 4.1 percentage points behind the best performing region.

- The proportion of high-growth firms in the regional stock of digital sector business is underdeveloped significantly. At 1.3%, this is more than four times less that of the best performing region.
- Digital sector spin outs from universities are relatively weak, at 3.0 per 1 million of population. The best performing region is achieving at least double this number.
- Higher Education postgraduates per 1k of population is just in the lower quartile, at 0.3. Again, this is half the performance of the best performing region on this metric.
- The proportion of users finding information online for work/study is 36%, almost half that of the best performing region. On this metric, the West Midlands is the worst performing UK NUTS1 region.
- Graduate retention is soft, with the region's 67.1% performance some 20 percentage points below the best performing region.
- Broadband connectivity is poor in the Black Country; full fibre coverage is 15% in Sandwell, 11% in Walsall, and less than 10% in Dudley, taking in some of the most disadvantaged communities in the UK.
- It is reported the region has the highest proportion of employers saying they find digital skills difficult to obtain from applicants of any UK region (38%)[39].
- Notwithstanding the establishment of the Midlands Engine, recent strategy comments that limited cross-regional governance constrains shared progress on digital challenges, particularly around data sharing, digital inclusion, and basic digital infrastructure.

Achieving Prosperity

- On the basis of Steer-ED's indicative modelling ((see Section 2 of the Main Report), the digital sector in the West Midlands has the potential to grow by at least £2.7 billion in annual GVA by 2025 (an increase of 41% on the 2019 value), creating an additional 52,700 jobs (an increase of 55% on the employment in 2019).
- In driving for this 'prosperity prize', the region's strong performance on digital occupations growth, the sector's overall GVA growth rate and productivity, and levels of international trade must be maintained, and developed still further. The underlying factors which these metrics represent are all key to growing value, competitiveness, and employment in the digital economy.
- In parallel, areas of weaker performance need to be addressed. On inclusion, the region is equal to the 25th percentile for internet users finding information online. Within the Ideas and Innovation domain, the proportion of computing graduates, and levels of university spin-out must be increased (although it should be remembered that the latter is but one channel to spin-out). Average Computer Science research rated 4* across the region needs to be strengthened to bolster the already strong position of Universities of Birmingham and Warwick. On Angel and Venture Capital, the metrics for which are both just on the wrong side of the median, these need to be ramped-up to help drive the virtuous process of start-up/scale-up, generating new value, employment, and opportunity. In the round, these actions will help improve the 'investability' of the digital economy sector in the region, and help it achieve its prosperity potential.

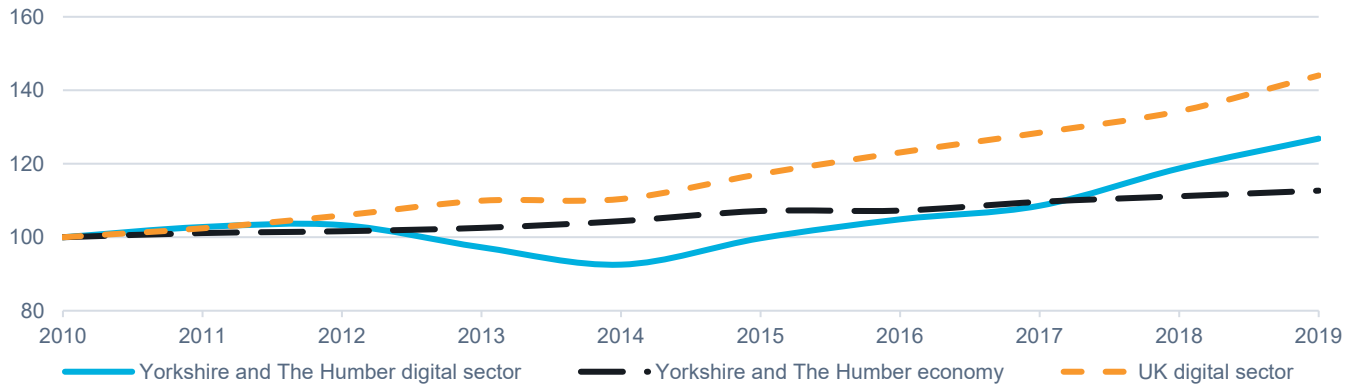
[39] West Midlands Digital Roadmap

Yorkshire and The Humber – Summary Dashboard

Region

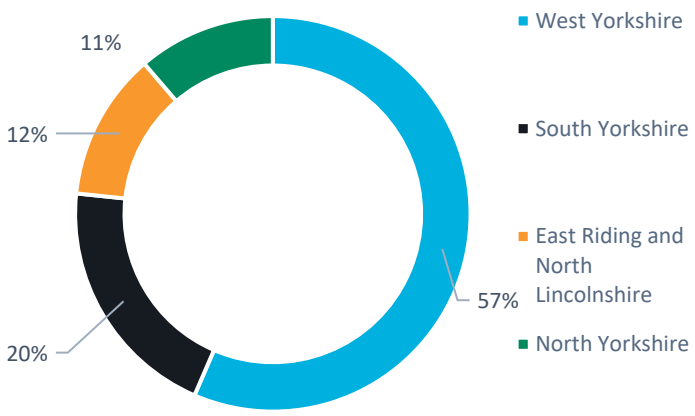
- **Component NUTS2 regions:** East Riding and North Lincolnshire, North Yorkshire, South Yorkshire, and West Yorkshire.
- **Key Statistics:** 15,540km^2, 5.2m population, £125bn total GVA (2019), 1.5% total annual GVA growth (2014-2019).
- Yorkshire and The Humber has multiple hubs, with main population centres in Bradford, Kingston-Upon-Hull, Leeds, Sheffield, and York.
- This region continues to perform strongly relative to the UK in manufacturing, particularly in Food Products, Textiles, Metal Products, and Equipment, with more recent diversification into service sectors such as Transport and Storage, Financial Services and Advanced Manufacturing.
- The Digital Sector is relatively small as a percentage of total output for the region (4.1%), but it is showing strong growth in economic output (6.5%, 2014-2019), faster than the UK's Digital Sector, and much faster than Yorkshire and The Humber's economy as a whole.
- Digital employment (estimated at 140k in 2019) is weighted towards digital occupations in businesses not traditionally in the Digital Sector, indicative of higher demand for digital skills in non-digital sector industries, such as Transport and Storage, Aerospace, and the Public Sector, where Yorkshire and The Humber has large employers of digital occupations.
- Demand for digital occupations is dominated by West Yorkshire, with 57% of digital occupation online job postings in 2019-2020. This is followed by South Yorkshire, with these two most urbanised NUTS2 regions constituting 77% of demand.
- There is relatively high demand for Test/IT Support Analysts (location quotient above 1.0, the UK average) although the largest absolute demand for occupations is Software Developers, making up 23.5% of digital occupation job adverts 2019-2020, indicating increasing demand for innovative software and accelerating growth in technology.

Digital Sector GVA Growth, 2010-2019 (indexed to 2010), Yorkshire and The Humber NUTS1 Region



Source: Regional Gross Value Added, ONS

Demand for Digital Occupations by NUTS2 region in Yorkshire and The Humber (2019–2020)

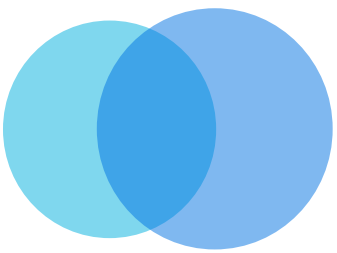


Source: Geek Talent, 2021

Digital Sector & Digital Occupation Employment (2019), Yorkshire and The Humber NUTS1 Region

Employment in Digital Sector: 78k

Residents In Digital Occupations: 96k



Total digital employment in Yorkshire and The Humber: c. 140k

Source: Business Register and Employment Survey and Annual Population Survey, 2019

Concentration of demand for Digital Occupations (2019-2020), Yorkshire and The Humber NUTS1 Region

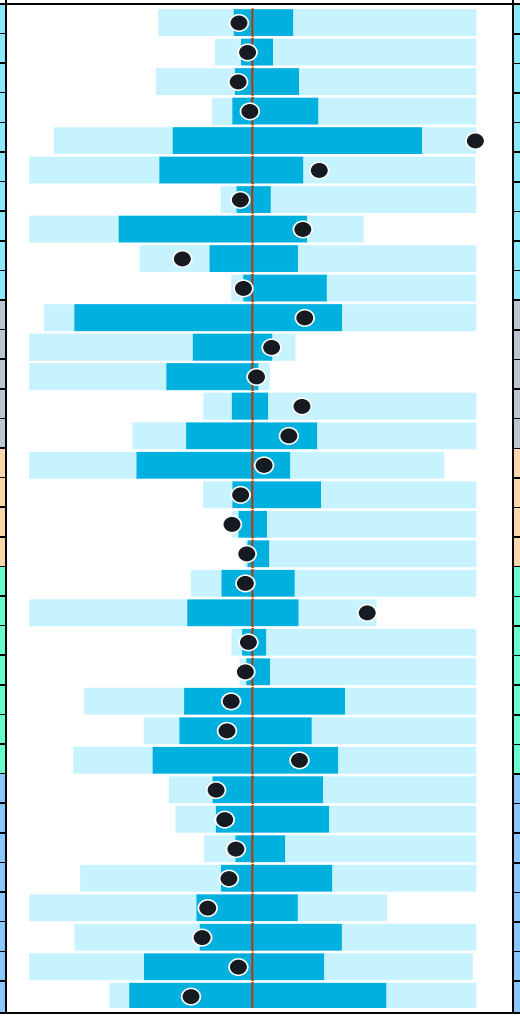
- This table shows digital occupations by demand for Yorkshire and The Humber. It displays the total number of adverts, percentage share of digital occupation adverts, and the concentration of demand against the UK average (known as the location quotient). Total demand is highest for Software Developers, Data Engineers, and Business Analysts, but comparative demand is highest for Test Analysts, IT Support Analysts, and Database Administrators. Broadly these in demand roles are digital occupations that are not necessarily in the digital sector.

Occupation	Total digital occupation adverts (2019-2020)	Share of total digital occupation adverts (%)	Location Quotient vs UK (1 = UK average)
Test Analyst	5,610	3.9%	1.44
IT Support Analyst	9,490	6.6%	1.28
Database Administrator	2,356	1.6%	1.27
Software Developer	33,949	23.5%	1.17
System Administrator	2,123	1.5%	1.11
IT Service Manager	2,812	1.9%	1.08
Test Automation Engineer	2,538	1.8%	1.08
Network Engineer	3,304	2.3%	1.06
Web Developer	6,678	4.6%	1.06
Business Analyst	11,069	7.7%	1.02

Source: Geek Talent, 2021

Yorkshire and The Humber - Digital Ecosystem Metrics, relative to UK NUTS1 Regions

- The table below presents a list of indicators arranged into the five components of a regional digital ecosystem. It shows the value for Yorkshire and the Humber and how this compares to the lowest and highest NUTS1 region values, to enable an assessment to be made of where the key strengths and opportunities for growth of the digital ecosystem are. The period at which the data is recorded is indicated for each indicator.
- The box plot below the table indicates visually where Yorkshire and the Humber (black dot) sits against the median (red line), interquartile range (deeper blue) and range (lighter blue) of the UK NUTS1 regions. Where the black dot is to the right of the median, Yorkshire and Humber is above the median value on this indicator.

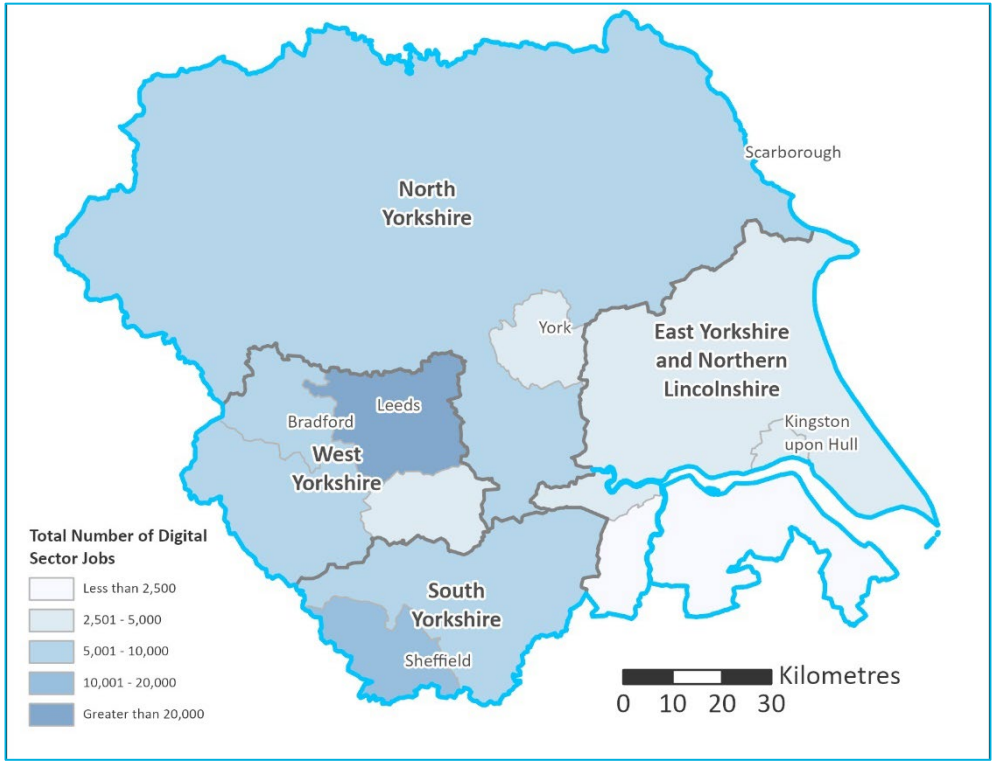
Indicator name	Period	Y&H	Box plot comparison	Lowest	25th centile	Median	75th centile	Highest
Digital sector % share of total enterprises	2020	**5.8**		3.0	5.6	6.3	7.7	14.1
Digital sector % share of employees	2019	**2.9**		2.1	2.8	3.0	3.5	8.4
Digital occupations % share of employment	2020	**4.1**		3.0	4.0	4.3	4.9	7.2
Digital sector % share of enterprise births	2019	**5.9**		4.8	5.4	6.0	8.0	12.7
Average annual growth in digital sector employees (% p.a.)	2015-19	**8.2**		-2.0	0.9	2.8	6.9	8.2
Average growth in digital occupations over 5 years (% p.a.)	2015-20	**6.7**		1.8	4.0	5.6	6.4	9.4
Digital sector % share of GVA	2019	**4.1**		3.4	4.0	4.5	5.1	12.3
Average real growth in digital sector GVA - 5 years (% p.a.)	2014-19	**6.5**		1.8	3.3	5.6	6.6	7.6
Digital sector GVA per hour worked (£/hour)	2019	**33.9**		29.8	36.6	40.7	45.1	62.4
Balance of international trade in digital sector services as % of GVA	2018	**0.2**		0.0	0.2	0.3	1.3	3.5
Earnings p.a. as % of house prices	2020	**16.0**		9.3	10.1	14.6	16.9	20.3
Average business floorspace per £1k rateable value (sq. m)	Mar-2020	**17.9**		4.1	13.4	16.8	17.9	19.2
Superfast broadband coverage (% of premises)	Jan 2021	**95.7**		89.1	93.1	95.6	95.7	96.0
Full fibre coverage (% of premises)	Jan 2021	**28.7**		10.5	15.8	19.5	22.3	60.7
Gigabit-capable coverage (% of premises)	Jan 2021	**39.8**		10.5	20.6	33.0	45.0	74.8
3yr survival rate of digital sector firms (%)	2016-2019	**62.0**		58.2	59.9	61.8	62.4	64.9
% of digital sector firms identified as 'high growth'	2020	**1.6**		0.9	1.4	1.8	2.9	5.7
Digital sector firms raising Angel Network funds	2016-20	**2.0**		2.0	5.0	11.0	17.3	110.0
VC investment in digital sector firms per capita (£)	2016-20	**14.8**		5.8	18.5	44.4	132.8	1256.7
Computer Science FTEs in REF2014	2014	**128.5**		60.8	99.1	137.0	188.6	413.8
Average % Computer Science research rated 4* in REF2014	2014	**32.8**		10.0	20.7	25.1	28.2	33.4
Digital sector R&D tax credit expenditure per enterprise (£k pa)	2017/18	**18.0**		13.8	16.5	19.0	22.3	75.6
Innovate UK grants in "AI & Data Economy" sector (£m)	2011-20	**7.7**		2.3	8.7	14.5	31.2	232.7
Digital sector university spin-outs per 1m pop	Apr 2021	**3.5**		1.1	2.7	3.8	5.2	7.3
HE postgrad computing students per 1k pop	2019/20	**0.4**		0.3	0.3	0.4	0.5	0.8
HE postgrad comp, eng & tech, and maths students per 1k pop	2019/20	**1.3**		0.7	0.9	1.2	1.4	1.7
Digital sector median gross annual pay (£k)	2020	**32.8**		30.2	32.6	34.9	38.8	47.4
Median gross annual pay for IT and telecoms professionals (£k)	2020	**37.7**		35.0	37.2	39.3	43.5	51.7
Proportion of people aged 16-64 with NVQ4+ (%)	2020	**37.3**		34.5	37.3	38.8	41.6	58.5
Proportion of people aged 16+ using the internet (%)	2020	**90.8**		88.2	90.6	91.2	92.6	95.1
Proportion of households with internet access (%)	Q1 2021	**93.0**		89.0	92.8	94.0	95.0	97.0
Proportion of internet users finding info online for work/study (%)	Q1 2020	**37.0**		23.0	36.8	42.5	52.3	67.0
% of first degree graduates that remain in the region	2016/17	**68.7**		51.7	61.1	69.9	75.7	87.8
Higher Education computing students per 1k pop	2019/20	**1.6**		1.3	1.4	1.8	2.3	2.6

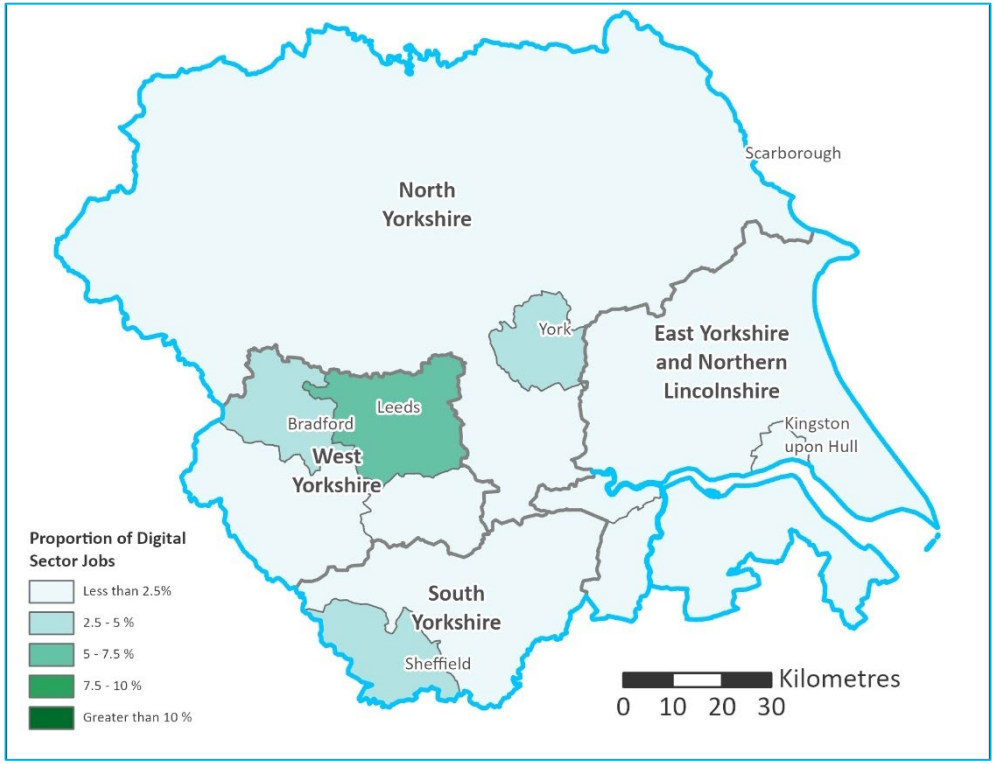
Source: Steer-ED and various datasets – See Appendix B

Yorkshire and The Humber - Digital Sector's spatial distribution

Digital Sector Employment Total and, as a percentage of Total Employment by NUTS3 (2019)

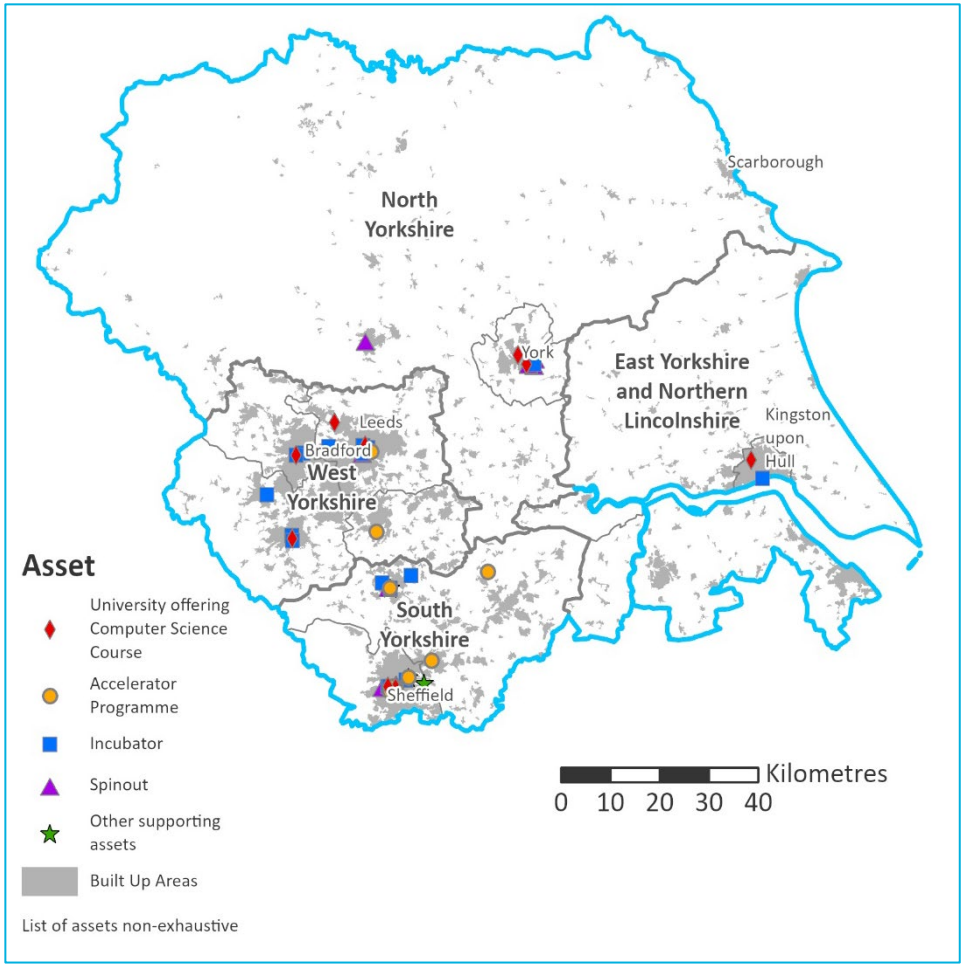
- The maps below show absolute digital employment and digital sector employment as a percentage of total employment by NUTS3 regions. They highlight where employment is concentrated and where there are relatively large employment clusters.

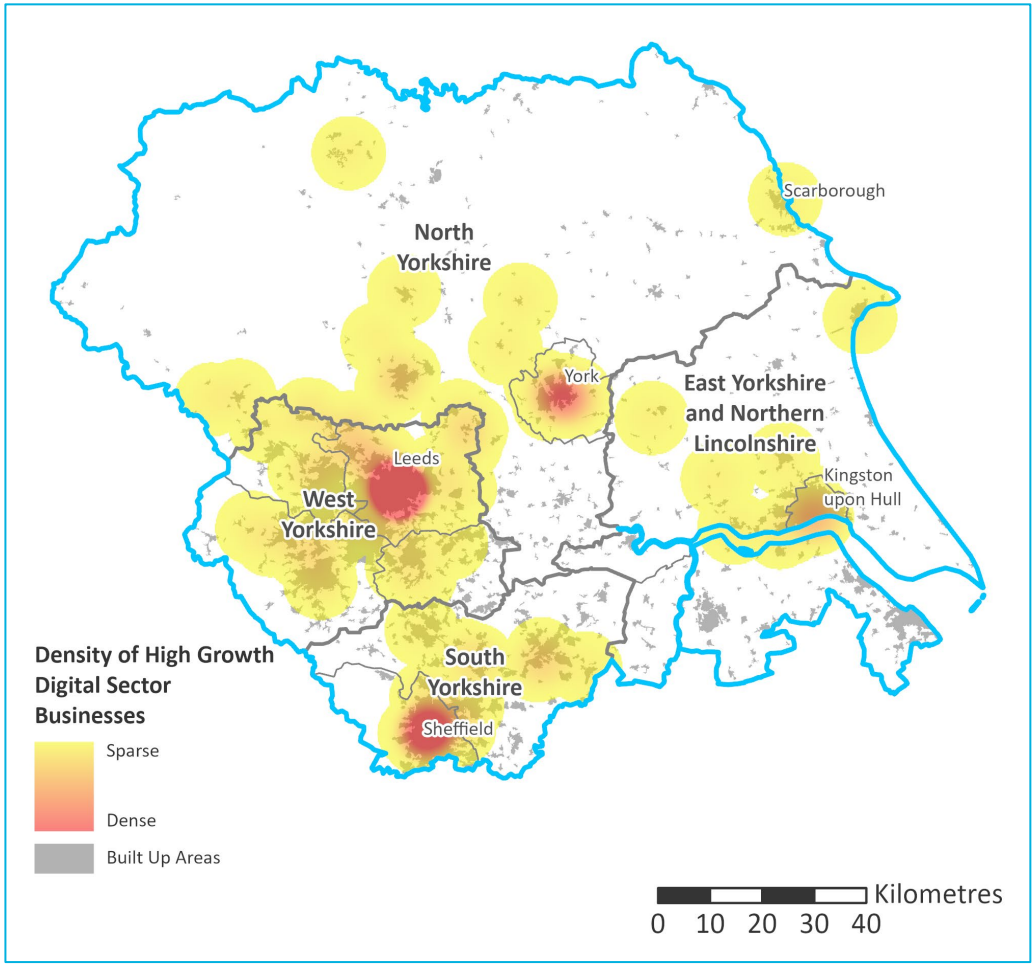




Digital Sector assets (2021), and density of digital sector high growth businesses (2020)

- The map to the left shows the location of digital ecosystem assets in Yorkshire and the Humber, including accelerators, incubators, universities with computer science courses, university spinouts and additional research assets. It highlights the concentration of assets in urban centres with universities.
- The map to the right shows the density of high growth businesses operating in the digital sector in Yorkshire and the Humber. It highlights how high growth businesses are concentrated in larger urban areas.



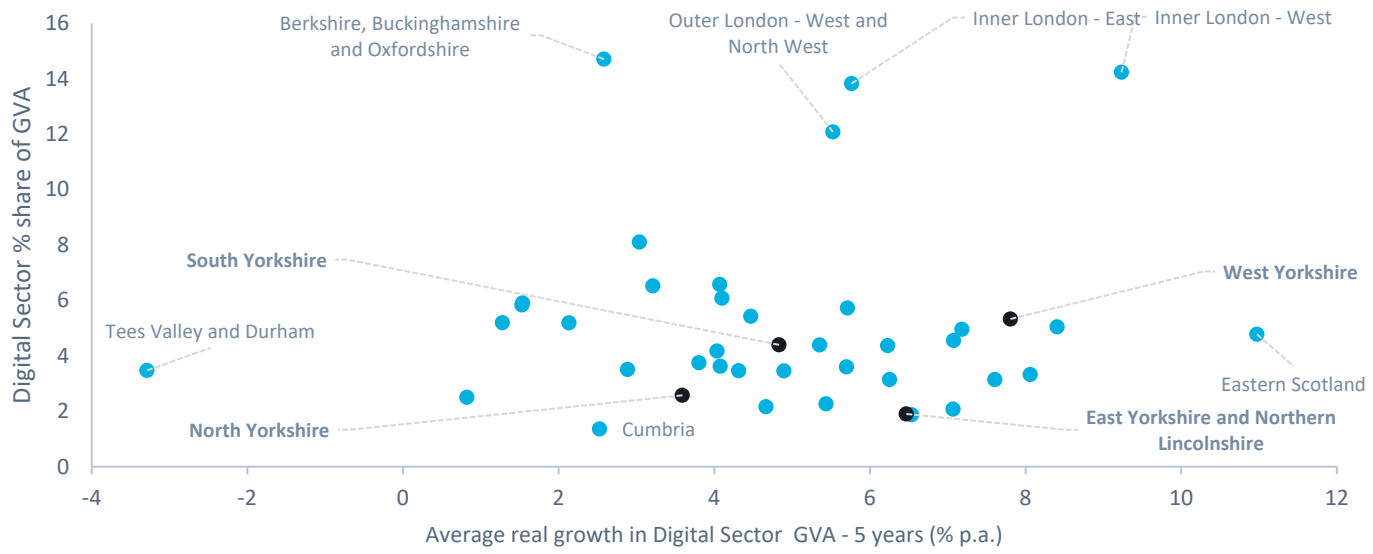


Yorkshire and The Humber – Sub-Regional Potential

Analysis of Key Metric Combinations, NUTS2 level

- The charts below highlight key metrics at a NUTS2 and NUTS3 level and how they relate to the relative size of the digital sector in Yorkshire and The Humber, highlighting where there is sub-NUTS1 potential for uplifting the digital sector and in turn boosting prosperity.
- Each data point (blue) equates to one NUTS2 or NUTS3 region in the UK. Yorkshire and The Humber are indicated in black. Key outliers outside Yorkshire and the Humber are labelled to provide context. National trends are largely replicated as sub-NUTS1 regional trends in Yorkshire and the Humber.

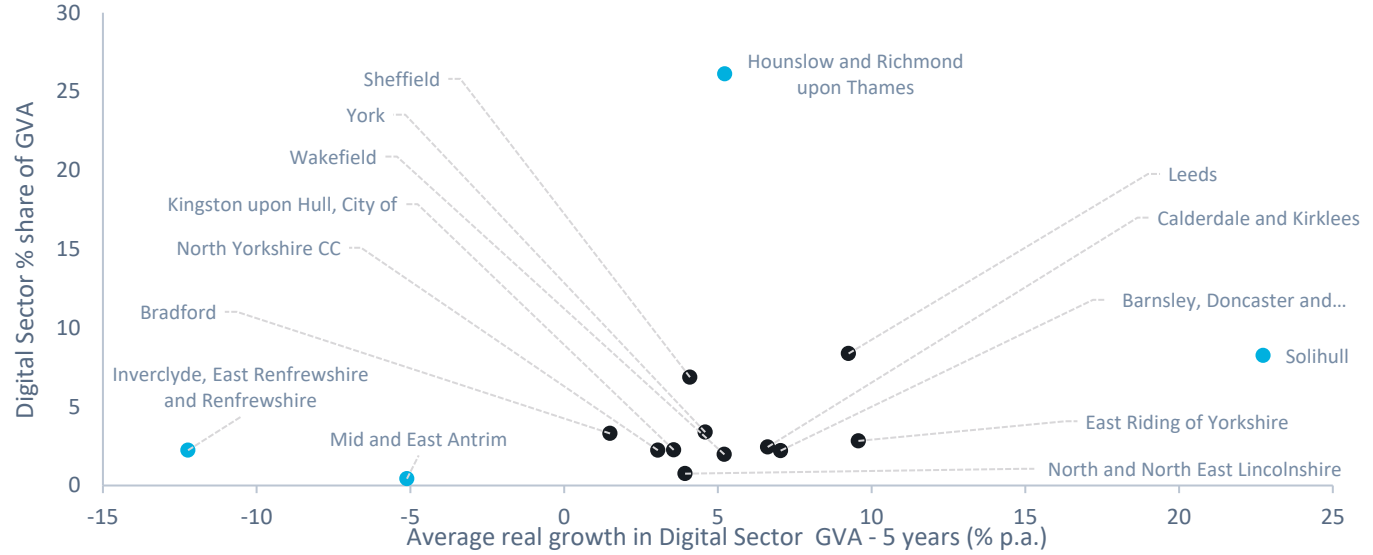
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – All UK NUTS2 regions



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows that NUTS2 regions in London and the South East are outliers, with large relative digital sector output.

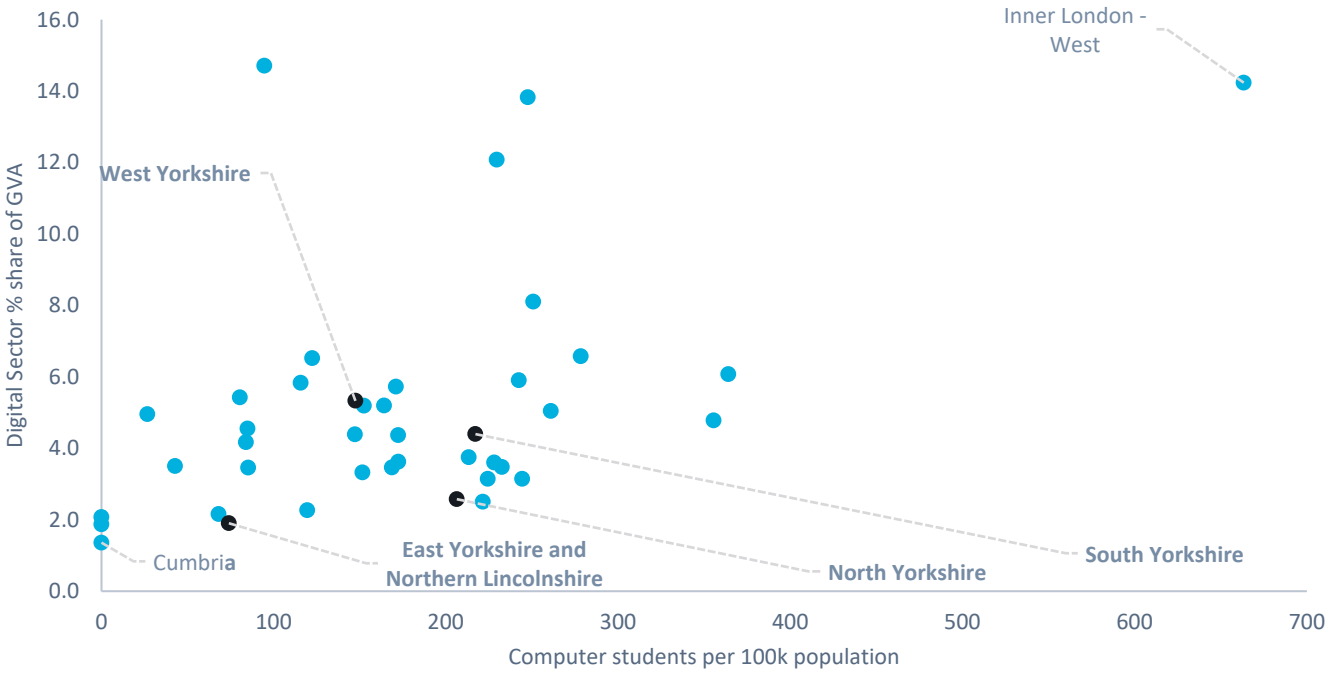
Digital Sector GVA % plotted against Digital Sector GVA 5 year growth rate (2014-19) – Yorkshire and the Humber NUTS3 regions, and UK NUTS3 outliers



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

- The chart above shows how digital sector growth is correlated with the relative size of the digital sector in Yorkshire and Humber's NUTS3 regions. It plots these against outlier NUTS3 regions from the rest of the UK.

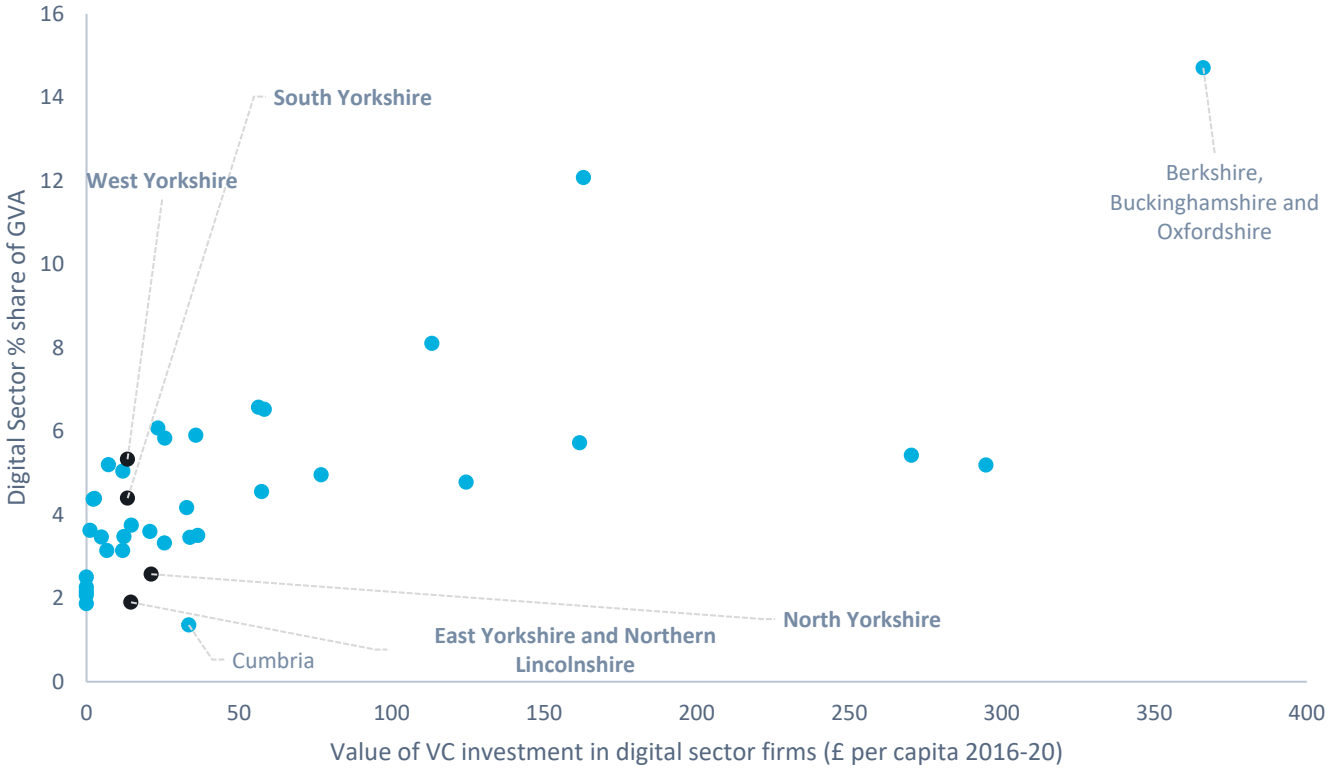
Digital Sector GVA % plotted against Computing Students per 100k population (NUTS2 regions)



Source: HESA, 2019, Regional gross value added (balanced) by industry (ONS), 2021

- The chart above shows there is a slight positive trend between the number of higher education computer students and the relative size of the digital sector.

Digital Sector GVA % plotted against VC investment per capita (2016-2020). Inner London East and West excluded as large outliers (NUTS2 regions)



Source: Beauhurst, 2021 and Regional Gross Value Added (balanced) by industry: all NUTS level regions, 2021

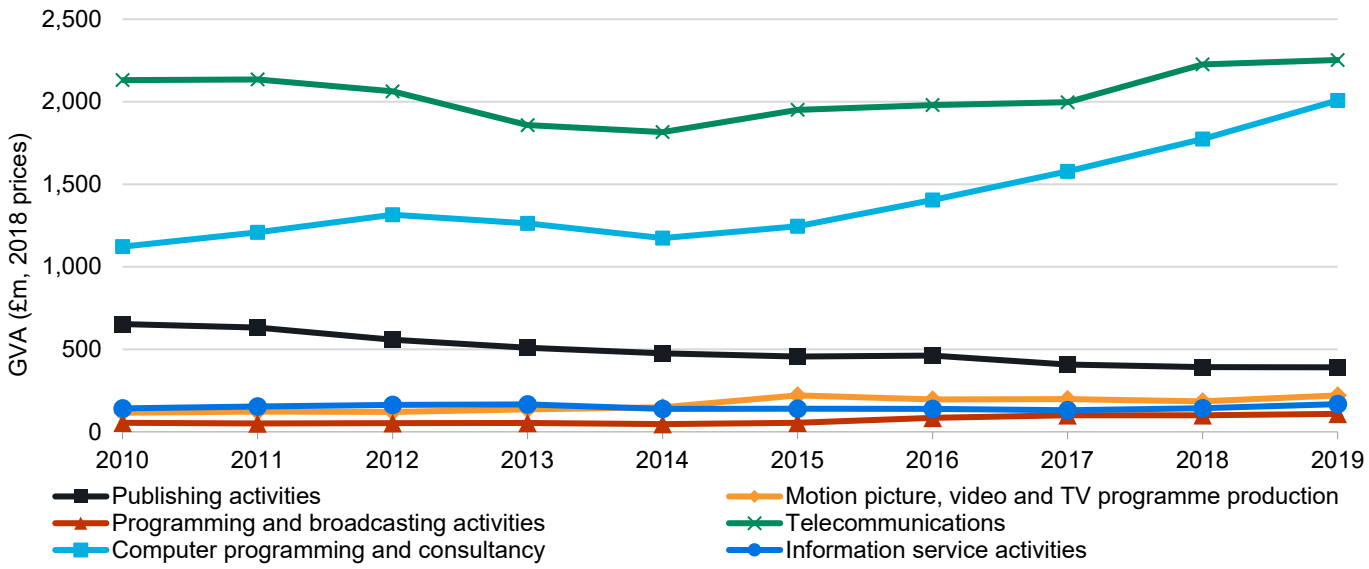
- The chart above shows there is a positive trend between the amount of VC investment per capita and the relative size of the digital sector. Inner London East and West have been excluded as significant outliers.

Yorkshire and The Humber – Potential and High Growth Business Specialisms

Growth Potential

- To understand the growth potential of Yorkshire and the Humber, it is important to understand what is driving growth. The chart below plots the annual GVA output from six sub-sectors of the digital sector from 2010-2019.

Annual GVA output from Digital Sector sub-sectors (2010-2019)



Source: Regional Gross Value Added (balanced) by industry (ONS), 2021

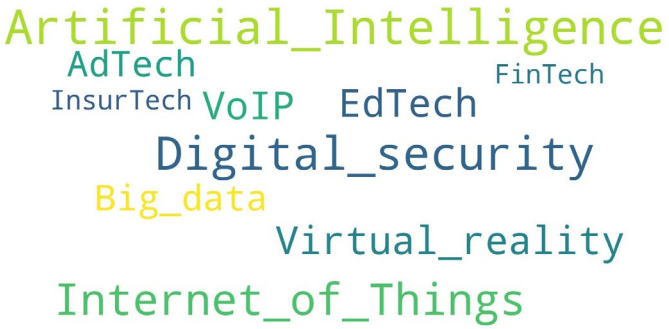
- The chart above shows that there has been significant growth in Computer programming and consultancy (CAGR of 11.33%). These sub-sectors are where the growth potential for Yorkshire and the Humber is. Telecommunications is the largest sub-sector in Yorkshire and the Humber, but it did not show steady growth between 2010-2019.

High Growth businesses and specialisms

- Activities of high growth digital sector businesses help to identify in more detail the specific market areas in which Yorkshire and the Humber's potential for further economic growth lie. There were 174 high growth businesses in the digital sector in Yorkshire and the Humber in 2021, equating to 1.6% of the total number of digital sector businesses in the NUTS1 region.
- The specialisms in which these high growth businesses operate are tracked by Beauhurst. The word clouds below show the most common sub-sectors (as defined by Beauhurst) in which the region's high-growth firms operate in and 'buzzwords' that relate to their business operations.

Word Cloud showing the frequency of high growth digital sector business sectors, as defined by Beauhurst

World Cloud showing the frequency of high growth digital sector business buzzwords, as defined by Beauhurst



Source: Beauhurst, 2021

Yorkshire and The Humber's Digital Ecosystem in Summary

Strengths

- Strong recent growth in digital sector employee jobs, which at 8.2% per annum is the highest of any NUTS1 region. The recent digital occupation growth rate, at 6.7% per annum, is also in the top quartile of UK regions.
- Rapid real GVA growth (6.5% per annum between 2014 and 2019), which has been driven primarily by the 'Computer programming and consultancy' (11.3% per annum) and Telecommunications (4.4% per annum) sub-sectors.
- Success in attracting large digital sector employers, such as Channel 4's new National HQ in Leeds, and Sky's digital and technology hub in Leeds.
- Established tech hubs/incubators such as C4DI in Hull, the Barnsley DMC and The Media Centre in Huddersfield have proved successful in supporting digital sector SMEs and in building connections within local digital tech communities. The three-year survival rate for digital sector firms in Yorkshire and the Humber is 62% (just above the regional median).
- Events have also been important in creating networking opportunities, and in raising the region's national and international profile in digital tech. In particular, the annual Leeds Digital Festival is now one of the UK's largest tech events.
- Cluster organisations such as Sheffield Digital have also played a critical part in strengthening networks within the digital sector and in providing a stronger and more coherent 'voice' for local digital businesses.
- Has a base of excellent digital-related research at its universities, particularly at the Universities of York, Sheffield, and Leeds. Based on REF 2014 results, the region had one of the highest average proportions of Computer Science and Informatics research which was rated 4*; at 32.8%, this was second only to the South East of England by this indicator.
- Universities are strengthening their engagement with industry, through initiatives such as Nexus in Leeds, the Advanced Manufacturing Park in South Yorkshire, and the Advanced Wellbeing Research Centre at Sheffield Hallam.
- Parts of the region benefit from being in the vanguard of the UK's full fibre roll-outs; in particular, Kingston-Upon-Hull has the highest full fibre coverage of any of the UK's NUTS3 areas (at 98% of premises), and York and Leeds also appear in the top quartile of NUTS3 areas for this metric (at 58% and 49% respectively).
- Initiatives such as the West Yorkshire Digital Skills Partnership (funded by DCMS) can play important roles in linking within/across the sector.

Opportunities/Specialisms

- Amongst the region's 174 digital sector companies identified as high growth, prominent sub-sectors include Software-as-a-Service (34% of firms) and mobile apps (21% of firms). In the 'buzzword' analysis of these firms' activities, the most common tagged specialisms are Artificial Intelligence (6% of firms), Digital Security (6%), Internet of Things (5%), EdTech (4%) and Virtual Reality (4%).
- A major opportunity for the region is around the digital transformation of traditional industries. Exciting companies are emerging in the spaces where digital-meets-traditional sectors, such as manufacturing (e.g. Additive Manufacturing Technologies, Elements Technology Platforms), education (e.g. Solutionpath, VICTVS), and health (e.g. Advanced Digital Innovation, OneMedical Group); and there are growth opportunities for consultancies (e.g. Infinity Works, recently acquired by Accenture, AND Digital and Azzure IT) offering digital transformation support across various sectors.
- The presence in Yorkshire of large organisations' digital activities such as Hermes (logistics), Sky (entertainment) and DWP (public services) also provide wider opportunities for growth in these sectors.
- Recently commenced participation in the Made Smarter Technology Adoption Pilot, helping SME manufacturers to introduce digital tools and technologies to boost productivity and growth in the face of Industry 4.0. Subject to the success of the Pilot, there could be opportunities to scale-up such support to make substantial impacts on the region's productivity growth.
- Recently awarded funding to establish one of the UK's Space Hubs, in West Yorkshire. According to Space Hub Yorkshire, there are at least 143 Yorkshire businesses with known involvement or active interest in space (much of it around data collection and analysis), and these businesses have increased employment by 15% in the past three years.
- Some of the region's accelerator programmes specialise in certain areas. These include Propel@YH, delivered by the Yorkshire & Humber Academic Health Sciences Network, which is focused on digital health innovations, and Sheffield-based TwinklHive which majors in education technology.
- Potential for East Yorkshire & Northern Lincolnshire and North Yorkshire to capitalise on their relatively high-quality broadband, in driving future growth in digital sector enterprises and employment.
- Recently launched West Yorkshire Local Digital Skills Partnership provides a focus for addressing digital skills needs across the sub-region.
- Relevant strategies/policies include the Leeds City Region Digital Framework, which focuses on five areas (digital for all businesses, digital skills for all, the digital service sector, world class digital infrastructure, and tech for good), and the Sheffield City Region Digital Action Plan which sets out three aims: growing a nationally significant tech cluster, building digital capability for all, and enhancing Sheffield City Region's digital ecosystem.

Barriers to Growth

- The availability of talent is a key constraint on digital growth. Recruitment is reported to have been a major challenge. This may be exacerbated by the region currently appearing towards the lower end of average annual pay levels: fourth lowest amongst the UK regions for both median pay in the digital sector (£32.8k) and median pay for IT and telecoms professionals (£37.7k).
- Although there were 8,900 students enrolled in Higher Education Computer Science courses in the region in 2019/20, the region had the fourth lowest ratio of computing students per head of population amongst UK NUTS1 regions.
- Whilst many parts of the region have excellent broadband infrastructure, digital inclusion remains a challenge: the region lies below the regional medians for the proportion of households with internet access (93%), the proportion of people aged 16+ using the internet (91%), and the proportion of internet users finding information online for work or study (37%).
- In common with other regions, access to funding continues to be a major issue. Deal flow has been relatively low in Yorkshire, which appears in the bottom quartile for the value of venture capital investment in digital sector firms per capita (in the period 2016 to 2020, funds raised by Yorkshire and the Humber digital companies amounted to just 0.6% of the UK total, according to Beauhurst data, compared to the region's UK population share of 8%).

Achieving Prosperity

- On the basis of Steer-ED's indicative modelling (see Section 2 of the Main Report), the digital sector in Yorkshire and The Humber has the potential to grow by at least £1.6 billion in annual GVA by 2025 (an increase of 31% on the 2019 value), creating an additional 42,200 jobs (an increase of 46% on the employment in 2019).
- In realising this 'Prosperity Prize', the Digital Economy ecosystem in Yorkshire and The Humber is relatively well developed and, importantly, balanced across all five enabling domains. The high level of recent employment growth in the Digital Sector and the average percentage of Computer Science Research rated as 4*are existing high points, and work is needed to maintain these well-established positions. Incubation infrastructures, public policy digital sector/cluster programmes, a strong Higher Education presence, and the region's inward investment track record provides important anchors for further growth. Across the ecosystem as a whole, the challenge is to continue to grow and improve at a rate faster than the average at the level of NUTS1 regions as a whole, so 'closing the gap' with best-of-class performance.
- Average Digital Sector productivity levels and the Percentage of Higher Education Students (all levels) studying Computing are, respectively, immediate and longer terms constraints on achieving the Prosperity Prize; transforming performance in these areas will matter to achieving the 'Prosperity Prize'.
- The already substantial Digital Sectors in Leeds and Sheffield, both of which have seen significant growth over the last five years must work on 'staying ahead'. Similarly, the region's smaller but developing digital agglomerations, in for example Bradford, York, and the East Riding of Yorkshire, provide 'next generation' platforms for digital economy growth and scaling.
- The region's specialisms, focused on driving the digital transformation of the region's traditional Manufacturing base, the development of high-growth 'software-as-a-service' and mobile apps business, and the region's hosting of digital centres for major logistics, entertainment and public sector services together provide further routeways to regional prosperity.

5 Conclusions

5.1 This study's research has confirmed that every nation and region of the UK is seeing vibrant growth in their digital ecosystems. Growth is especially healthy in the larger cities, which benefit from agglomeration economies. Larger cities offer people a wide range of job opportunities, providing firms with a large addressable labour market, and stronger networks of industry contacts.

Differing States of the Ecosystem

5.2 Drawing on a variety of indicators, this report paints a nuanced picture in which each nation and region has a different mix of strengths and challenges in their digital ecosystems. For example:

- The East of England appears in the top quartile of regions for several indicators including the digital sector's share of enterprises (8.7%), digital occupations share of employment (5.2%) and three-year survival rate of digital sector firms (63.8%), and has a particularly well-developed sector in Cambridge, underpinned by the University; but its skills challenges are highlighted by it also being the region with the lowest total number of Higher Education computing students per head of population (1.3 per 1,000), and the lowest proportion of graduates remaining in their home region after graduation (51.7%).
- The East Midlands has one of the highest three-year survival rates for digital sector firms (62.7%), and has two cities, in Nottingham and Leicester, that both feature amongst the UK's top NUTS3 areas for the recent growth in digital sector employees and GVA; but it also has the second lowest median annual pay for the digital sector (£30.2k),and has also seen relatively slow average growth in digital occupations over the last five years (2.4% per annum).
- London, unsurprisingly, appears as the top region by numerous metrics, including digital sector share of employees (8.4%), digital occupations share of employment (7.2%), digital sector services balance of trade as a proportion of GVA (3.5%), venture capital investment per capita in digital sector firms (£1,257), and median annual pay for IT and telecoms professionals (£51.7k). Its highly developed digital ecosystem includes numerous accelerators and incubators focused on digital tech. However, it is also the region with the worst metrics for the affordability of housing and business floorspace, and - starting from a very high base – it does not feature in the top quartile for the recent *growth* in digital sector employees (3.6% per annum) and digital occupations (6.0% per annum).
- The North East has the largest number of Higher Education computing students per head of population (2.6 per 1,000 which is equal with Scotland)

and more Higher Education postgraduate students per head of population (0.8 per 1,000) than any other region; it is also the most affordable region for housing on average. Its digital sector GVA has grown almost four times faster than the overall North East economy in recent years (1.8% per annum), but this is the least rapid growth amongst the nations and regions, largely because it already has a relatively large number of jobs and GVA in the slower-growing telecommunications sub-sector.

- The North West appears towards the median of the UK nations and regions by numerous metrics, but the regional averages mask the local strengths, particularly in Manchester, which appears in the top quartile of NUTS3 areas for several indicators, including digital sector share of GVA (8.1%), recent digital sector GVA growth (10.5% per annum), and the proportion of digital sector firms identified as 'high growth' (5.6%). The region has strong computing science R&D capabilities, including at the Universities of Manchester, Liverpool and Lancaster and The Hartree Centre at Daresbury, and the highest superfast broadband coverage of any region (96%). However, the three-year survival rate of digital sector firms (58.2%) is the lowest of the UK regions.
- Northern Ireland has a particularly interesting mix of very promising strengths and significant challenges. It performs better than any other UK nation or region for the recent growth in digital occupations (9.4% per annum), the proportion of digital sector firms identified as 'high growth' (5.7%), average digital sector R&D tax credit expenditure per enterprise (£75.6k per annum) and full fibre coverage (60.7%). However, it is also the area with the lowest averages for digital sector GVA per hour worked (£29.82), the proportion of computer science research rated 4* in REF 2014 (10%), superfast broadband coverage (89.1%), the proportion of people aged 16+ using the internet (88.2%) and proportion of households with internet access (89.0%).
- Scotland has the highest number of Higher Education computing students per head of population (2.6 per 1,000, which is equal with the North East), and also out-performs all other nations and regions in the metrics of recent growth in digital sector employees (8.2% per annum), active digital sector university sector spinouts per head of population (7.3 per million), and the proportion of first degree graduates remaining in their home nation/region after graduation (87.8%). Growth is particularly strong in Edinburgh and Glasgow, which have developed very active digital ecosystems over the last several years, with the universities playing a key part. Of the various metrics selected for this study, Scotland only falls in the lowest quartile for one: superfast broadband coverage (92.8%).
- The South East is one of the highest performing regions for the digital economy by various indicators. It ranks first for the three-year survival rate of digital sector firms (64.9%), and the average proportion of computing science & informatics rated 4* in REF 2014 (33.4%). It features in the top quartile for many other metrics, including digital sector share of employees (5.7%), digital occupations share of employment (6.4%), digital sector GVA per hour worked (£54.43), and the proportion of people aged 16+ using the

internet (94.3%). However, the region has the fewest Higher Education computing students per head of population (1.3 per 1,000), and from a high starting point, the South East's recent *growth* has been somewhat behind many other regions: the recent growth in digital occupations (1.8% per annum) is the lowest of the nations and regions, and the recent growth in digital sector employees (-1.7% per annum) and in digital sector GVA (2.9% per annum) are also in the lowest quartile.

- The South West is one of the top-performing regions in terms of digital inclusion, with the proportion of people aged 16+ using the internet (93.4%) being in the top quartile, and it also has a relatively high digital sector share of enterprise births (7.9%). There are strong digital clusters around the Bristol/Bath area and in Gloucester and Cheltenham, with substantial cyber security activity benefitting from close proximity to GCHQ. However, the region currently has the fewest Higher Education postgraduate computing students per head of population (0.3 per 1,000), and its superfast broadband coverage (92%) is also in the lowest quartile.
- Wales's digital economy is as yet nascent by some metrics. It has the lowest digital sector share of employees (2.1%), digital occupations share of employment (3.0%), digital sector share of GVA (3.4%) and median annual pay for IT and telecoms professionals (£35.0k). However, its recent growth in digital sector employees (7.8% per annum) has been very strong, and Wales also benefits from having a relatively large number of Higher Education computing students (2.2 per 1,000) and a relatively high proportion of digital sector firms identified as 'high growth' (2.8%).
- The West Midlands showed the strongest recent growth in digital sector GVA of any region (7.6% per annum). It also showed high recent growth in digital occupations (6.9% per annum), and benefits from having the highest proportion of households with internet access (97%), high gigabit broadband coverage (51.6%), and relatively high digital sector GVA per hour worked (£51.13). However, it currently has the lowest digital sector share of enterprise births (4.8%), and the number of Higher Education postgraduate students per head (0.3 per 1,000) is also in the lowest quartile.
- Yorkshire and The Humber showed the strongest recent growth in digital sector employees of any region (8.2% per annum), and also saw strong recent growth in digital sector GVA (6.5% per annum) and digital occupations (6.7% per annum). At 32.8%, its average proportion of Computer Science and Informatics research rated at 4* in REF 2014 was second only to the South East, and the region also benefits from relatively high full fibre coverage (28.7%), with Kingston-Upon-Hull having the highest full fibre coverage of any NUTS3 area (97.5%). However, the average digital sector GVA per hour worked (£33.95) is as yet relatively low, as are the median annual pay in the digital sector (£32.8k) and median annual pay for IT and telecoms professionals (£37.7k).

Driving Growth in Prosperity

5.3 Informed by the regional richness above, to provide some perspective on the economic benefits to be had from continuing to strengthen the digital

ecosystems throughout the UK, this study has undertaken some indicative modelling based on the growth trends observed in the digital sub-sectors in which there has been relatively consistent growth across the UK in recent years: 'Computer programming and consultancy' and 'Information services'. Based on the projected regional growth of these sub-sectors alone, it is estimated that the UK's digital sector annual GVA could grow by at least £41.5 billion by 2025 (above the 2019 level), creating a further 678,000 jobs. The decomposition of this analysis is in the table below.

Table 5-1: Indicative additional GVA and jobs in the digital sector by 2025 (above the 2019 values)

NUTS1 region or nation	Potential additional annual GVA by 2025 (£m, 2018 prices)	Potential additional jobs by 2025
East Midlands	1,500	36,500
East of England	2,250	41,400
London	16,760	216,500
North East	460	13,800
North West	2,680	50,000
Northern Ireland	790	13,300
Scotland	2,160	34,300
South East	8,820	129,500
South West	1,370	36,600
Wales	350	11,300
West Midlands	2,750	52,700
Yorkshire and The Humber	1,590	42,200
Total	**41,480**	**678,100**

Source: Steer-ED, 2021

Regional Specialisms

5.4 The study highlights that there is much commonality between regions in the specific parts of the digital economy where stakeholders considered there to be particularly good prospects for growth. FinTech, Cyber Security, HealthTech, Big Data, Artificial Intelligence and the digital transformation of traditional industries (including Advanced Manufacturing) were each explicitly mentioned in most stakeholder roundtable discussions as promising areas, and the study's assessment of the data on high growth companies confirms that these are key foci for almost all regions.

5.5 Given this rich diversity of digital activities happening in every nation and region, it would be misleading to pigeon-hole each region as 'specialising' in certain areas.

5.6 Beyond the tech hotspots of London and the South East, which are both vital in their own right *and* in encouraging the development of other UK regions, there are areas where the digital sector has particularly high levels of activity in, for example: FinTech (e.g. Scotland and Wales), Cyber Security (e.g. Northern

Ireland and South West), HealthTech (e.g. East Midlands and Scotland), e-Commerce and AdTech (e.g. North West and Northern Ireland), Big Data (East of England and Wales), EdTech (West Midlands and North West), AgriTech (e.g. East of England, and Yorkshire and the Humber), Internet of Things (e.g. South West and Wales), Space Tech (e.g. Yorkshire and the Humber), the digitisation of Advanced Manufacturing (e.g. West Midlands and North East), and the digital delivery of public services (e.g. North East and Scotland).

5.7 However, it should again be stressed that each of the nations and regions has extensive digital activities beyond the specific examples cited above. Given this, creating and maintaining the enabling conditions in which all parts of the digital ecosystem can flourish must be a key imperative for economic development policy.

Impacts of the Pandemic

5.8 The shift to remote working practices, driven by COVID-19, is likely to endure to a significant extent, post-pandemic. This has the potential to work to the advantage of the digital ecosystems beyond London for two reasons. First, due to the shift in remote working, this has widened the pool of experienced talent available to firms across the UK. This has been highlighted in the study's roundtable discussions, where we heard views that 'the world had become a smaller place' and that *not* being based in London had become less of an issue in accessing support, advice and market opportunities. Second, there was also anecdotal evidence of people employed by London-based firms relocating to work remotely from other regions[40].

5.9 However, the study also heard evidence that the increased willingness of London-based firms, and even Silicon Valley firms, to employ remote workers was leading to wage inflation for experienced talent in other regions. This is making it somewhat harder for non-London based businesses to recruit locally in some regions, as they are increasingly competing with London-based firms for staff living in their areas.

Access to Talent

5.10 Access to talent was a consistent issue highlighted in all of the study's roundtable discussions as *the most important barrier* to growth for regional digital ecosystems[41]. There are too few young people leaving school with competence in programming, data science and computer science, too few

[40] We note that the shift to home-working could have some interesting implications for how the geographic distribution of economic activity (e.g. employment and GVA) is measured. If a digital firm has one business site, located in London, and half of its staff work from home outside London, how much of that firm's employment and GVA should be allocated to London? It is beyond the scope of this study to explore this issue, but the digital sector has the highest prevalence of home-working of any industry. If there are any distortions due to home-working in the geographic apportionment of economic activity they are likely to be greatest for this sector.

[41] See, for example, **Quantifying the UK Data Skills Gap - Full report** (DCMS, 2021), which highlights that over the last two years, just under half (46%) of businesses have struggled to recruit for roles that require data skills.

people studying computing-related subjects at university, and too few UK-based students seeking to set-up their own tech businesses after university. Especially for regions and nations beyond London and the South East, it can be very difficult to attract experienced talent from elsewhere in the UK or overseas – such as mid-career programmers and senior executives with experience in successfully scaling tech businesses. All parts of the UK suffer digital skills shortages, and the digital economy ecosystems beyond London and the South East are yet to reach the 'tipping point' beyond which a virtuous circle operates, with a critical mass of activity making it relatively easy to attract and retain talent, which in turn fuels further growth in the sector: a classic 'network effect' externality. One litmus test for this would be if someone re-locates themselves and their family from London to take up a senior executive post, there would be plenty of other attractive opportunities to choose from in the city or region if that job did not work out.

Capital for Growth

5.11 The availability of growth capital is heavily skewed geographically. Looking at the private equity and venture capital investments in digital sector firms tracked by Beauhurst, £15.5 billion was raised in funds between 2016 and 2020. Of this, £11.3 billion (73%) went to London-based businesses. In the roundtable discussions, several people expressed the view that it was difficult to persuade some venture capital providers to make digital sector investments beyond London. Agglomeration effects are at work here too, i.e. if a region has relatively few investment opportunities at an appropriate scale, quality and stage, then venture capitalists may consider the region to be too small to be worth exploring, and/or too small to sustain a scale-up.

Opportunities for strengthening regional digital ecosystems

5.12 All of the UK's nations and regions have key assets which are essential for supporting thriving digital ecosystems, albeit to differing degrees between the regions. These key assets include:

- Universities, with world-class excellence in digital-related research, and with substantial numbers of students enrolled on computing courses;
- Digital-focused incubator facilities, and accelerator programmes for start-up and scale-up;
- Industry-led tech cluster organisations, acting as catalysts for networking and knowledge exchange; and
- Tech-focused networks/events, including large annual conferences, which help bring people together and raise the profile of the region's digital sector.
- Emerging clusters of some particular industrial specialisms (e.g. cyber security, FinTech, HealthTech), providing foundations for further growth.

5.13 In London, and increasingly in some of the UK's other major cities, there is also the further critical ingredient for world-class digital ecosystems: scale. With a diverse mix of employers, an extensive labour market, and large numbers of job opportunities at every level of seniority, London's scale is a key factor in driving its unrivalled growth.

5.14 What no UK region or nation currently has, however, is enough skilled people. The roots of the problem can be traced back to school-level education: there are too few people leaving school with basic competence in computing. In England, Computer Science accounted for just 1.5% of total GCSE subject entries in 2020[42]. In Scotland, the number of student entries for computing science at National 5 level has fallen by 22% since 2016[43]. Across the UK, girls account for only about 20% of computing students at school[44].

5.15 It is beyond the remit of this study to offer specific policy recommendations to DCMS. However, in the light of the study's research, it is suggested that the following should be considered by DCMS and other Government departments when developing policy in this area:

- Careful thought should be put into what the appropriate *scope* is for the types of economic activity which the policy is trying to support. The current DCMS definition of the 'Digital Sector' is very broad, including, for example, book publishing, TV broadcast activities and motion picture projection activities, as well as telecommunications and computer programming (see Appendix A). While this may be appropriate for statistical reporting purposes, it is unlikely that a world-class suite of interventions can be developed which effectively addresses the very diverse needs of such a broadly defined sector. An alternative approach would be that taken by the well-regarded Scottish Technology Ecosystem Review, which focused on software engineering-intensive businesses, irrespective of domain, which operate or aspire to operate under 'internet economy' principles. The study considers that it is these types of businesses which offer particularly high growth potential, and which would have the most impact for the Government's levelling-up agenda;
- A sustained and long term cross-government approach is required to the skills and talent issues highlighted in this, and other, research. Fundamental to this would be to increase radically the capacity of schools to teach computer science, to improve computer science participation in schools throughout the UK especially amongst girls and other under-represented groups, and to ensure that the curriculum is well-aligned to industry needs. This will help ensure that industry has access to a diverse and appropriately skilled talent base, which is critical to future growth. Furthermore, this needs to be supported by digital skills capacity building in and alongside the workplace, to directly address digital skills shortages at mid- and senior-levels;
- Although it is a much broader issue, the problems of digital poverty have been brought into sharp focus by COVID-19 restrictions, specifically the closure of schools to all but vulnerable children and the children of key

[42] **Results tables for GCSE, AS and A level results in England, 2020**, Ofqual, 2020

[43] **SQA National 5 Statistics**, 2020

[44] **JCQ GCSE (Full Course) Results Summer 2020** and Table 5 of **SQA National 5 Statistics, 2020**

workers. Consideration should be given to the options for ensuring that young people from disadvantaged backgrounds are not *de facto* excluded from experimenting with computers and seeking digital occupations in the future, as a result of them lacking appropriate devices and broadband at home;

- Adult education can provide opportunities for people at various life-stages and from diverse backgrounds to direct their careers towards digital industries. This is particularly important in addressing the digital skills shortage, given that 80% of the people who will make up the UK's workforce in 2030 are already in the workforce today[45]. This should be a well-funded and enduring feature of policy, building on initiatives such as CodeClan in Scotland and DCMS' Local Digital Skills Partnerships and digital skills bootcamps delivered in many of England's main cities
- The issue of university key performance indicators (KPIs) and incentives to improve innovation development and entrepreneurship emerged in some of the roundtable discussions. This study proposes that this area should be considered within the policy development process, seeking to ensure that universities are appropriately encouraged to grow the *local* base of skilled personnel, to increase spin-outs and industry collaborations, and to ensure that students are exposed to entrepreneurship education;
- Grassroots industry-led cluster organisations play a critical role in developing local tech communities. Government might consider how best to provide practical support for such initiatives, for example in their core funding, events programmes, locations for meetings, and remote participation facilities;
- Further support, where possible, might be considered for the various tech events and conferences held throughout the country. This could include help with engaging/arranging speakers, facilitating remote participation, and ensuring that these events expose local tech communities to international contacts for business opportunities and international best practice in growing tech businesses
- While all nations and regions have some digital incubators, they vary considerably in terms of capacity and local/national profile, and hence in their ability to act as a flagship physical hub for the local digital ecosystem. DCMS should consider ensuring that every major city has sufficient incubator capacity of an appropriate type, with the financial support necessary to offer low rents to start-up tenants, easy-in/easy-out terms, and with the ability to provide founders with support and education in managing growth. Facilitating networks of relevant incubators at regional or even national levels may be helpful in strengthening connections within the tech community;

[45] **UK Skills Mismatch in 2030, Industrial Strategy Council, 2019**

- Insufficient access to growth finance is clearly a challenge to the development of digital ecosystems outside London and the South East. The Government should work with venture capitalists, local tech cluster groups and the British Business Bank to consider how best to address this critical issue; and
- The capacity of public sector leadership organisations to develop high performing digital ecosystems varies significantly between different places. In some regions there is confusion about the different roles and responsibilities of different tiers of government and different government agencies. DCMS should consider how best to ensure a joined up and adequately resourced approach is taken by the public sector to enable growth based on the different circumstances across the UK's regions.

A Closing Thought

5.16 The digital economy is complex. So, too, are the range of governance structures and economic development models operating across the UK's 12 NUTS1 regions. These range from single departments or agencies in the Devolved Administrations with specific responsibilities for the digital economy, to metro mayors in the key English cities, and to Local Enterprise Partnerships elsewhere in England.

5.17 Accordingly, in seeking to take forward this report's research and to support and drive forward the UK's digital economy DCMS will need to flex its cooperation model to align fully with each area's specific governance arrangements and economic development models. One-size-fit models very rarely work in sectoral economic development, and this will be the case especially as the richness and variety of the UK's devolution journey further plays out. The UK's digital economies must be enabled by this diversity, not constrained.

Appendices

A: SIC and SOC Codes for the 'Digital Economy' used by the Study

B: Sources for the longlisted metrics considered for characterising the enabling domains of the digital economy ecosystem

C: Summary Dashboards for each of the UK's NUTS2 regions

D: Write-up of the Rapid Evidence Review which informed the Study's approach and method.

A SIC and SOC Codes for the 'Digital Economy' used by the Study

Table A-1: 4-digit SIC Codes comprising the 'Digital Sector' (DCMS definition)

SIC07	Description
2611	Manufacture of electronic components
2612	Manufacture of loaded electronic boards
2620	Manufacture of computers and peripheral equipment
2630	Manufacture of communication equipment
2640	Manufacture of consumer electronics
2680	Manufacture of magnetic and optical media
4651	Wholesale of computers, computer peripheral equipment and software
4652	Wholesale of electronic and telecommunications equipment and parts
5811	Book publishing
5812	Publishing of directories and mailing lists
5813	Publishing of newspapers
5814	Publishing of journals and periodicals
5819	Other publishing activities
5821	Publishing of computer games
5829	Other software publishing
5911	Motion picture, video and television programme production activities
5912	Motion picture, video and television programme post-production activities
5913	Motion picture, video and television programme distribution activities
5914	Motion picture projection activities
5920	Sound recording and music publishing activities
6010	Radio broadcasting
6020	Television programming and broadcasting activities
6110	Wired telecommunications activities
6120	Wireless telecommunications activities
6130	Satellite telecommunications activities
6190	Other telecommunications activities
6201	Computer programming activities

SIC07	Description
6202	Computer consultancy activities
6203	Computer facilities management activities
6209	Other information technology and computer service activities
6311	Data processing, hosting and related activities
6312	Web portals
6391	News agency activities
6399	Other information service activities n.e.c.
9511	Repair of computers and peripheral equipment
9512	Repair of communication equipment

Source: DCMS, 2021

Table A-2: 4-digit SOC Codes comprising 'Digital Occupations' (DCMS definition)

SOC Code	Description
1136	IT & telecommunications directors
2133	IT specialist managers
2134	IT project & programme managers
2135	IT business analysts, architects & system designers
2136	Programmers & software development professionals
2137	Web design & development professionals
2139	IT & telecommunications professionals not elsewhere classified
3131	IT operations technicians
3132	IT user support technicians
5242	Telecommunications engineers
5245	IT engineers

Source: DCMS, 2021

A.1 For datasets where only two-digit SIC code classifications were available, the study used SIC codes 58-63 inclusive (which together constitute SIC section J) as a close proxy for the digital sector. These industries are entirely within the DCMS definition of the digital sector, and together account for 89% of total digital sector employment (as at 2019).

B Sources for the longlisted metrics considered for characterising the enabling domains of the digital economy ecosystem

Ecosystem Domain	Metric	Data Source
Digital Tech Businesses, Employment & GVA	Digital Sector % share of total enterprises	NOMIS: UK Business Counts - Enterprises
Digital Tech Businesses, Employment & GVA	Digital Sector % share of employment	NOMIS: BRES, NISRA (NI)
Digital Tech Businesses, Employment & GVA	Digital occupations % share of employment	NOMIS: Annual population survey
Digital Tech Businesses, Employment & GVA	Average annual growth in Digital Sector employment (% p.a.)	NOMIS: BRES, NISRA (NI)
Digital Tech Businesses, Employment & GVA	Digital Sector % share of GVA	ONS: Regional gross value added (balanced) by industry: all NUTS level regions
Digital Tech Businesses, Employment & GVA	Average real growth in Digital Sector GVA - 5 years (% p.a.)	ONS: Regional gross value added (balanced) by industry: all NUTS level regions
Digital Tech Businesses, Employment & GVA	Average Digital Sector GVA per hour (£/hr., 2018 prices)	ONS Regional gross value added (balanced) by industry: all NUTS level regions; BRES for employment
Digital Tech Businesses, Employment & GVA	Average growth in digital occupations over 5 years (% p.a.)	NOMIS: Annual population survey
Digital Tech Businesses, Employment & GVA	DS % share of enterprise births	ONS: Business Demography
Digital Tech Businesses, Employment & GVA	Balance of international trade in DS services as % of GVA	ONS Regional gross value added (balanced) by industry: all NUTS level regions and Experimental data on international trade in services
Place, Infrastructure & Assets	Earnings p.a. as % of house prices	ONS House Price Index full file; ASHE
Place, Infrastructure & Assets	Average business floorspace per £1k rateable value (sq. m)	ONS: VOA Administrative Data as of 31 March 2020
Place, Infrastructure & Assets	Superfast broadband coverage (% premises)	Ofcom Connected Nations update: Spring 2021
Place, Infrastructure & Assets	% of premises with access to full fibre services	Ofcom Connected Nations update: Spring 2021
Place, Infrastructure & Assets	Gigabit-capable coverage (% of premises)	Ofcom Connected Nations update: Spring 2021
Investment & Business Environment	3yr survival rate of firms in the digital tech sector (SIC classification)	ONS, Business Demography

Ecosystem Domain	Metric	Data Source
Investment & Business Environment	% of digital sector firms identified as 'high growth'	Beauhurst
Investment & Business Environment	Count of digital sector investee companies which raised funds between 2016-2020, where investees included an Angel Network	Beauhurst
Investment & Business Environment	Value of VC investment in DS firms per capita	Beauhurst
Investment & Business Environment	Number of digital sector unicorns	Beauhurst
Ideas & Innovation	Computer Science FTEs in REF2014	REF 2014
Ideas & Innovation	Average % Computer Science research rated 4* in REF2014	REF 2014
Ideas & Innovation	The number of DS spin-outs by university (per 1m population)	Beauhurst
Ideas & Innovation	Innovate UK grants in "AI & Data Economy" sector (£m)	Innovate UK
Ideas & Innovation	HE postgrad computing students per 1k pop	HESA
Ideas & Innovation	HE postgrad computing, engineering & tech, and maths students per 1k pop	HESA
Ideas & Innovation	Annual digital sector R&D tax credit expenditure per capita (£)	Corporate tax: Research and Development Tax Credits
Ideas & Innovation	Digital sector R&D tax credit expenditure per enterprise (£k/pa)	Corporate tax: Research and Development Tax Credits
People, Skills & Inclusion	Proportion of people aged 16-64 with NVQ4+ (%) -2020	Annual Population Survey & NISRA
People, Skills & Inclusion	Proportion of people aged 16+ using the internet (%)	ONS
People, Skills & Inclusion	Proportion of households with internet access (%)	Ofcom Nations & Regions Technology Tracker 2021
People, Skills & Inclusion	Proportion of internet users finding info online for work/study (%)	Ofcom Nations & Regions Technology Tracker 2020
People, Skills & Inclusion	% of first degree graduates that remain in the region	HESA
People, Skills & Inclusion	Total HE students (all levels) per 1k pop	HESA
People, Skills & Inclusion	HE computing students (all levels) per 1k pop	HESA
People, Skills & Inclusion	HE computing, engineering & tech, and maths students (all levels) per 1k pop	HESA
People, Skills & Inclusion	Total HE postgrad students per 1k pop	HESA
People, Skills & Inclusion	Total HE postgrad students studying computing per 1k pop	HESA
People, Skills & Inclusion	Total HE postgrad students studying computing, engineering & tech, or maths per 1k pop	HESA
People, Skills & Inclusion	Digital sector median gross annual pay (£k)	Annual Survey of Hours and Earnings
People, Skills & Inclusion	Median gross annual pay for IT and telecoms professionals (£k)	Annual Survey of Hours and Earnings

C Summary Dashboards for each of the UK's NUTS2 regions

C.1 These are provided to as a separate document.

D Write-up of the Rapid Evidence Review which informed the Study's approach and method

Paper 1 (National): Digital Industries in the UK, 2016, Tech Partnership

Scope

D.1 This report provides an overview of the digital industry structure in the UK. The primary data sources used are from the Office for National Statistics, including the Interdepartmental Business Register (IDBR), Annual Population Survey (APS) and Annual Business Survey (ABS).

Key Indicators

Key digital tech indicators used	Source for indicator	Rationale
• Number of enterprises • Number of digital enterprises • Share of Digital enterprises • Share of All Enterprises • Digital density (digital as a % of area total) • Change in the number of business enterprises by UK nation/region, 2010-15 • Largest changes in digital enterprises by sub-region 2014-15 and 2010-15 • Digital enterprises by nation and digital sub-group, 2015 • Industry trends, 2010-2015 • Legal status of digital and other enterprises in the UK, 2015	IDBR	The IDBR is 'a comprehensive list of UK businesses used by government for statistical purposes' comprising data for over 2.1 million businesses in all sectors of the UK economy. The primary IDBR inputs are the Value Added Tax (VAT) system from HMRC (Customs) and Pay As You Earn (PAYE) from HMRC (Revenue).

Key digital tech indicators used	Source for indicator	Rationale
• Company, Sole Proprietor and Other • Digital industry by size (employment based) and sub-sector, 2015		
All digital specialists	APS	A continuous household survey undertaken across the UK to 'provide information on important social and socio-economic variables at local levels. The APS (and the LFS) are recommended sources for socio-economic and employment-related statistics, which are collected from approximately 320,000 respondents per year
• Digital Specialists in other firms • Workers in digital firms • Other workers in digital firms • Digital specialists in digital firms • The digital workforce by industry sub-group, 2010-2015	APS	A continuous household survey undertaken across the UK to 'provide information on important social and socio-economic variables at local levels. The APS (and the LFS) are recommended sources for socio-economic and employment-related statistics, which are collected from approximately 320,000 respondents per year
Gross value (£ m's) added by the digital industries, 2009-2014	ABS	A key resource for understanding the detailed structure, conduct and performance of businesses across the UK.' It is based on survey returns from approximately 74,000 UK businesses each year sampled from the IDBR and incorporates data on turnover, purchases, employment costs, capital expenditure and stocks
GVA per head, 2010-14	ABS and APS	A key resource for understanding the detailed structure, conduct and performance of businesses across the UK.' It is based on survey returns from approximately 74,000 UK businesses each year

Key digital tech indicators used	Source for indicator	Rationale
		sampled from the IDBR and incorporates data on turnover, purchases, employment costs, capital expenditure and stocks
Turnover (£ m's) amongst the digital industries, 2009-2014	ABS	A key resource for understanding the detailed structure, conduct and performance of businesses across the UK.' It is based on survey returns from approximately 74,000 UK businesses each year sampled from the IDBR and incorporates data on turnover, purchases, employment costs, capital expenditure and stocks

Methodology

D.2 The paper presents charts and diagrams on data obtained from the sources outlined in the indicator table. The data is obtained through desk-based research. It uses ONS Standard Industrial Classification (SIC2007) codes to classify digital industries. Digital enterprises can be classed as the following:

- IT;
- Telecoms; and
- Games.

Findings/Observations

- Of the 31m people working in the UK in 2015 1.75m (6%) were working in the digital sector – 1.1m (61%) within digital businesses and a further 0.65m (39%) as digital specialists within other parts of the economy.
- There were 170,000 digital enterprises in the UK in 2015 representing 7% of the entire UK business population.
- Just under one half (48%) of digital enterprises were located in London/the South East of England.
- At sub-regional level, Reading was the local authority with the highest density of digital enterprises – 21% of local business in 2015.
- More than nine in ten digital enterprises in 2015 were IT businesses (91%) and virtually all (93%) were digital service providers.
- The number of digital business increased by 30% between 2010 and 2015 – almost twice the increase in UK business enterprises as a whole (17%).
- Virtually all digital enterprises (99.8%) were classed as SMEs and the proportion of large digital employers was half that for UK industry as a whole (0.2% and 0.4% respectively).

- In total there were 1.16m people working in digital businesses in 2015 – 3% of the UK workforce.
- Employment across digital businesses is mainly focussed on IT (74%), with Telecoms employing 24% and Games 2%.
- The number of workers in the digital industries increased by almost three times the rate recorded for all UK workers over the past five years (2010-2015).
- Turnover amongst digital businesses in 2014 was £209bn, 6% of the UK total.
- The gross value added (GVA) by digital enterprises was £94.8bn – 6% of the annual total across all UK industries.
- Of the digital GVA contribution, 62% was from IT businesses, 37% from Telecoms and 0.4% from Games establishments.
- The increase in digital GVA over the five years 2009-14 exceeded overall growth in the economy in the same period with comparison figures of 27% and 20% respectively.
- The gross value added to the economy per worker in the digital industries was almost double the norm for UK workers, £92,000 for digital industry workers compared with just £54,000 for workers as a whole.

Paper 2 (National): The future UK tech built, 2021, Tech Nation

Scope

D.3 This report provides an overview of the UK's digital ecosystem. It looks at what's next for UK tech; the challenges that are being faced by stakeholders in the ecosystem; and how scaling companies have the potential to build back in a way that delivers benefit for everyone. It captures the investment landscape of the Tech sector and includes analysis of emerging sectors such as healthtech, fintech and edtech. The report captures the transformative impact of technology and the companies developing and applying ground-breaking tech, and assess the effect this is having on people the world over.

D.4 The report provides an overview of each region's tech sector performance.

Key Indicators

D.5 The table below presents some of the most relevant indicators found in this report.

Key digital tech indicators used	Source for indicator	Rationale
VC Investment in UK nations and regions (excluding London) 2015-2020	Dealroom	No explicit rationale given, but key independent variable for understanding relative investment attractiveness
VC investment by European city, 2020	Dealroom	No explicit rationale given, but key independent variable for understanding relative investment attractiveness

Key digital tech indicators used	Source for indicator	Rationale
VC investment by UK cluster	Dealroom	No explicit rationale given, but key independent variable for understanding relative investment attractiveness
Investment by tech subsector in the UK ($bn) 2015-2020	Dealroom	No explicit rationale given, but key independent variable for understanding relative investment attractiveness
What changes have you made to the way you engage with technology due to the COVID-19 pandemic	Streetbees	Tracking the trajectory of technology and identifying clusters
Number of Unicorns in the UK	Dealroom	No explicit rationale given, but key independent variable for identifying cluster catalysts
Digital economy jobs (2005-2019)	APS/BSD (Business Structure Database)	No explicit rationale given, but key independent variable for understanding sector size
Number of digital tech firms	ONS	No explicit rationale given, but key independent variable for understanding sector size
Digital % of firms	ONS	No explicit rationale given, but key independent variable for understanding sector size
Number of future unicorns	Dealroom	No explicit rationale given, but key independent variable for identifying future potential clusters
Emerging Tech Sector Investment	Pitchbook	No explicit rationale given, but key independent variable for understanding relative investment attractiveness
Tech sector jobs	Talent up	No explicit rationale given, but key independent variable for understanding sector size

D.6 Notes on Data Sources used:

- Pitchbook data- They collect data using over 650,000 web crawlers capturing relevant information from news articles, regulatory findings, press releases, websites and other source
- Streetbees - We surveyed 1,437 online participants, over the age of 18, across The UK - including UK regions, The US, and Singapore shared their views on technology - their habits, use and the impact covid-19 has had on their usage
- SEMrush - Keyword data used in this report comes from SEMrush Keyword Magic Tool

- Talent Up - TalentUp uses proprietary Big Data and AI technology to analyse millions of companies and professionals on social networks and websites
- Global Web Index - Global Web Index's data is based upon 16-64 internet users. The markets of focus in the data used are The US and UK. Although the data is based on internet users, if a market has a high internet penetration rate, the online population will be similar to the general population
- Dealroom data deals with venture capital investment and excludes debt, lending capital, grants, ICOs and other non-equity. Secondary rounds, buyouts, M&A and IPOs are also excluded. The data excludes biotech. Including biotech the UK and European investment data would make it much higher. Dealroom's proprietary database and software aggregate data from multiple sources, including news flow aggregation and processing, web scraping and manual research. Data is verified and curated with an extensive manual process, augmented by data processing.

Findings/Observations

- The City of Hull in Yorkshire stands out in 2020 for venture capital investment, ranking 6th in the UK with £81.4. Its previous investment record was £11.2m in 2017 (ranking 14th)
- This year's success - with £80m raised by smart city business Connexin alone - is a key example of how high-growth businesses in emerging technology can change the playing field for regional economies.
- Outside of London, edtech activity in 2020 was clustered in the East of England and the Midlands, with a number of companies harnessing deeptech for adaptive educational tools.
- The Covid-19 pandemic has not only highlighted the importance of investing in health technology and remote medical services, but also challenged the idea that start-ups in major cities like London have an advantage by being optimally positioned for in-person
- meetings and pitches with investors.
- Most fundraising deals happened entirely remotely last year (2020), and the North West of England experienced the highest increases in healthtech investment from 2019 - up 224% from £25m to £82m.
- The adoption of tech in the climate and agriculture sector in the UK is developing rapidly, evidenced in part by the fact that the amount invested across the whole sector grew 81% between 2018 and 2019, and another 63% between 2019 and 2020 to reach £1.3bn.
- Overall, consumers reported using technology more for communication, for work or school activities, and for entertainment. Surprisingly, given physical retail closures, an increase in online shopping was reported less frequently than other changes, only just making it into the top 10 changes in the UK.

- South East England (4x), Yorkshire and the Humber (nearly 2x), the West Midlands (10x) and the East Midlands (3x) saw rapid increases in VC investment over the course of 2020.
- UK unicorns are stampeding - and seven more were added to the UK herd in 2020. The unicorn class of 2020 includes Hopin, Gousto, Arrival, Cazoo, Gymshark, Infobip and Octopus Energy, who all reached the $1bn+ valuation mark last year.

Paper 3 (National): The prospects for regional disparities in the UK in times of Brexit and Covid-19, 2020, Arnab Bhattacharjee, David Nguyen, and Tony Venables

Scope

D.7 This paper looks at regional disparities across the UK, providing examples of where disparities exist such as austerity and government spending. It argues that shocks such as Covid-19 and Brexit may cause further special inequalities due to the structural differences such as digital infrastructure and EU fund reliance.

Key Indicators

Key digital tech indicators used	Source for indicator	Rationale
• Have Internet at Home • Send/receive emails • Find info. Online for work/study • Access files via cloud service • Use Internet banking	Ofcom Nations & Regions Technology Tracker – 2019. Percentages show share of people in the UK that are using the internet for a given category of online service	The distribution of various 'online' activities, shows considerable differences across people living in different places

Key Findings/Observations

- Disparities come in many shapes and the forms are highly persistent
  - Austerity related cuts since 2010 have been unevenly distributed across the country and increased spatial inequalities (Gray and Barford, 2018), with cities in the North East hit the hardest. Moreover, the UK's Industrial Strategy is heavily focussed on R&D and favouring specific sectors. This means that to some degree it is a spatial policy since sectors tend to be concentrated in a few places only
- Major economic shocks could worsen spatial inequalities further
  - In terms of the overall share of jobs that could be done from home, London is leading (almost 60 per cent of jobs), followed by the South East and South West while the share is lowest for the North East (below 40 per cent), as well as Scotland, Wales and Northern Ireland (Costa Dias et al., 2020
  - There is another aspect as even those workers that can work from home face different levels of digital infrastructure.

  - Sensier and Devine find that the South East and South West are the most resilient regions in the UK, with Northern Ireland and the North East being the least resilient ones
- Better data is needed to show what is going on at the regional level
  - Productivity is the main source for long-term economic growth and regional economic disparities tend to arise when highly productive firms and workers cluster in some places.
  - Another key factor that economic theory associates with the economic performance of a firm or place is the amount of available capital (per worker) but regional data on capital stocks have been difficult to come by in the UK.
  - The final article of this issue focuses on improving the availability of regional data in the UK. More specifically, Koop, McIntyre, Mitchell and Poon (Strathclyde and WBS) produce more up-to-date data on quarterly regional economic output and labour productivity, at a higher frequency and with much less delay. Their method allows for nowcasting quarterly regional GDP shortly after the national quarterly GDP figures for the UK are released.

Paper 4 (National): Blueprint for cities and regions as launch pads for digital transformation, 2016, Strategic Policy Forum on Digital Entrepreneurship

Scope

D.8 This report provides the recommendations of the strategic policy forum on Digital Entrepreneurship. It looks at some of the key dimensions required to activate the digital transformation process.

D.9 The ideas and case studies described in this blueprint show how diverse stakeholders across Europe have worked together to build partnerships, develop local talent and attract skills, employ novel sources of data and invest in infrastructure that drives growth and prosperity through digital transformation.

D.10 The report is aimed at helping readers come across new ideas and examples to help their city and region to be a purposeful engine of effective and inclusive digital transformation for all the citizens and organisations that connect to it.

Methodology

D.11 This report analyses 13 city and region cases with diverse profiles. It investigates the nature of projects, their origins, the local governance models, the funding sources and the success factors.

Key Findings/Observations

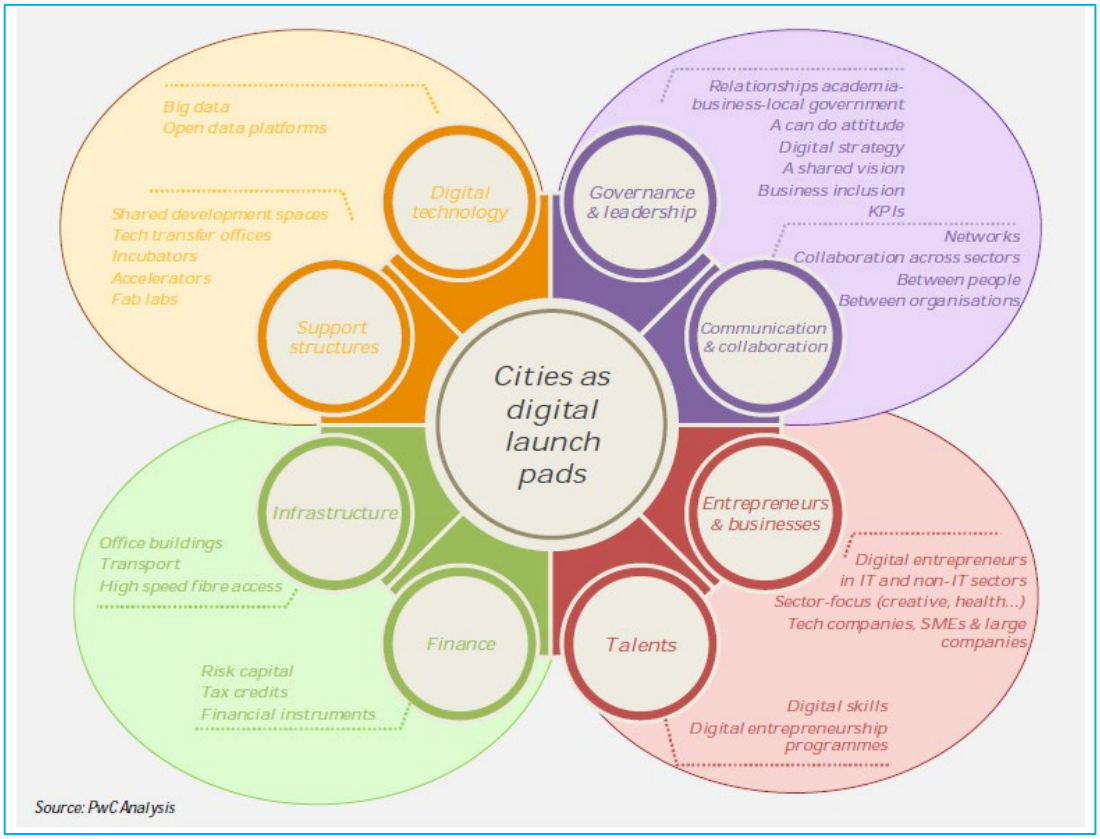
- As cities and regions continue to grow, the prospects for those acting as launch pads for digital transformation become even more prominent.
- Examples and many others showcased in the blueprint illustrate fantastic opportunities for European cities and regions to bring together local stakeholders and to mobilise them in order to accelerate the digital

transformation process in a symbiotic ecosystem. They reflect the interconnections of all the players, not only the traditional ones who are collaborating to make the digital transformational reality.

- The blueprint is intended to serve as a catalyst to leverage all current initiatives on smart and sustainable cities. It sets out the incentives and the benefits for local stakeholders to act as digital launch pads. It defines the success factors and indicators or signals to measure them.

Key Indicators

Figure D-1: Key dimensions to activate the digital transformation process



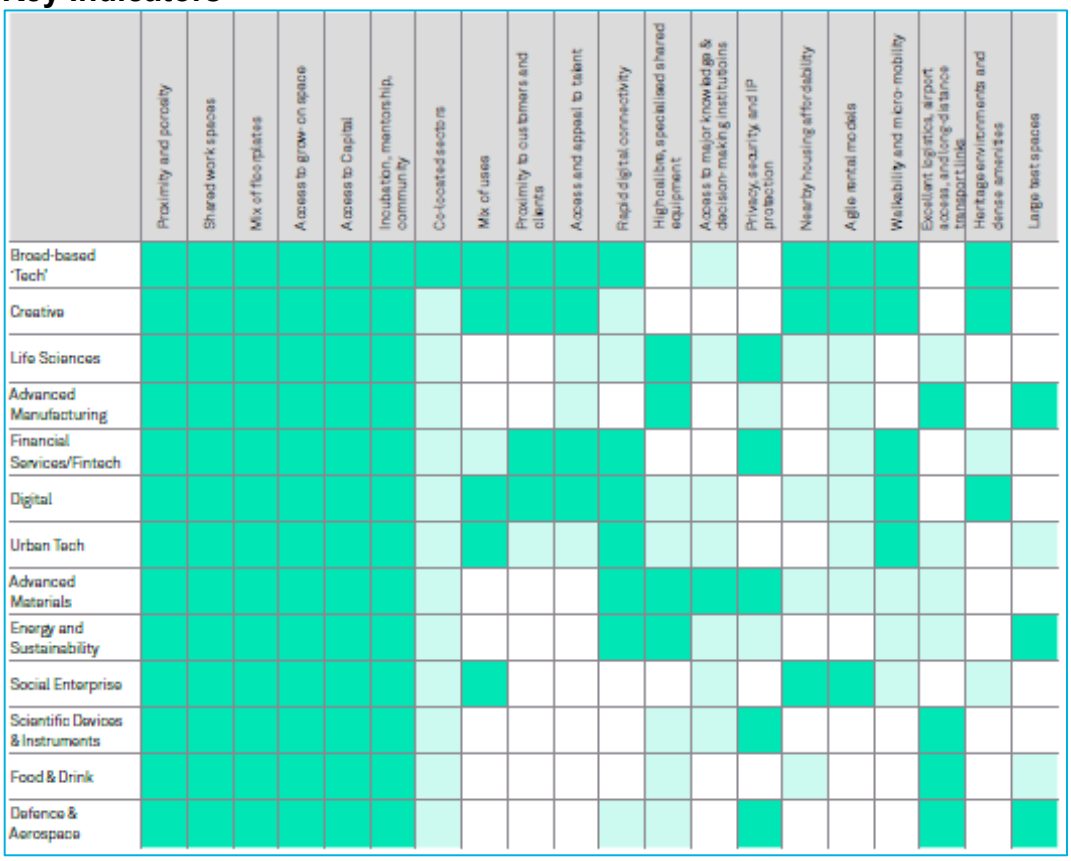
Paper 5 (National): Places of Innovation: The role of Districts, Quarters, Corridors and other venues of the Covid-adjusted innovation economy, 2021, Catapult

Scope

D.12 This report captures the recent experience of a wide variety of places around the world in order to understand what it takes to host the innovation economy across different formats. It underlines the sheer variety of innovation locations and the importance to shift beyond a one-size-fits-all approach to consider the specific needs – of place connectivity, leadership and co-ordination – of each format.

D.13 The report also looks at the factors which shape an innovation ecosystem, providing four domains: Economic Demand Drivers, Business & Investment, Enabling Infrastructure and Skills and Human Capital.

Key Indicators



Methodology

D.14 The report describes an innovation economy as: Innovation is more than a single 'tech sector' or 'start-up scene' – it's a way of describing how whole portions of an economy embrace technologies and change.

Findings/Observations

- No one type of location is predestined to be more successful than others. Although some types are more conducive to the space and talent requirements of particular technology enabled sectors, each has a role to play in every nations innovation map over the coming decades.
- While there are no hard and fast rules governing a place's capacity to host an innovation location, aspiring cities or regions do require a critical mass of the fundamental ingredients outlined in this report. In the UK, many places clearly have the knowledge, R&D, and skills drivers (world-class university, talent pool, academia-business porosity) in abundance, as well as sector and inter-firm drivers. Others have the market and investment drivers (consumer base, institutional presence, airport) supported by expanding knowledge anchors. Places build an innovation economy in different ways and with different assets – but a minimum threshold of drivers is needed. The journey towards how different places in the UK develop such drivers and then assemble the specific place-based ingredients for innovation success are explored in an accompanying handbook by the Connected Places Catapult.

Paper 6 (Local): Lancashire's Digital Landscape, 2019, Lancashire Enterprise Partnership

Scope

D.15 Lancashire LEP, the Lancashire Skills Hub, Lancashire Digital Skills Partnership and strategic partners in Lancashire, including education providers, local authorities and key business representatives, have recognised the need to prioritise the development of essential, general and specialist digital skills to ensure that Lancashire's businesses have access to the digital skills they need at all levels of the workforce, and that Lancashire's residents are able to live and work well in an increasingly digitally-enabled world.

D.16 The objectives of the study were to provide the following:

- Agree a definition of the digital sector and digital occupations
- Provide a robust baseline for the digital landscape in Lancashire
- Identify business skills needs, now and in the future
- Review digital training and learning, including gaps in provision
- Measure the digital skills of Lancashire's population
- Provide insights at a local level
- Insightful and clear messages to inform the work of the DSP

Key Indicators

Key digital tech indicators used	Source for indicator	Rationale
Baseline		
DS business count	UK Business Counts	No explicit rationale given, but key independent variable for understanding sector size
DS employment	UK Business Counts	No explicit rationale given, but key independent variable for understanding sector size
DS business size by employees	UK Business Counts	No explicit rationale given, but key independent variable for understanding sector size
SIC/SOC Data	ONS	No explicit rationale given, but key independent variable for understanding sector size
Location Quotients	BRES Employment Data 2012-2017	Used to evaluate the strength and size of an industry in an area or region.
Employment forecasts	Oxford Economics	No explicit rationale given, but key independent variable for understanding sector size
GVA	ONS	No explicit rationale given, but key independent variable for understanding economic productivity

Key digital tech indicators used	Source for indicator	Rationale
Digital Sector Proportion of Total GVA	ONS	No explicit rationale given, but key independent variable for understanding economic productivity
Forecast GVA growth per travel to work area	Oxford Economics	No explicit rationale given, but key independent variable for understanding economic productivity
DS Employee age groups	Annual Population Survey 2018	No explicit rationale given, but key independent variable for understanding sector demographics
DS employee sex	Annual Population Survey 2018	No explicit rationale given, but key independent variable for understanding sector demographics
DS employment type (full-time/part-time)	ONS	No explicit rationale given, but key independent variable for understanding sector demographics
DS occupation group (Director, Engineer, etc.)	Annual Population Survey 2018	No explicit rationale given, but key independent variable for understanding sector demographics
DS salaries	IPPR North	No explicit rationale given, but key independent variable for understanding sector earnings
GVA per head	Tech Nation	No explicit rationale given, but key independent variable for understanding economic productivity
DS Median earnings	APS	No explicit rationale given, but key independent variable for understanding sector earnings
DS age demographics	APS/Tech Nation	No explicit rationale given, but key independent variable for understanding sector demographics
DS employee ethnicity	ONS	No explicit rationale given, but key independent variable for understanding sector demographics
A Skilled and Productive Workforce		
Digital skills	Lancashire Digital Employer Survey 2019, The UK Employer Skills Survey 2017	The survey was designed to provide an evidence base on the current and

Key digital tech indicators used	Source for indicator	Rationale
		anticipated skills issues and recruitment challenges for employers in Lancashire. The skills categories used are taken from the Burning Glass report for the DCMS
Causes of hard to fill digital role vacancies	Lancashire Digital Employer Survey 2019	The survey was designed to provide an evidence base on the current and anticipated skills issues and recruitment challenges for employers in Lancashire.
Most mentioned types of Digital Skills and Qualifications shortages	Lancashire Digital Employer Survey 2019	The survey was designed to provide an evidence base on the current and anticipated skills issues and recruitment challenges for employers in Lancashire.
Digital apprenticeships	Lancashire Digital Employer Survey 2019	The survey was designed to provide an evidence base on the current and anticipated skills issues and recruitment challenges for employers in Lancashire.
Digital skills training/education	Lancashire Digital Employer Survey 2019	The survey was designed to provide an evidence base on the current and anticipated skills issues and recruitment challenges for employers in Lancashire.
Future Workforce		
GCSE / A-Level computer science uptake	The Royal Society (2017) After the reboot: computing education in UK schools	No explicit rationale given, but key independent variable for identifying sector skills
Hours of teaching on ICT	33 University of Roehampton (2018) Annual Computing in Education Report: Data from 2017	No explicit rationale given, but key independent variable for identifying sector skills
Gender of students taking up computer science GCSE/A-level	The Royal Society (2017) After the reboot: computing education in UK schools	No explicit rationale given, but key independent variable for identifying sector skills
Digital related courses by subject & qualification	College Course Information, 2019	No explicit rationale given, but key independent variable for identifying sector skills

Key digital tech indicators used	Source for indicator	Rationale
FE Digital Starts	DfE Data Cube	Provides info on the numbers, achievements, demographics of people choosing digital subjects in FE
Under/postgrads in computer science related subjects	HESA	No explicit rationale given, but key independent variable for identifying sector skills
Destination of HE leavers	HESA	No explicit rationale given, but key independent variable for identifying sector skills
Inclusive workforce		
Internet usage by location	ONS Internet Usage Data 2019	No explicit rationale given, but key independent variable for understanding inclusivity
Super- or Ultra-Fast Broadband availability	Ofcom Connected Nations Data May 2018	No explicit rationale given, but key independent variable for understanding digital infrastructure
Access to the internet	Lancashire resident digital skills survey	No explicit rationale given, but key independent variable for understanding inclusivity
% of respondents with essential digital skills	Lancashire resident digital skills survey	No explicit rationale given, but key independent variable for understanding inclusivity

Methodology

D.17 The baseline study was structured around the three Skills and Employment Strategic Framework themes: skilled and productive workforce; future workforce; and inclusive workforce. Across each of these themes, some of the required information was available through secondary sources, whilst some required bespoke primary research. The maximum possible use was made of existing data – drawing on ONS sources, research reports and existing literature. An element of primary research in each of the three themes added value to existing information and filled gaps in knowledge, this consisted of:

- Skilled and Productive Workforce – an online and telephone survey of Lancashire businesses to establish skills needs and challenges, identify drivers for change and how recent sector and technological developments are impacting and will impact on the demand for skills and the workforce.
- Future Workforce – an online consultation survey of Lancashire education and skills providers exploring challenges and barriers to providing digital skills education in Lancashire.
- Inclusive Workforce – a telephone survey of Lancashire residents asking about their digital skills, their use of digital technologies and their access to digital opportunities.

Findings/Observations

- It is estimated that most workers are in other sectors – in other words, non-digital specific sectors that rely on digital skills to operate. This demonstrates the importance of digital skills across the economy.
- A lack of diversity in terms of gender, age and ethnicity.
- Businesses report considerable vacancies and skills gaps in their Digital workforce across key skills areas. Because of a lack of suitable candidates, and the education system not fully developing the skills that employers require, businesses are turning to freelance contractors to plug skills gaps.
- A diverse range of specific digital skills is sought by employers.
- Employers are competing for a constrained supply of workers. Where common skills needs are identified, 'clustering' of employers and delivering jointly to those with similar needs may help to make bespoke provision more financially viable for both employers and providers. Working in partnership with their larger customers can also help smaller businesses to address their skills needs, whilst building closer relationships with key customers.
- There is also a need to create pathways for the current workforce in other occupations / sectors to acquire the skills they need to move into digital roles.
- There is a growing focus on better aligning skills provision with the needs of local economies, through closer business engagement in the curriculum.
- Age is a major determinant of digital competency amongst residents. Help is most frequently sought from friends and family in order to complete tasks.
- Access to the internet will go some way to improving digital literacy.
- Recent curriculum changes have seen a small increase in the uptake of Computer Science at school level.
- The constant evolution in digital roles and jobs creates challenges for providers in keeping the curriculum up to date with changing technologies and skills needs.
- Rather than attempting a fine-grained forecast of future needs, the focus for public sector investment should be on providing core digital skills – at school, at college and at university – which can then be built on and further developed by those seeking to work in digital roles.

Paper 7 (Local): Matrix's Digital ICT Report, 2016, Matrix Digital ICT Panel

Scope

D.18 MATRIX, the Northern Ireland Science Industry Panel, formed a subpanel of experts in the Digital ICT sector to look at the opportunities within the sector and produce a capability assessment and foresight study into Northern Ireland's Digital Information and Communications Technology sector. The report uses the term Digital ICT sector to include sectors that support the capture, transmission and electronic display of data and information as well as the

enterprise software, middleware, storage, and audio-visual systems which enable users to access, store, transmit, and manipulate information. The report does not examine the creative industries sector.

D.19 The 2016 MATRIX Digital ICT Report aims to:

- Clearly identify future opportunities - global trends which will play to Northern Ireland's specific strengths
- Suggest how best to tackle barriers to success
- Make recommendations and suggest ownership and timelines for implementation.

Key Indicators

Key digital tech indicators used	Source for indicator	Rationale
DS business count	NISRA	No explicit rationale given, but key independent variable for understanding sector size
DS employment	NISRA	No explicit rationale given, but key independent variable for understanding sector size
GVA	NISRA	No explicit rationale given, but key independent variable for understanding economic productivity
Digital ICT exports	NISRA	No explicit rationale given, but key independent variable for understanding economic contribution
Healthcare App users	Deloitte	No explicit rationale given, but key independent variable for understanding sector inclusion
% global population living in urban areas	UN Development Programme	Smart city infrastructure is locally relevant, and so are the opportunities globally to export solutions to urbanisation challenges
Global consumer spend	Not stated	Clustering, cooperation and global niche manufacturing networks can bring market opportunities through strategic partnerships & collaborative technologies.
Digital skills	International Data Corporation	No explicit rationale given, but key independent variable for identifying sector skills

Key digital tech indicators used	Source for indicator	Rationale
VAT and/or PAYE registered Digital ICT businesses operating in Northern Ireland	Inter-Departmental Business Register, NISRA	No explicit rationale given, but key independent variable for understanding sector size
Turnover of Northern Ireland ICT businesses 2008-2013	Inter-Departmental Business Register, NISRA	No explicit rationale given, but key independent variable for understanding economic productivity
Median gross weekly earnings for Northern Ireland tech specialists	NISRA	No explicit rationale given
DS Foreign Direct Investment	Invest NI	No explicit rationale given, but key independent variable for understanding relative investment attractiveness
Business expenditure on R&D	Not Stated	No explicit rationale given, but key independent variable for understanding investment in research and development
Business ICT expenditure	Not Stated	No explicit rationale given, but key independent variable for understanding sector size
DS employee sex	**TP Degrees**	No explicit rationale given, but key independent variable for understanding sector demographics
% of Northern Ireland ICT companies reporting skills gaps for ICT specialists	NI ICT snapshot survey	No explicit rationale given, but key independent variable for identifying sector skills
Top sectors with skills shortages NQF4+	NI Skills Barometer	No explicit rationale given, but key independent variable for identifying sector skills
Stem subjects by gender	NISRA – Women in Northern Ireland 2015	No explicit rationale given, but key independent variable for identifying sector skills
IT apprenticeships by gender	Tech Partnership Women in IT Scorecard	No explicit rationale given, but key independent variable for identifying sector skills
Ageing population stats	UNDESA, Population Division, United Nations Department of Economic and Social Affairs	Higher life expectancy and falling birth rates will have far-reaching effects on budgets such as health, but effective digital solutions could help to address these issues.

Key digital tech indicators used	Source for indicator	Rationale
Software revenue	IDC Worldwide Software Forecast, 2015–2019	No explicit rationale given, but key independent variable for understanding sector size
Global spend on cybersecurity	Cybersecurity Ventures	No explicit rationale given, but key independent variable for understanding sector size
Big data market value	IDC	No explicit rationale given, but key independent variable for understanding sector size

Methodology

- The study is based on secondary research from sources such as: NISRA, DETI, ONS, InvestNI, E-skills, Deloitte, DEL, IDC, QUB and UU.
- The panel used the SIC codes J61 – 63 inclusive to identify the ICT Digital sector: Telecommunications, Computer programming, consultancy and related activities, Information service activities.

Findings/Observations

- Demand is increasing for ICT products which help people manage their own health and wellness. There is also increased pressure for health services to find ways to improve efficiency in the delivery of healthcare.
- Smart city infrastructure is locally relevant, and so are the opportunities globally to export solutions to urbanisation challenges.
- There is a need for the delivery of devices, networks, services and applications that support the demands of 'digital natives' – i.e. those whose who are fully at ease with technology.
- Exponential growth in computing power, combined with a dramatic reduction in cost has seen computer technologies transform the workplace, displacing labour from some jobs but also creating new types of work that call for different skills.
- Clustering, cooperation and global niche manufacturing networks can bring market opportunities through strategic partnerships & collaborative technologies.
- Challenges to digital growth include supply of talent, leadership/strategy, government support, smart specialisation and funding.

Paper 8 (Local): Sheffield City Region (SCR) Digital Action Plan, 2018, SCR LEP

Scope

D.20 In 2017, Sheffield LEP decided to: "build a greater understanding of the digital sector in Sheffield City Region and to create a Digital Action Plan, to enable the area to meet the related challenges of growing the sector and competing globally". Based on an independent analysis of the strengths, weaknesses,

opportunities and threats facing the City Region's digital economy, it identifies the key actions that the LEP – and its partners in business, government and the private sector – will take to drive forward Sheffield City Region's digital potential.

Key Indicators

Key digital. tech indicators used	Source for indicator	
DS employment	Tech Nation	No explicit rationale given, but key independent variable for understanding sector size
DS GVA	Tech Nation	No explicit rationale given, but key independent variable for understanding economic productivity
DS productivity	Tech Nation	No explicit rationale given, but key independent variable for understanding economic productivity
NVQ4+	ONS	No explicit rationale given, but key independent variable for identifying sector skills
Digital literacy	Doteveryone (2015, Digital exclusion heatmap	No explicit rationale given, but key independent variable for identifying sector skills
Levels of enterprise activity/creation	ONS, Business Demography (2015)	No explicit rationale given, but key independent variable for understanding sector size
GVA per employee	ONS and BRES data	No explicit rationale given, but key independent variable for understanding economic productivity
GVA Growth	ONS GVA (income approach) data	No explicit rationale given, but key independent variable for understanding economic productivity
Concentrations of digital sector employment	ONS and BRES data	No explicit rationale given, but key independent variable for identifying potential clusters
Digital sector employment in comparator LEP areas	BRES	No explicit rationale given, but key independent variable for understanding sector size
Changes in digital sector employment	BRES	No explicit rationale given, but key independent variable for understanding sector size
Projected growth (%) in IT services and media, 2015-30	Cambridge Econometrics forecast data	No explicit rationale given, but key independent variable for understanding sector size

Key digital. tech indicators used	Source for indicator	
Digital sector local enterprise units	ONS Business Counts	No explicit rationale given, but key independent variable for understanding sector size
Size of digital businesses	UK Business Counts	No explicit rationale given, but key independent variable for understanding sector demographics
Comparator LEP data for change in business stock (2011-2016)	UK Business Counts	No explicit rationale given, but key independent variable for understanding sector size
Employment growth and specialisation	ONS & BRES	No explicit rationale given, but key independent variable for understanding labour market
Concentration of game publishers and developers	**Gamesmap**	No explicit rationale given, but key independent variable for identifying potential clusters
Planned and proposed projects in central Sheffield	Sheffield Digital, focus group F5	No explicit rationale given, but key independent variable for identifying potential future clusters
Incubator facilities and managed workspaces in Sheffield City Region	SCR LEP/ Genecon (2015), Sheffield City Region Incubation Study	No explicit rationale given, but key independent variable for identifying sector resources
Tech sector commercial investment	Tech City UK, Tech Nation 2017, p.39	No explicit rationale given, but key independent variable for understanding relative investment attractiveness
Broadband connectivity	Ofcom	No explicit rationale given, but key independent variable for understanding sector inclusion
DS occupation level	Approximated using the UK Commission for Employment and Skills	No explicit rationale given, but key independent variable for understanding sector size
Occupational profile of the Sheffield City Region workforce	Working Futures 2014-24 data	No explicit rationale given, but key independent variable for understanding labour market
Qualifications profile	Working Futures 2014-24	No explicit rationale given, but key independent variable for identifying sector skills
Gender imbalances	UK Commission for Employment and Skills (2014), Working Futures, 2014-24	No explicit rationale given, but key independent variable for understanding sector demographics
Employment status	Working Futures, 2014-24	No explicit rationale given, but key independent variable for understanding labour market

Key digital. tech indicators used	Source for indicator	
Levels of digital exclusion	Tech Partnership, Go.ON UK (2016)	No explicit rationale given, but key independent variable for understanding sector inclusion
Changing labour demand in information and communications, 2014-24	Working Futures 2014-24	No explicit rationale given, but key independent variable for understanding labour market
Job vacancies in the Sheffield City Region	Labour Insight Jobs, Burning Glass Technologies	No explicit rationale given, but key independent variable for understanding labour market
Skill clusters in demand in the digital sector	Labour Insight Jobs, Burning Glass Technologies	No explicit rationale given, but key independent variable for identifying sector skills
Skills employers require	SCR Skills Bank	No explicit rationale given, but key independent variable for identifying sector skills
Changing digital skills demands in selected 'non-digital' sectors	Not Stated	No explicit rationale given, but key independent variable for identifying sector skills
Higher education qualifiers by subject of study	Higher Education Statistics Agency (HESA)	No explicit rationale given, but key independent variable for identifying sector skills
Employment outcomes and regional retention for graduates in digital subjects	HESA, Destinations of Leavers of Higher Education (DLHE) survey	No explicit rationale given, but key independent variable for understanding labour market
Digital Apprenticeships	Not Stated	No explicit rationale given, but key independent variable for identifying sector skills

Methodology

D.21 The evidence base set out in this report is broad. It draws on a framework for analysis which considers the key components of an innovation 'ecosystem'. This includes:

- Business base
- Support infrastructure
- Knowledge base
- Infrastructure
- Skills and demand
- Wider growth factors

D.22 The study draws together evidence from a wide range of data and reports, as well as from consultation with around 50 businesses and other stakeholders in the City Region.

Findings/Observations

- There is a growing concentration of larger digital businesses.
- The digital sector is diverse in business terms.
- There is a competitive higher education offer.
- There is a large and high-quality graduate base.
- Overall, the digital sector lacks scale and density.
- There are few large anchor businesses and institutions.
- Digital sector employment remains low, and recent employment growth has been slow.
- The sector lacks strong leadership.
- The sector faces significant skills challenges. Because of the small size of the sector, this includes difficulties in recruiting and retaining staff with the right technical skills.
- Participation at some levels (e.g. apprenticeships) is low, and (as in other parts of the country) the potential talent pool is narrowed by very low female participation at higher qualification levels.
- High levels of digital exclusion.

Paper 9 (Local): Scotland's Digital Technologies: Research & Analysis Report

Scope

D.23 The report has been developed and funded by Scottish Government through the Digital Scotland Business Excellence Partnership whose partners include Skills Development Scotland, ScotlandIS, Scottish Government, Scottish Enterprise, Highlands & Islands Enterprise, Scottish Funding Council, SQA, Education Scotland and Digital Technologies sector representatives.

D.24 The aims of the report are to:

- Detail the size and scale of the sector, and its economic importance to Scotland;
- Articulate the current composition and forecast changes in the sector's business base;
- Map the education supply pipeline for the sector;
- Identify the key drivers for change in the sector; and
- Articulate the current and likely future recruitment, workforce and skills needs of employers.

Key Indicators

Key digital tech indicators used	Source for indicator	
Enterprises in the Digital Technologies sector by Sizeband and Local Authority	UK Business Counts and BRES Employment Data	No explicit rationale given, but key independent variable for understanding sector size

Key digital tech indicators used	Source for indicator	
Enterprises in the Digital Technologies sub-sectors in Scotland	UK Business Counts and BRES Employment Data	No explicit rationale given, but key independent variable for understanding sector size
Digital Technologies sector employment by Local Authority,	UK Business Counts	No explicit rationale given, but key independent variable for understanding sector size
Share of total employment in Digital Technologies by local authority	BRES Employment Data	No explicit rationale given, but key independent variable for understanding sector size
Concentration of employment (LQ) in the Digital Technologies sector by local authority	BRES Employment Data	No explicit rationale given, but key independent variable for understanding sector size
Percentage of full and part-time employees in Digital Technologies by Local Authority	BRES Employment Data	No explicit rationale given, but key independent variable for understanding labour market
Employment in Digital Technologies sub-sectors in Scotland	BRES Employment Data	No explicit rationale given, but key independent variable for understanding sector size
Forecast growth in employment (expansion demand) in the Digital Technologies industry	ekosgen calculations based on Annual Population Survey, ONS, 2016 and Oxford Economics forecasting, 2016	No explicit rationale given, but key independent variable for understanding future sector size
Employment by Digital Technologies occupation group	Annual Population Survey, ONS	No explicit rationale given, but key independent variable for understanding sector size
Change in Digital Technologies employment by occupation group	Annual Population Survey, ONS	No explicit rationale given, but key independent variable for understanding labour market
Forecast growth in Digital Technologies employment by occupation group	ekosgen calculations based on Annual Population Survey, ONS, 2016 and Oxford Economics forecasting, 2016	No explicit rationale given, but key independent variable for understanding future sector size
Digital Technologies median salary by industry and occupations	ONS, Annual Survey of Hours and Earnings	No explicit rationale given, but key independent variable for understanding sector earnings
Change in components of the Digital Technologies workforce	Annual Population Survey, ONS	No explicit rationale given, but key independent variable for understanding labour market
Computing qualifications for pupils at publicly funded schools	Scottish Qualifications Authority (SQA)	No explicit rationale given, but key independent variable for identifying sector skills
College enrolments on qualifications relating to Computing and ICT (FE/HE)	Scottish Funding Council (SFC)	No explicit rationale given, but key independent variable for identifying sector skills

Key digital tech indicators used	Source for indicator	
Destinations of Computing and ICT college leavers	SFC	No explicit rationale given, but key independent variable for identifying sector skills
Provision of apprenticeships in subjects related to Digital Technology	Skills Development Scotland (SDS)	No explicit rationale given, but key independent variable for identifying sector skills
Enrolments on courses at Scottish universities relating to computing and ICT and courses with a computing component	SFC	No explicit rationale given, but key independent variable for identifying sector skills
Destinations of computing and ICT university leavers	SFC	No explicit rationale given, but key independent variable for understanding labour market
College enrolments relating to computing	SFC	No explicit rationale given, but key independent variable for identifying sector skills
Potential pipeline for Digital Technologies sector/occupations	SDS	No explicit rationale given, but key independent variable for understanding labour market
Digital initiatives	Various – desk research	No explicit rationale given, but key independent variable for understanding sector inclusion
GVA	SABS 2014: Additional Tables for ICT sector	No explicit rationale given, but key independent variable for understanding economic productivity
Digital Skills	UKCSE (2014) Sector Insights: Skills and Performance Challenges in the Digital and Creative Sector	No explicit rationale given, but key independent variable for identifying sector skills
DS Workforce Gender	Equalities In Scotland's Growth Economic Sectors: Final Report	No explicit rationale given, but key independent variable for understanding sectordemographics
DS salary, geographical markets, market change, growth, recruitment (challenges), skills, cybersecurity, utilisation, training, sustainability	ekosgen Digital Technologies Survey	Various

Methodology

D.25 An extensive desk-based analysis forms the basis of this research commission. This covers employment and enterprise data from a variety of statistical and employer sources to provide detail on the size and scale of the sector. It also draws upon occupation and industry data to build a picture of the cross-sector composition of Digital Technologies. In addition to this, an in-depth review of

education and training provision and qualifications has been undertaken for subjects related to the Digital Technologies sector. Building on this, an extensive survey and consultation programme has been undertaken with Digital Technologies employers, to explore the particular skills challenges facing employers within the sector, and outside in other parts of the Scottish economy.

Findings/Observations

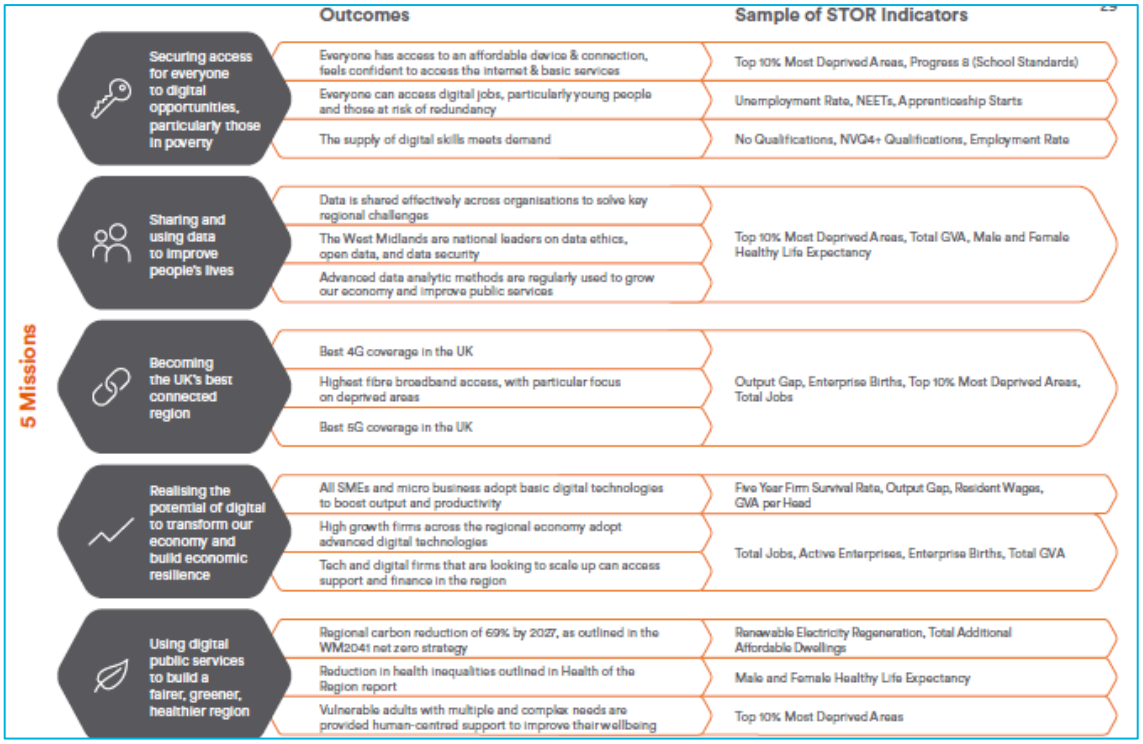
- There are considerable challenges in securing an adequate supply of skills to meet both current and future needs.
- Ensuring a supply of appropriately skilled new entrants is important, but equally there is a need for upskilling or re-skilling the existing workforce to adapt to changes in technology and ways of working. Additional research, focused on the changing skills requirements of the existing workforce, may help to understand this further.
- There is already a lot of work being undertaken to capture the interest of more people, and young people in particular, and attract them to a career in Digital Technologies. It must be borne in mind, however, that entrants must have the right skills and understanding, and this is likely to become a more important consideration as the sector, and technology more generally, evolves and becomes increasingly complex.
- As well as greater numbers of workers, there is a need for the workforce to be resilient and agile, able to adapt quickly when needed to in a constantly evolving environment. This will likely require a degree of planning on the part of employers, but also from stakeholders and education and training providers in terms of the skills provided, but equally it is arguable that there may be a need for the right flexible people, rather than the people that have until now been considered right for the sector and its roles.

Paper 10 (Local): West Midlands Digital Roadmap, 2021, West Midlands Combined Authority

Scope

D.26 The West Midlands digital roadmap plans to set out the direction of travel for the West Midlands – to become a forward looking and inclusive digital economy, where data is used to improve public services and the latest technology is used to reduce carbon footprint. No real indicators as the report is primarily qualitative and very forward looking.

Key Indicators



Findings/Observations

Securing access for everyone to digital opportunities, particularly those in poverty

- Improve digital literacy through Adult and Community Learning offers, delivered by LAs and funded through the Adult Education Budget
- Work with young people and schools to improve digital literacy and build core skills
- Work with Local Authorities and Community Groups to embed resilience to online disinformation across the region
- Support collaboration between the public, private, and third sector through the Digital Skills Partnership
- Deliver the Digital Retraining Scheme, supporting unemployed people and adults facing the risk of redundancy
- Use the Adult Education Budget to increase the volume of technical and advanced digital skills, and also establish a basic digital offer
- Boost technical education by doubling the number of digital apprenticeships
- Develop higher level data analytic skills to support both economic growth and public sector analytic capacity, and retain and support graduates coming from our region's universities with these skills

Sharing and using data to improve people's lives

- Focus sharing of data on key areas:
  - Economic Recovery – Business level data and economic analysis
  - Reaching Net Zero – Transport, energy, & planning data to support WM2041 five-year delivery plan

  - Tackling Health Inequalities – as outlined in Regional Health Impact of Covid report
  - Supporting Individuals with Multiple and Complex Needs – using improved insights from better connected datasets
- Develop and agree a regional set of data ethics and information assurance guidelines to support the sharing and use of data by all parts of the public sector and relevant parts of the private and third sectors
- Use the West Midlands Datastore project to realise open data commitments improving transparency and accountability
- Leverage the support of local universities
- Support the creation of specific teaching materials for FE
- Develop the Office for Data Analytics and the West Midlands Regional Economic Development Institute
- Build the capability of staff across the public sector, from senior leaders to frontline staff, to use data to inform decisions and delivery.

Becoming the UK's best-connected region

- Uses 5G and broadband coverage as an indicator
- Large focus on improving 5G coverage

Realising the potential of digital to transform our economy and build economic resilience

- SMEs and micro business adopt basic digital technologies to boost output and productivity. These include AI, blockchain, VR/AR, 5G, IoT
- Four major areas of growth:
  - Future of Mobility – particularly connected and autonomous vehicles
  - Data Driven Health and Life Sciences
  - Creative Content, Techniques, and Technologies – particularly gaming cluster, eSports and screen sector (supported by Create Central)
  - Modern Services – particularly role of digital in 'as a Service' opportunities in professional services industry
- Growth Hubs working with regional SMEs to boost digital technology adoption and promote e-commerce, alongside private sector partners
- Drive innovation through over 24 specialist schemes across LEPs, Universities, and other partners
- Ensuring digital technology is at the heart of major projects such as HS2 and Commonwealth games
- Tech and digital firms that are looking to scale up can access support and finance in the region

Using digital public services to build a fairer, greener, healthier region

- Innovate mobility through projects such as:
  - Regional Transport Coordination Centre - providing real-time view of the transport network and disruptions
  - Midlands Future Mobility programme

  - Future Mobility Zone
  - WM5G developing 5G enabled transport products and services to combat road congestion, reduce emissions, highlight parking space availability, maintain infrastructure, and improve traveller experience
- Innovate in the delivery of healthcare, in partnership with the NHS, through WM5G pilots focussing on remote monitoring and support of care home patients, home delivery of endoscopy services
- Support collaboration between the public and private sectors in healthcare innovation
- Collaborate across the region to share best practices on digital public services, and to increase collective expertise in user research, human centred design, and agile delivery

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