TECH & DIGITAL
DEEP DIVE REPORT

Regional Observatory

BIRMINGHAM CITY University

Key Headlines

The tech and digital sector is one of the most dynamic parts of the UK economy. In 2016 there were nearly 270,000 tech and digital firms in the UK – some 31% more than there were in 2011.

The WMCA area is a key national centre for the tech and digital sector

Tech and digital was the fifth largest sector in the WMCA economy with nearly 14,000 tech and digital businesses in 2016, 5% of the national total and more than any other combined authority area in the country. Birmingham is the UK's premier centre for the sector outside London with just under 3,000 tech and digital firms and there are also significant numbers in Warwick (more than 1,000), Solihull (more than 900), Stratford-on-Avon (nearly 700), Wolverhampton (nearly 600) and Telford (nearly 500).

11,000 are in B2B markets providing hardware, infrastructure, networks, systems and software or services relating to, for example, cyber security and the Internet of Things. More than 2,400, meanwhile, are in creative services such as design and publishing and a further 600 are in digital media (e.g. TV or music production, TV broadcasting and games design and development).

Supporting tens of thousands of highly skilled jobs

The tech and digital sector in the WMCA area employs more than 70,000 people, of which a particularly high proportion are in highly skilled, highly paid jobs. For example 55% are in highly skilled professional and technical occupations (compared with 26% across all sectors) and 47% require degree or post graduate qualifications (compared with 35% across all sectors). National level research, meanwhile, indicates that tech and digital salaries are 36% above the national average and have grown 19% faster than the average over the last 3 years.

As at a national level, there is a particularly strong demand for (i) specialist technical staff such as Software and web developers, business analysts, architects and systems designers and (ii) people with expertise in specific applications such as SQL, .NET, C#, Php, ASP and Vb.

With a range of local hot spots of activity

Birmingham is the UK's premier centre for tech and digital outside London with just under 3,000 tech and digital firms. Other key hot spots include Warwick, Solihull, Coventry and Stratford-on-Avon.

Strong business growth

The number of tech and digital businesses based in Birmingham has risen by 38% over the last 5 years - of the major UK cities only London, Edinburgh and Manchester saw stronger rates of growth. There was also particularly strong growth in business numbers in Coventry (47%) and Solihull (37%).

The importance of small and micro businesses

94% of tech and digital firms in the WMCA area are small and micro businesses employing less than 10 people, rising to 95% in creative services and 96% in digital media. Only the tech B2B subsector has any larger firms employing more than 250 people. These firms are driving business growth, accounting for 94% of the growth in tech and digital business numbers since 2011. The proportion rises to 97% for digital media.

Drivers of growth – innovation

The innovative use of digital technologies has tremendous potential to create value and boost competitiveness and productivity. To exploit this potential tech and digital firms are clustering around key innovations such as:

* Cyber Security
* Data Analytics
* 5-D BIM (Building Information Modelling)
* Cloud-based Digital Collaboration & Mobility
* The Internet-of-Things (IoT)
* Blockchain technology and Robo-advice in financial services
* Digital care services
* Smart grid technologies
* 3D visualisations
* Open data

A new wave of growth in emerging markets

Tech and digital firms have an opportunity to exploit a new wave of growth with an acceleration of technology adoption and digital media consumption in emerging markets such as China, India, ad Russia. This is being driven by:

* A young demographic
* Large scale broadband penetration
* Rapid smartphone adoption
* Rising disposable incomes

Key Headlines

Drivers of growth – inward investment

The UK has been the number one destination in Europe for tech and digital inward investment for a number of years, and the West Midlands has been one of the most successful regions.

SMEs and micro businesses (both so-called 'born globals' looking to expand rapidly from the outset to gain leadership of specific niche markets; and 'going globals' already strongly established in their domestic market and now seeking a more organic/phased expansion internationally) have accounted for more than three quarters of projects.

The majority of projects have been in B2B activities such as software applications (for example for systems, graphics, communications, networking or security) and IT services (for example big data analytics, the internet of things, cyber security).

Investment has been predominantly drawn from London, where investors tend to be looking for lower property, staff costs and staff turnover rates, the USA – and particularly regions such as Silicon Valley - Australia (notably Sydney and Melbourne), Canada (notably the Waterloo-Toronto region), Germany (where more and more tech start-ups in hotspots like Berlin and Munich are accessing funding for international expansion) and France (there has been an explosion of start ups in the Paris area).

Emerging needs, gaps and shortages

Access to the right skills and talent can often be the number one factor for choice of location for tech and digital inward investment. Looking forward, the UK's and the WMCA area's strengths in emerging technologies such as the Internet of Things, wearable technologies, Big Data and Data Analytics, Cyber Security, 5G and wireless technologies, robotics, autonomous vehicles, advanced manufacturing and building automation is leading to an emerging demand for specialist technical skills in areas such as 3D printing, CAD, graphic design, Building Information Modelling (BIM), digital marketing and digital publishing.

At the same time, however, there are shortages of key technical skills and expertise in (i) the existing tech and digital workforce and (ii) in the labour market in areas such as Data Analytics, Big Data and Cloud Computing. This is a particularly critical issue for SMEs and micro businesses who lack the resources to recruit globally.

HEIs as a key source of talent and workforce development expertise

While a significant proportion of tech and digital firms recruit new talent from the existing workforce HEIs are also a key source of talent. Some 36% recruit from local universities and a further 16% look to HEIs across the UK. While tech and digital firms are most likely to develop their staff in-house and/or via informal approaches, meanwhile, it is notable that nearly 30% use local universities and a further 15% use HEIs based elsewhere in the UK.

Strong growth in GVA and employment is forecast over the next decade

Over the 2015-2025 period we forecast that the gross value added generated by tech and digital in the WMCA area will rise by £1.3 billion (20% or 2% per annum) from £5.7 billion to £7 billion, with the potential to rise to £7.9 billion.

We forecast that employment, meanwhile, will rise by nearly 14,000 from just over 70,000 to 84,000. In addition to the 14,000 new jobs created (expansion demand) we expect a further 27,000 to arise due to staff turnover effects (replacement demand). These jobs will be predominantly in higher skilled, well paid roles with 91% in professional, associate professional and technical roles and almost all of new jobs will be in roles requiring a foundation, undergraduate or higher degree.

Introduction

We aim to produce a suite of 'deep dive' reports, updated annually and covering the WMCA geography, providing in-depth insights on the priority sectors for the West Midlands Growth Company.

The 'deep dive' reports are underpinned by:

- The wealth of rich and valuable sector-specific data and intelligence available from the Regional Observatory

- Specialist, cutting edge insights and real life case studies from co-authors and sponsors drawn from Marketing Birmingham's network of Commercial Partners

The reports are intended to:

- Inform the strategy, market positioning and tactics of the West Midlands Growth Company as it seeks to attract investment and support business growth in the WMCA area

- Raise the profile of the Regional Observatory and co-authors and sponsors as sector experts, widening and deepening their engagement with sector businesses

This report on the tech and digital sector is the second in the series and is being sponsored and co-authored by Birmingham City University (BCU), which has particular strengths in ICT and digital technology research and teaching and close ties with industry. BCU specialises, for example, in:

- Areas where the Regional Observatory's research and analysis indicates significant market opportunities and prospects for growth such as gaming, big data analytics, cyber security, cloud based applications, 3D visualisation and open data

- The development of graduate and post graduate talent to help meet the sector's recruitment needs, alongside its workforce development offer which includes placements, internships and traineeships, CPD and the development of bespoke in-business training and development solutions

This report explores a wide range of issues, notably:

- The scale and importance of the sector in the WMCA area
- Growth trends
- Key concentrations and hot spots of activity
- The importance of small and micro businesses
- Key drivers of growth – for example: innovation, key growth markets and investment
- Skills issues – for example: emerging needs, skills gaps and shortages and sources of skills and talent

We also include illustrative case studies demonstrating where Birmingham City University's research is supporting key aspects of the sector.

The West Midlands Combined Authority geography is evolving over time. While the City Councils and Metropolitan Borough Councils that make up the old 'West Midlands County' are all full constituent members of the Combined Authority (Birmingham, Coventry, Dudley, Sandwell, Solihull, Walsall and Wolverhampton), local authority districts in southern Staffordshire, northern Worcestershire and Warwickshire are either 'non-constituent' members or waiting for legislation to be passed to allow them to become so. Further afield the Marches LEP area, which includes Telford, Shropshire and Herefordshire may also become 'non-constituent' members. We have therefore included data and analysis for all of these areas in this report.

While tech and digital industries are expanding rapidly, making a growing contribution to GVA and the creation of highly skilled jobs, tech and digital technologies are transforming virtually every sector of the economy. Key examples within the WMCA area include automotive and other areas of advanced engineering. Within this report, however, we have focused specifically on tech and digital industries – tech B2B, digital media and creative services.

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The Faculty of Computing, Engineering & the Built Environment is a thriving, vibrant, and inspiring learning community located in a modern campus in the heart of Birmingham. Partnership with local and global organisations in order to develop cutting-edge expertise, is at the heart of our approach to making our teaching and research vital to the evolving market for digital and technical skills.

Our research has developed technologies and solutions in a number of areas including digital media, data analytics, cybersecurity, wireless sensor networks and engineering which are being applied in Smart Cities, Digital Health, Digital Productivity, Creative Industries and Advanced Manufacturing (Industry 4.0).

Professor Hanifa Shah, Associate Dean, Research & Enterprise BCU

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Baseline data & analysis

The economic importance of the sector

The tech and digital sector is one of the most dynamic parts of the UK economy, achieving growth in GVA some 32% greater than the economy as a whole over the last 5 years[1]. In 2016 there were nearly 270,000 tech and digital firms in the UK – some 31% more than there were in 2011[2].

The fifth largest sector in the WMCA economy

Of these, nearly 14,000 are based in the WMCA area and tech and digital is the fifth largest sector in the WMCA area economy in terms of business numbers – behind professional services, retail, transport and logistics and construction but ahead of manufacturing, health and social care, hospitality and leisure, public sector services and banking and finance.
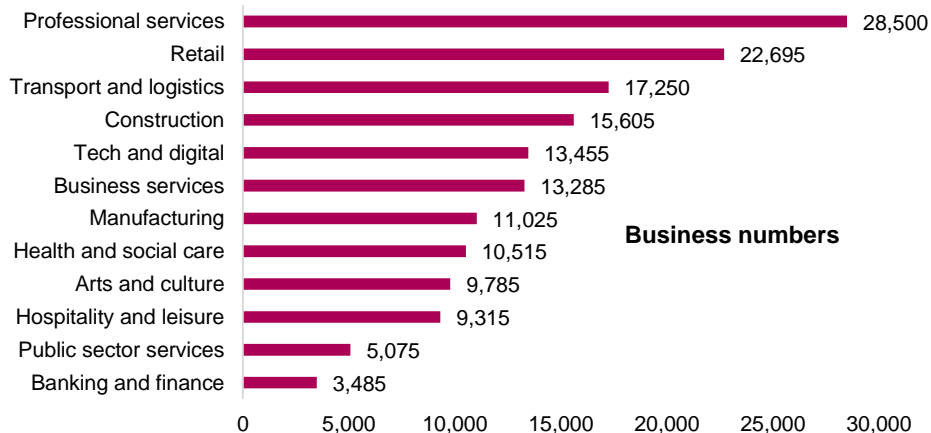
Looking at the structure of the tech and digital sector in more detail

- Nearly 11,000 (more than three quarters) are in the tech B2B sub-sector comprising activities such as provision of hardware, infrastructure, networks, systems, software and services relating to, for example, cyber security and the Internet of Things.

- More than 2,400, meanwhile, (nearly 20%) are in creative services such as design and publishing

- A further 600 are in digital media (e.g. TV or music production, TV broadcasting and games design and development)
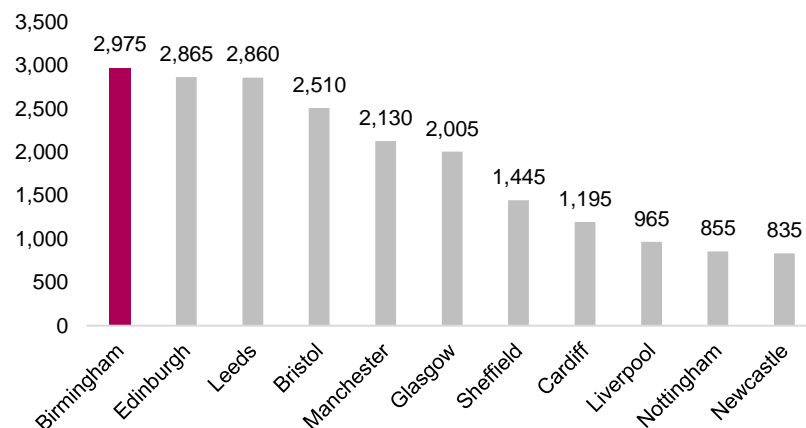
Birmingham is the UK's premier tech and digital centre outside London

Birmingham is identified as one of a number of tech and digital clusters across the UK with a concentration of talent and networks which are accelerating the growth of businesses. Indeed it is the UK's premier centre for tech and digital outside London with just under 3,000 tech and digital firms based in the city, well above nearest rivals Edinburgh and Leeds.

Key sectors in the WMCA economy in 2016[2]

Sector	Business numbers
Professional services	28,500
Retail	22,695
Transport and logistics	17,250
Construction	15,605
Tech and digital	13,455
Business services	13,285
Manufacturing	11,025
Health and social care	10,515
Arts and culture	9,785
Hospitality and leisure	9,315
Public sector services	5,075
Banking and finance	3,485

Business numbers

Number of tech and digital firms in UK cities outside London in 2016[2]

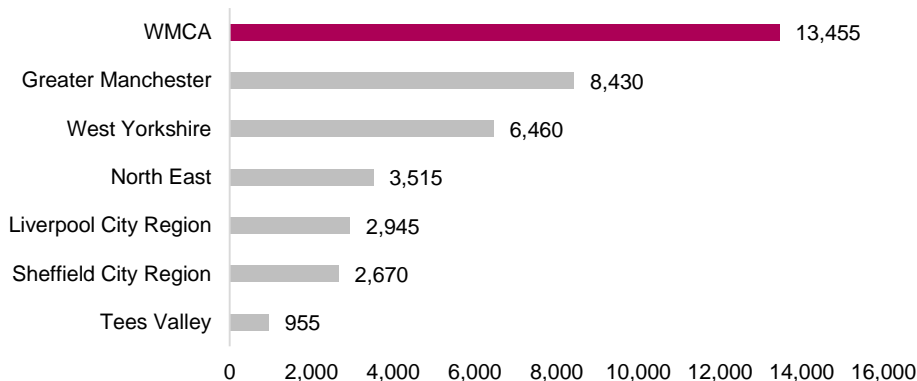| City	Firms
Birmingham	2,975
Edinburgh	2,865
Leeds	2,860
Bristol	2,510
Manchester	2,130
Glasgow	2,005
Sheffield	1,445
Cardiff	1,195
Liverpool	965
Nottingham	855
Newcastle	835

The economic importance of the sector

The WMCA has more tech and digital businesses than any other combined authority

While more than 20% of the WMCA area's tech and digital businesses are based in Birmingham, there are also significant numbers in Warwick (more than 1,000) Solihull (more than 900), Stratford-on-Avon (nearly 700), Wolverhampton (nearly 600) and Telford (nearly 500). Indeed the WMCA area is home to more tech and digital businesses than any other combined authority area in the country, with 60% more than its nearest rival Greater Manchester.

Total number of Tech & Digital Sector businesses in each Combined Authority area in 2016[2]

Area	Businesses
WMCA	13,455
Greater Manchester	8,430
West Yorkshire	6,460
North East	3,515
Liverpool City Region	2,945
Sheffield City Region	2,670
Tees Valley	955

0   2,000   4,000   6,000   8,000   10,000   12,000   14,000   16,000

CASE STUDY: Digital Media Technologies

BCU's DMT lab specialises in the development of methods for creating, processing, analysing, evaluating and distributing digital media. There are applications, for example, in:

- Music production – BCU's Audio Processing Group specialises in the correlation of musical features with semantic terms to inform the development of intelligent music production systems and digital audio effects using DSP and Machine Learning techniques.

- Health and wellbeing – BCU's Digital Image Processing Group has developed novel 3D edge detection schemes for tumours and cancers within MRI and CT data which is being developed alongside Birmingham Children's Hospital.

- Augmented and Mixed Reality – BCU's DMT Lab have developed unique techniques for direct manipulation of virtual objects that have applications in education, healthcare, museums and events,

- Birmingham in Real Time – As part of the ERDF funded Innovation Engine project the DMT Lab are storing and visualising data from a multitude of sensors around Birmingham. For example sensors at traffic lights are used to provide average speed for traffic over the city or along defined routes; car-park sensors give real-time occupancy.
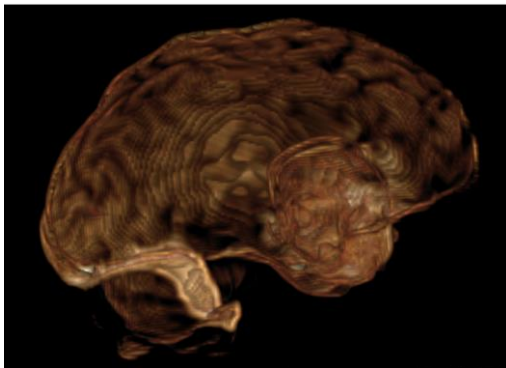
Employment in the WMCA

The tech and digital sector supports more than 70,000 jobs in the WMCA area

The tech and digital sector supports more than 70,000 jobs in the WMCA area. Of these 56,000 are in the tech B2B sub-sector, 4,500 are in digital media ad 9,500 are in creative services[3].

Local concentrations of employment

Tech and digital employment is concentrated in certain parts of the WMCA area. While Birmingham is by far the largest centre in terms of numbers jobs (more than 15,000), other key centres include Warwick (nearly 6,600 jobs – more than 8% of all jobs in the local area), Solihull (6,200 jobs - nearly 6% of the total), Coventry (nearly 6,000 jobs – nearly 4% of the total), Telford (nearly 5,000 jobs – more than 6% of the total) Stratford-on-Avon (nearly 2,600 jobs – 4% of the total). While employing fewer people, meanwhile, tech and digital also accounts for more than 5% of all jobs in Redditch, Bromsgrove and Tamworth.
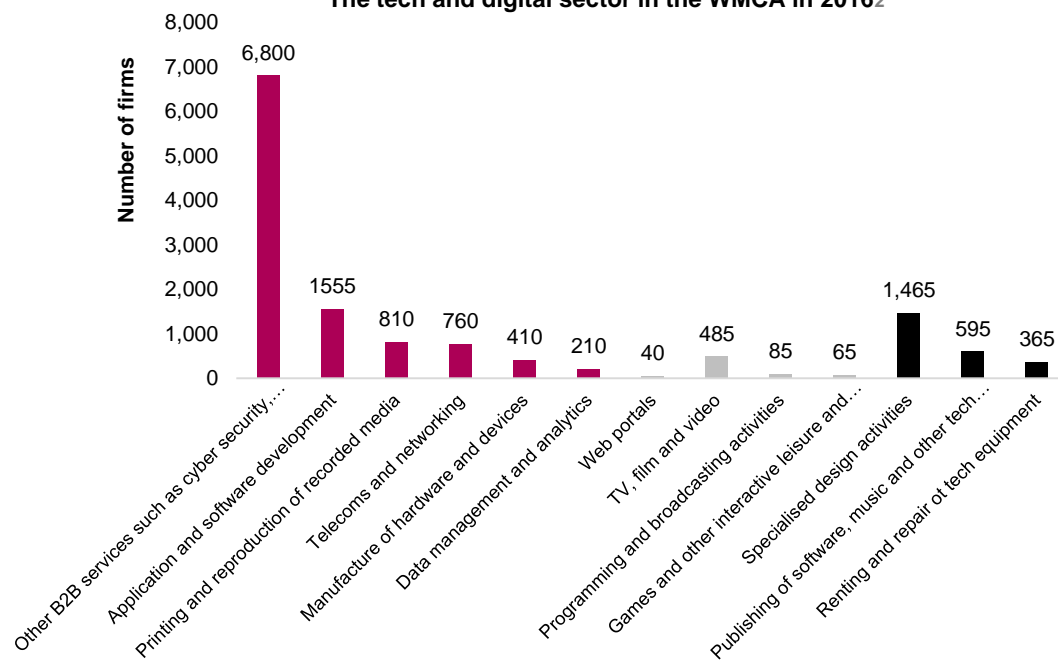
At a more detailed sub-sector and industry level, meanwhile, there are specific hot spots of activity in particular locations across the WMCA area – for example:

- Hardware and devices – Cannock, Redditch, North Warwickshire, Tamworth
- Apps and software – Telford, Solihull
- Telecoms and networking – Solihull, Stratford-on-Avon, Warwick
- Services relating to, for example, cyber security and the Internet of Things – Redditch, Telford, Solihull, Tamworth
- Data management and analytics – Warwick, North Warwickshire
- Games design and development – Warwick, Stratford-on-Avon (both areas are key national centres for the industry, with a share of total employment some 12 times the national average)
- Design and publishing - Stratford-on-Avon, Warwick, Bromsgrove, Tamworth
- Digital media – Rugby, Solihull

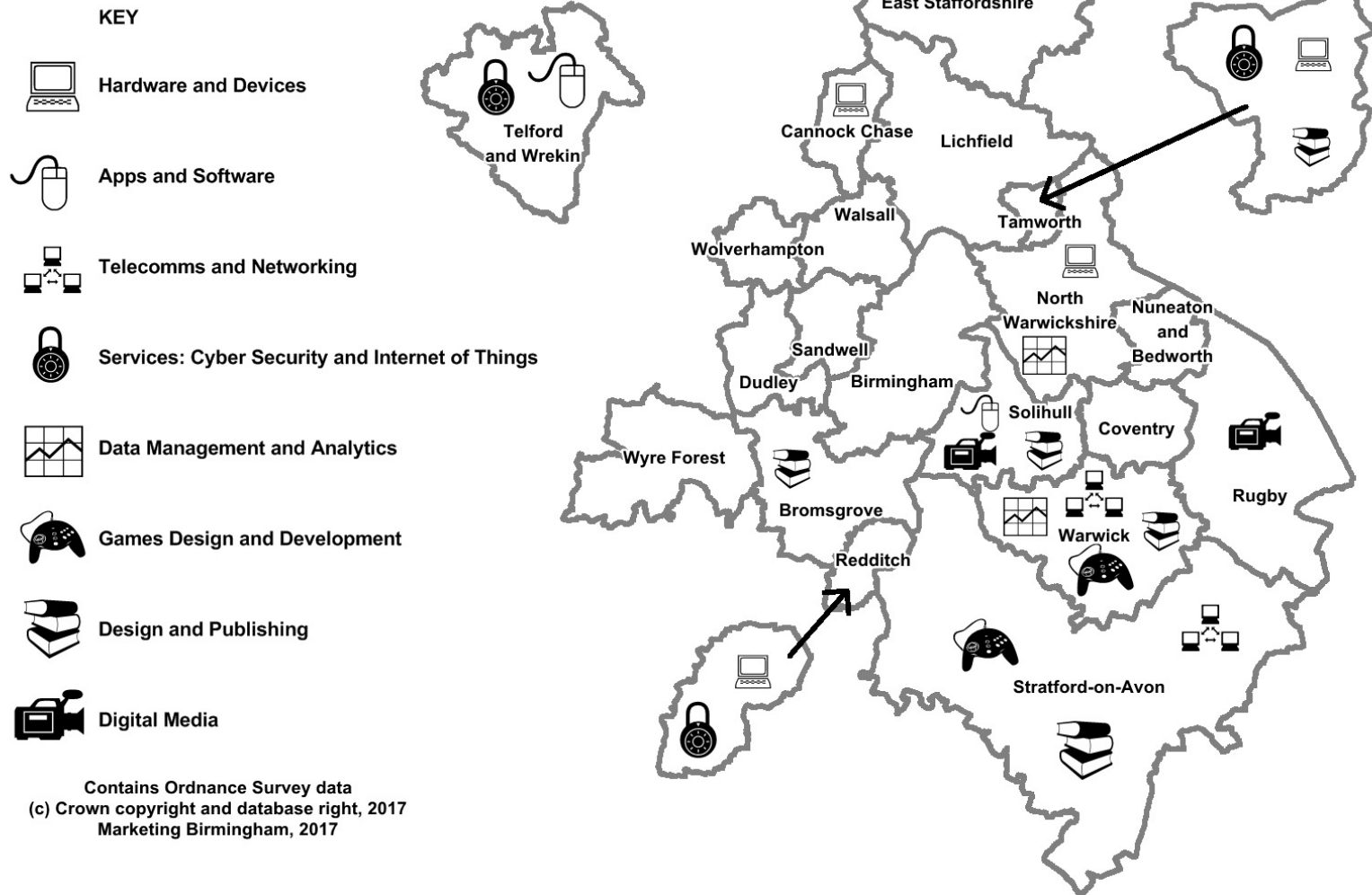**Tech and digital employment by local authority area in 2015[3]**

	Total employment	Proportion of total for all sectors
Birmingham	15,010	3.1%
Warwick	6,567	8.1%
Solihull	6,200	5.6%
Coventry	5,984	3.9%
Telford & Wrekin	4,945	6.1%
Wolverhampton	3,043	3.0%
Shropshire	3,019	2.6%
Stratford-upon-Avon	2,596	4.0%
Dudley	2,358	2.1%
Herefordshire	2,138	3.0%
Rugby	2,103	4.7%
Redditch	2,092	5.5%
Bromsgrove	2,079	5.7%
Walsall	1,823	1.8%
Sandwell	1,757	1.3%
Tamworth	1,512	5.0%

The tech and digital sector in the WMCA in 2016[2]

Hotspots of activity

Local concentrations of Tech and Digital Sector employment

KEY

Hardware and Devices

Apps and Software

Telecomms and Networking

Services: Cyber Security and Internet of Things

Data Management and Analytics

Games Design and Development

Design and Publishing

Digital Media

Contains Ordnance Survey data
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Marketing Birmingham, 2017

Workforce skills

The sector is a key source of highly skilled and well paid jobs
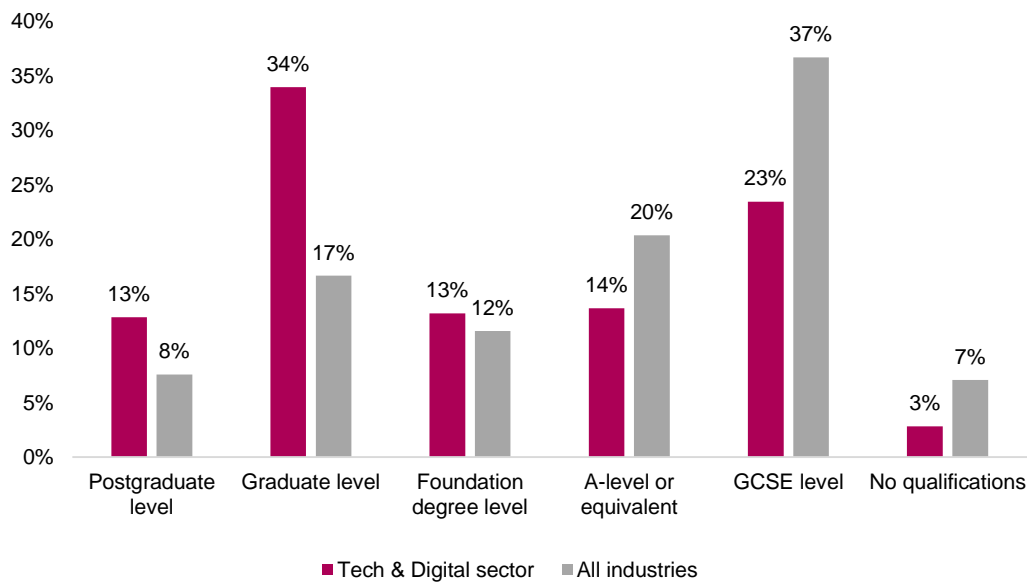
A particularly high proportion of tech and digital workers in the WMCA area are in highly skilled, highly paid jobs. For example[4]:

- 55% are in highly skilled professional and technical occupations (compared with 26% across all sectors)

- 34% of roles in the sector require a degree and a further 13% require a post graduate qualification (compared with 17% and 8% respectively across all sectors)

- National level research, meanwhile, indicates that tech and digital salaries are 36% above the national average and have grown 19% faster than the average over the last 3 years.

Current skills demand

Latest data on advertised job vacancies in the tech and digital sector across the WMCA area[5] reveals that, as at national level, specialist technical staff are particularly sought after – notably (i) software and web developers, business analysts, architects and systems designers and (ii) people with expertise in specific applications such as SQL, .NET, C#, PHP, ASP and Vb.

Workforce profile by qualification level in 2016[4]

	Tech & Digital sector	All industries
Postgraduate level	13%	8%
Graduate level	34%	17%
Foundation degree level	13%	12%
A-level or equivalent	14%	20%
GCSE level	23%	37%
No qualifications	3%	7%

Vacancies in the WMCA area in 2016: top job roles[5]
Software Developer
Web Developer
.Net Developer
Software Development Engineer
PHP Developer
Asp .Net Developer
C# Developer
Sql Developer
Vb .Net Developer
IT Project Manager
Systems Analyst
Cnc Programmer
Front End Developer
Data Analyst
Information Technology Manager
Java Software Developer
Php Web Developer
Sql Server Developer
Crm Developer
Sql Database Developer

PHP Developer – specific kind of software engineer who creates websites, applications and programmes using PHP

Asp. Net Developer – developer that uses Microsoft's open-source server-wide web application framework

C# Developer – C# is a general purpose, object orientated programming language designed for the Common Language Infrastructure

Sql Developer – developer who uses Sql to work with databases

Vb. Net Developer – Vb. is a general purpose, object orientated programming language designed for the Common Language Infrastructure

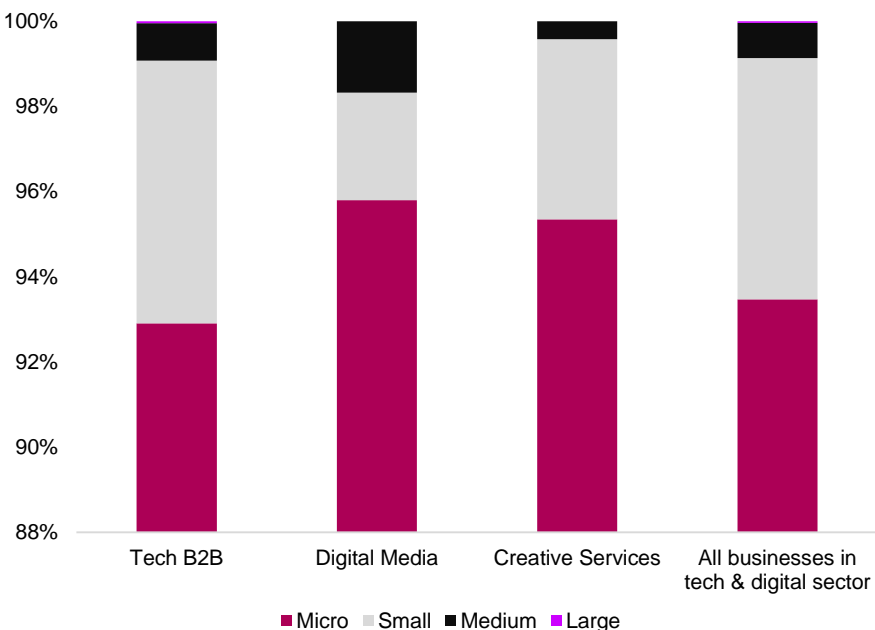**Cnc Programmer** – numerical tool and process control programmer

Importance of small & micro businesses

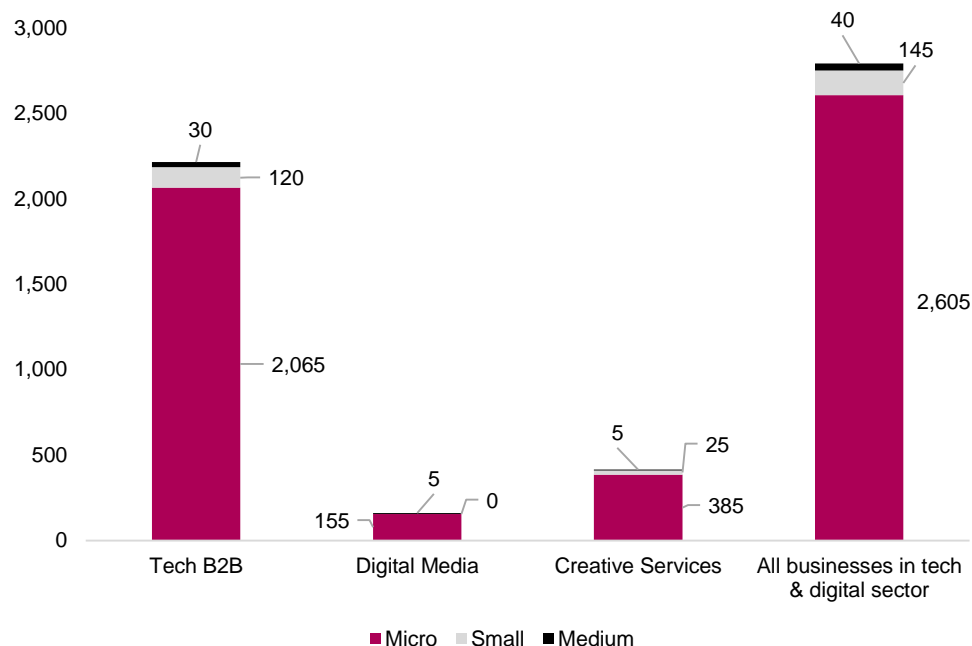**The importance of small and micro businesses**

The vast majority of tech and digital firms are micro businesses employing less than 10 people. Across the WMCA area 12,400 (94%) are in this category, rising to 95% in creative services and 96% in digital media. Only the tech B2B subsector has any larger firms employing more than 250 people.

And business growth is also being driven by micro businesses, which account for 2,600 (94%) of the growth in tech and digital business numbers since 2011. The proportion rises to 97% for digital media.

Tech and digital businesses by size in 2016 in the WMCA[2]

Legend: ■ Micro ■ Small ■ Medium ■ Large

Growth in business numbers in the WMCA by size 2011-2016[2]

Tech B2B: 30, 120, 2,065
Digital Media: 5, 0, 155
Creative Services: 5, 25, 385
All businesses in tech & digital sector: 40, 145, 2,605

Legend: ■ Micro ■ Small ■ Medium

WMCA performance & future prospects

Growth trends

Growth in tech and digital business numbers 2011-2016[2]

Manchester	54%
London	47%
Edinburgh	40%
Birmingham	38%
Liverpool	36%
Cardiff	35%
Glasgow	33%
Newcastle	31%
Bristol	31%
Leeds	31%
Sheffield	26%
Nottingham	25%
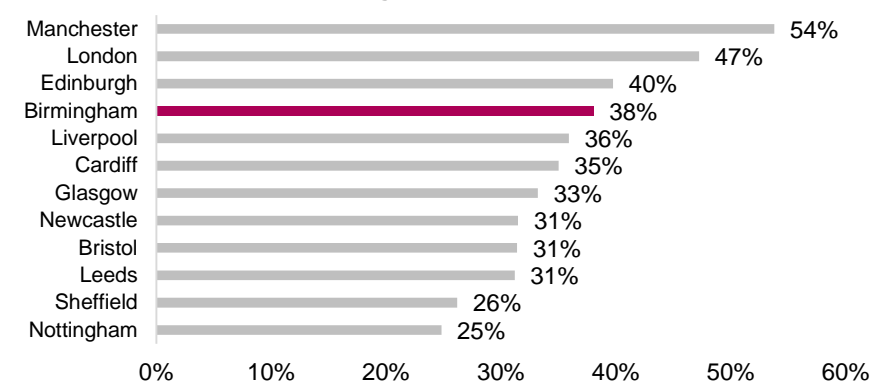
Growth in tech and digital business numbers 2011-2016: top performing local authorities[2]

Local authority	Growth
Coventry	47%
Birmingham	38%
Solihull	37%
Cannock Chase	32%
Sandwell	32%
Telford and Wrekin	29%
Walsall	29%
Rugby	27%
Wolverhampton	26%
Warwick	23%
Stratford-on-Avon	22%
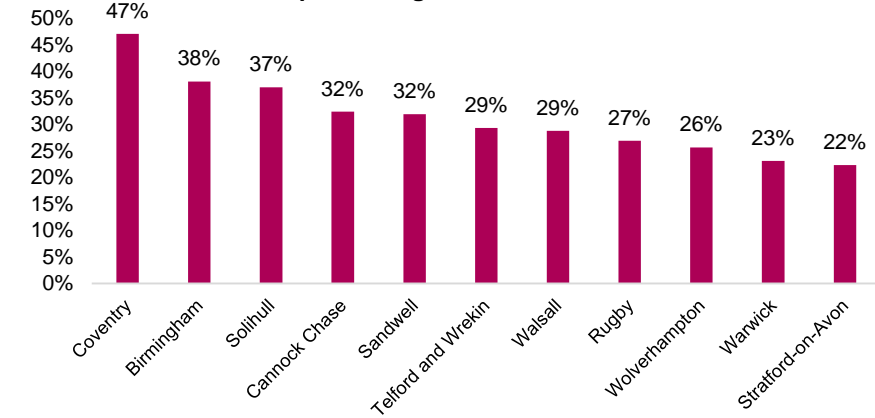
Growth in tech and digital business numbers in the WMCA 2011-2016[2]

Sub-sector	Number
Tech B2B	2,260
Digital media	165
Creative services	355
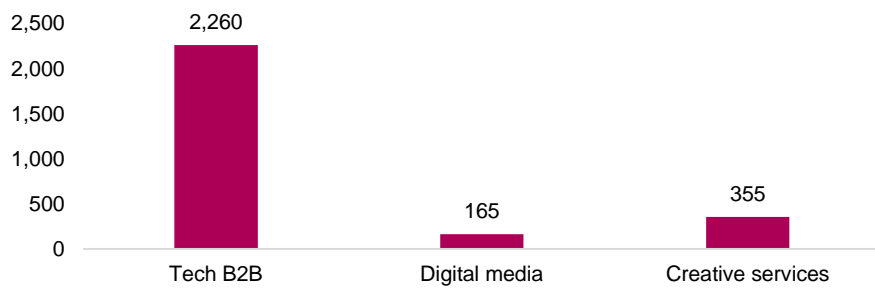
By local authority[2]

In 2016 there were nearly 3,000 more tech and digital firms based in the WMCA area than there were in 2011 (growth of 26%). While this rate of growth is below the UK figure of 31%, it was much stronger in certain parts of the West Midlands.

For example the number of tech and digital businesses based in Birmingham has risen by 38% over the last 5 years. Of the major UK cities only London, Edinburgh and Manchester saw stronger rates of growth.

In absolute terms there were more than 800 more tech and digital firms based in Birmingham in 2016 than there were in 2011 – the biggest increase of any UK city outside London.

Across the WMCA area there was also particularly strong growth in business numbers in some of the other key centres for the sector identified earlier – notably Coventry (47%) and Solihull (37%). There was also growth of more than 30% in business numbers in Cannock and Sandwell, growth of more than 25% in Telford, Walsall, Rugby and Wolverhampton and growth of more than 20% in Warwick and Stratford-on-Avon.

By sub-sector[2]

Nearly 2,300 (more than 80%) of the new firms created between 2011 and 2016 were in Tech B2B. Of these more than 1,800 were providers of services relating to, for example, cyber security and the Internet of Things, nearly 600 were in app and software development and more than 100 were in telecoms and networking.

While less than 200, meanwhile, were in digital media this represents growth of some 35%. More than 100 were in TV, film and music production and more than 30 were in games design and development. More than 350 were in creative services with more than 250 in specialised design services.

Inward investment projects attracted to the WMCA

Projects attracted to the WMCA area[20]

The WMCA area, and Birmingham in particular, which has a particularly strong proposition for tech and digital investors, has attracted numerous projects in recent years.

Since 2010 72 tech and digital inward investment projects have been landed in the area. Numbers have fluctuated year on year, with particularly significant numbers in 2012-2013 (17), 2013-2014 (21), and 2014-2015 (18).

Investment in Tech B2B activities has dominated, with 46 projects (nearly two thirds) in businesses providing software and other tech products and services to key sectors such as automotive, aerospace and other areas of advanced manufacturing, transport and logistics, specific applications such as e-commerce, product development, resource planning, marketing, cyber security and risk management and provision of broadband and other network services.

There have also been 18 investments in digital media (for example in TV or music production, TV broadcasting and games design and development) and a further 9 in creative services (for example software publishing and distribution).

Jobs created[20]

This investment has created more than 1,700 new jobs in tech and digital since 2010. Numbers have grown strongly year on year with nearly 600 created in 2014-2015 and nearly 650 created in 2015-2016.

Nearly 1,300 (nearly 80%) were in Tech B2B. While the majority of investment has been in SMEs and micro businesses, larger investments have included:

*   The investment by broadband provider Virgin Media based in its Birmingham base, creating 400 new jobs

*   The investment by South Africa based Vista Equity Partners in Birmingham based Advanced Computer Software creating 400 new jobs

A further 300 (12%) were in digital media. Key investments have included the expansion of the BBC's Birmingham studios with the creation of 80 new jobs.

More than 370 (15%) were in creative services. Key investments have included the expansion of Swedish owned, on-line technical guide producer Semcon's Warwickshire facility creating 60 new jobs.

Inward investment projects landed in the WMCA in the last 5 years[20]
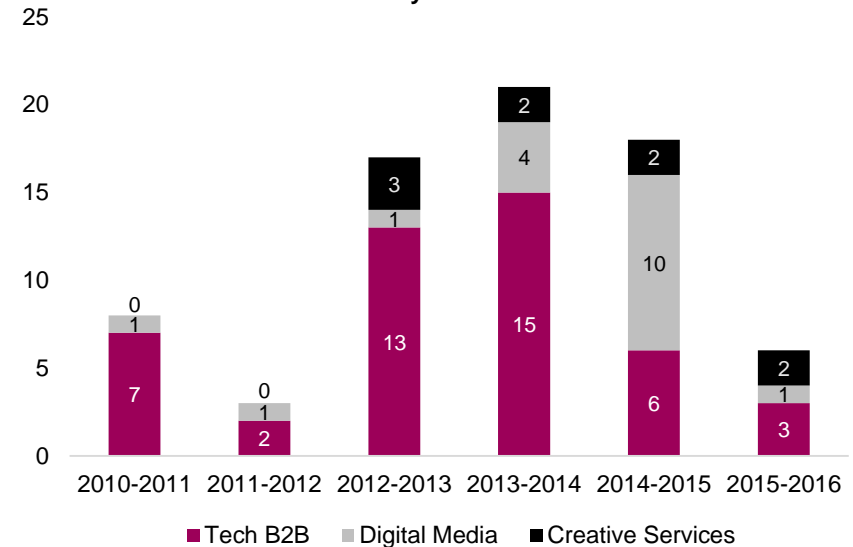
New jobs created by inward investment in the WMCA in the last 5 years[20]
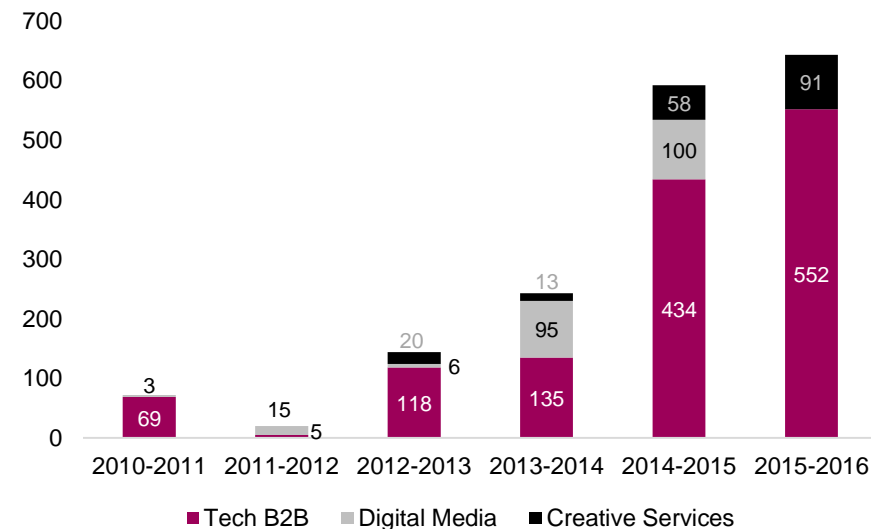
Inward investment projects attracted to the WMCA

Source markets

30% of inward investment projects in the WMCA have been by US based investors. Of these nearly half, and significant numbers of Tech B2B investors, are based in California. Other key overseas source markets include France, Italy and Ireland within Europe and India, Japan and Australia further afield.

Nearly 30% of tech and digital projects since 2010 have originated in the UK. With the exceptions of the BBC and Black Tape Studios examples quoted above, they have tended to be investments in new facilities in the region which, initially at least, employ only a handful of staff.
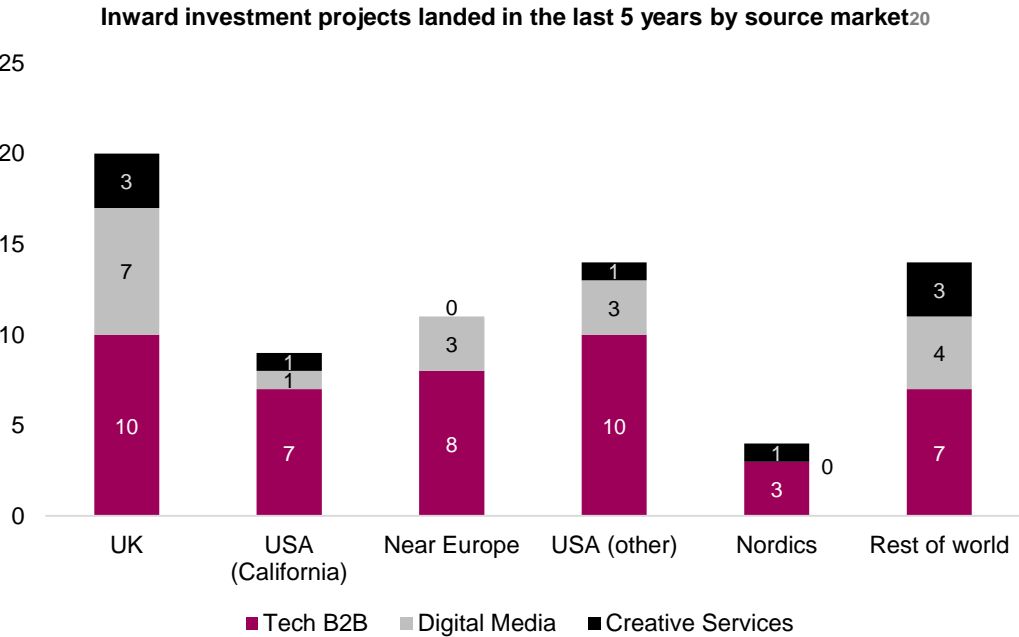
Where projects have landed across the area

Tech and digital inward investment has been concentrated in certain parts of the area. Nearly 70% of projects, and all of the UK based investments, have landed in Birmingham. A further 20% have landed in Solihull, while the remainder are in Coventry, Warwickshire, Lichfield, Telford and Wolverhampton.

Types of projects attracted

More than 40 (more than 60%) of projects landed since 2010 were new investments. A further 24% were expansions and 13% were acquisitions. However, as mentioned earlier, new investments tend to employ, at least at the outset, only a handful of people. Overall they created less than 300 jobs compared to nearly 1,200 for expansions.

However while tech and digital businesses attracted to the WMCA tend to be relatively small, they tend to have potential for rapid growth thereafter, in turn building the cluster's critical mass and attracting additional inward investors. At the same time, however, a funding gap has emerged which threatens to constrain their potential for growth. More than three quarters of UK series A, B and C funding for the development of new products, accessing new markets and recruiting new skills and talent was secured by London based tech businesses in 2016, and as a result some tech businesses being are forced to move south in order to access the funding they need to expand[1].

Inward investment projects landed in the last 5 years by source market[20]

Chart data (Tech B2B / Digital Media / Creative Services):
- UK: Tech B2B 10, Digital Media 7, Creative Services 3
- USA (California): Tech B2B 7, Digital Media 1, Creative Services 1
- Near Europe: Tech B2B 8, Digital Media 3, Creative Services 0
- USA (other): Tech B2B 10, Digital Media 3, Creative Services 1
- Nordics: Tech B2B 3, Digital Media 0, Creative Services 1
- Rest of world: Tech B2B 7, Digital Media 4, Creative Services 3

■ Tech B2B ■ Digital Media ■ Creative Services

Future prospects

Strong growth in GVA and employment is forecast over the next decade

The rapid pace of innovation, substantial market opportunities and significant potential for the attraction of further inward investment is expected to underpin further strong growth in the sector in the next decade[21]:

- Over the 2015-2025 period we forecast that the gross value added generated by tech and digital in the WMCA area will rise by £1.3 billion (20% or 2% per annum) from £5.7 billion to £7 billion, with the potential to rise to £7.9 billion.

- We forecast that employment in the Tech and Digital sectors across the WMCA will rise by almost 14,000 by 2025 - to just under 84,000 employees. In addition, 27,000 employment opportunities will arise due to staff turnover effects (replacement demand).

WMCA tech and digital sector GVA and employment forecast
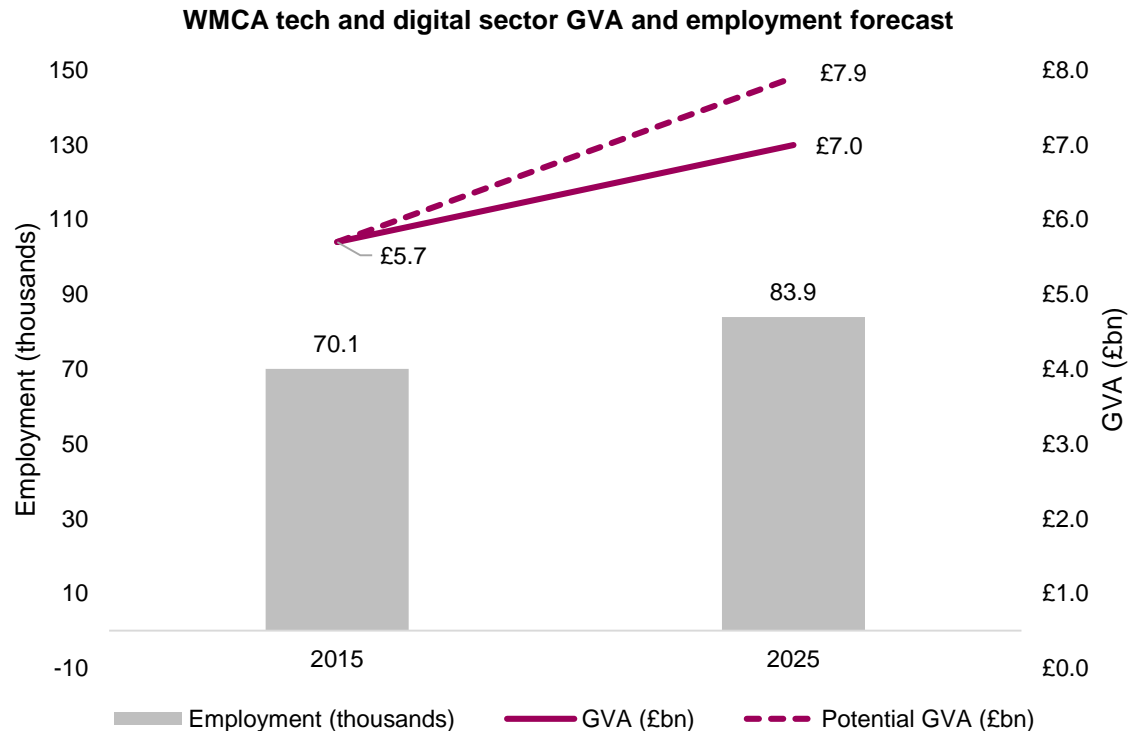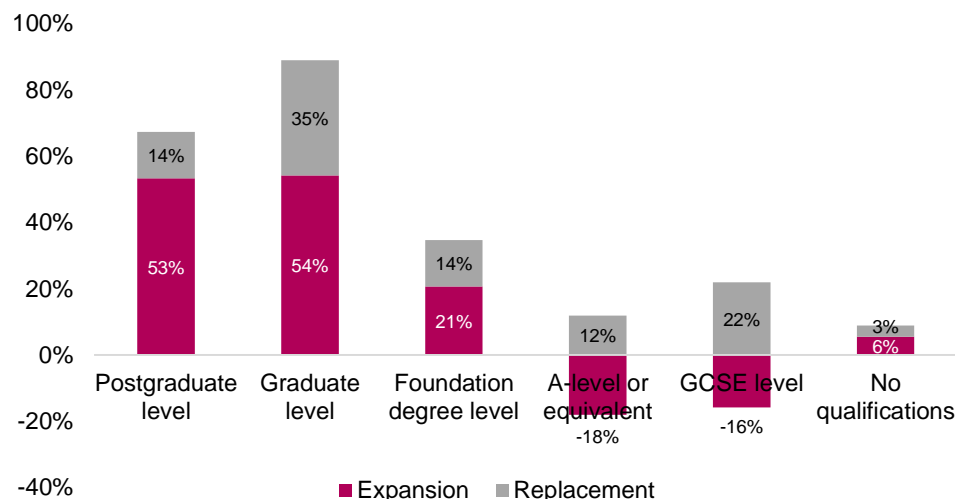
Employment Forecast

These jobs will be predominantly in higher skilled, well paid roles:

- 62% will be in professional occupations and a further 29% will be in associate professional and technical roles

- 54% will be in roles requiring a degree and a further 53% will be in roles requiring a higher degree, whereas roles requiring GCSE level or A-level equivalent qualifications which will decrease by 34%

Indeed the rapid pace of innovation and change in the tech and digital sector will lead to growing demand for staff in specific roles such as, for example:

- DevOps engineers with expertise both as a developer and in operations
- IoT architects
- UX designers to maximise the user friendliness of new apps
- Data scientists with expertise in data analytics and specific areas such as machine learning
- Blockchain engineers and developers to help facilitate the further penetration of this technology into financial services

Employment forecast for the Tech & Digital sector by qualification level, 2015-2025

Postgraduate level: Expansion 53%, Replacement 14%
Graduate level: Expansion 54%, Replacement 35%
Foundation degree level: Expansion 21%, Replacement 14%
A-level or equivalent: Expansion -18%, Replacement 12%
GCSE level: Expansion -16%, Replacement 22%
No qualifications: Expansion 6%, Replacement 3%

■ Expansion   ■ Replacement

Employment forecast for the Tech & Digital sector by occupation type, 2015-2025

Elementary staff: Replacement 2%, Expansion 1%
Machine operatives: Replacement 1%, Expansion 0%
Sales and customer services staff: Replacement 5%, Expansion 5%
Caring, leisure & other services staff: Replacement 7%, Expansion 10%
Skilled trades occupations: Replacement 6%, Expansion -6%
Administrative/clerical staff: Replacement 14%, Expansion 12%
Associate professionals: Replacement 14%, Expansion 17%
Professionals: Replacement 37%, Expansion 46%
Managers: Replacement 14%, Expansion 16%

■ Replacement   ■ Expansion

Drivers of growth

Innovation

Innovation

While the innovative use of digital technologies disrupts existing business models and value chains, it also has tremendous potential to create value and boost competitiveness and productivity and tech and digital firms are clustering around key innovations to exploit their potential. For example:

Cyber Security

The need to upgrade cyber security is a key driver of investment and innovation in the sector. As private, public and civil institutions become more and more digitised and dependent on information systems they become more vulnerable to attach by cyber criminals.

Despite the considerable investment which has taken place in recent years, it is suggested that cyber attacks could slow the pace of global technology and business innovation by as much as $3 trillion annually via, for example, delays in improvements in mobile functionality and the uptake of cloud services. The General Data Protection Regulation (GDPR), meanwhile, which becomes law across Europe and the UK in May 2018, means that businesses on all levels will have to increase their focus on cyber security [6,23].

Data Analytics

Data Analytics such as scenario planning and predictive modelling are increasingly being adopted by businesses to inform strategy and performance. In fintech, for example (i) structured and unstructured customer data is being used to help make better credit risk decisions, monitor portfolios, detect financial crime, and predict operational losses, (ii) machine learning is being used to improve the accuracy of risk models by identifying complex, nonlinear patterns in large data sets.

Acquiring the right mix of talent is vital to facilitate these developments. In particular data scientists with advanced mathematical and statistical knowledge are needed to convert data insights into business actions. In turn this is changing the occupational and skills profile of the workforce, with staff in these functions likely to account for nearly half of the workforce in a decade's time compared to 10% to 15% now [6,22,23].

CASE STUDY: Cyber Security

BCU's Centre for Cyber Security is a fusion of complementary expertise focusing on end to end security in areas such as Internet of Things, open Application Programming Interfaces (APIs), digital identities, software defined networks and data platforms. Key projects include:

- Cyber Threat Sharing - a recently awarded Horizon 2020 project, RED-Alert, involving sixteen European partners collaborating on the development of new software components for analysing data from social media channels and using AI methods to identify cyber threats and share actionable information with partners.
- Securing Software Defined Networks- in collaboration with Mega Nexus to provide secure connections for partnerships across disciplines and including government departments.
- Building in security, privacy and resilience by design- in collaboration with BT.
- Securing IoT home appliances- with LightwaveRF to construct a threat model for end to end IoT applications from sensors to hub, router, platform, and the controlling mobile app.
- Securing APIs for digital health- in collaboration with Comp-Bio-Med, EU funded Centre of Excellence in Computational Biomedicine, and TM Forum digital health projects. Our contribution focus on building in appropriate security and privacy protections for sensitive data in Open APIs.

Innovation

Other key innovations in the industry include:

- 5-D BIM (Building Information Modelling) allows construction designers and contractors to manage spatial design, critical cost and scheduling while identifying and mitigating risks before costly problems arise[6].

- Cloud-based Digital Collaboration & Mobility facilitates real-time sharing of project data, and digitises workflows, informing data and ROI-driven decisions, better and more predictable project outcomes and trust, transparency and accountability across project teams

- The Internet-of-Things (IoT) allows equipment and assets to 'talk' to one another via wireless technology and then be transmitted back to a collaboration platform, monitoring productivity, quality control, safety and inventory and in turn improving project efficiency, timelines and risk management

- In financial services blockchain technology, a public digital ledger shared among a network of computers worldwide, offers secure, fast and efficient transactions – doing away with cumbersome and expensive paper trails. Robo-advice, meanwhile, is an automated process of offering financial advice via computer, tablet or smartphone.

- Digital care services can both reduce cost and raise quality, helping tailor solutions to individual needs[7].

- Smart grid technologies can more effectively manage the demand and supply of energy and water[8].

- The use of data and technology inform the development of new markets for waste products and bring efficiencies and scale to the segregation and utilisation of waste as a resource

- 3D visualisations of city infrastructure can be used to map underground Assets and reduce unnecessary road works, where excavations are repeatedly dug in the same location by different utility firms.

- Open data can be used to guide and future proof city planning and design – in London, for example, the London Datastore has engaged London's developer community and resulted in numerous apps that help the city to function better.

CASE STUDY: Knowledge Based Engineering

Based on its extensive experience of working with industry nationally and internationally, BCU's School of Engineering & the Built Environment has developed the UK's first dedicated Knowledge Based Engineering Lab.

Its Advanced Manufacturing and Materials research and development group works closely with businesses servicing the automotive, aerospace, electronics, food and drink and nuclear sectors in areas such as Rapid Prototyping, 3D scanning, CMM, high speed CNC milling and machining, industry standard CAD/CAM and advanced materials testing and development.

Key projects include:

- Co-locating with the High Speed Sustainable Manufacturing Institute collaborating with organisations such as Meridian, the world's largest producer of magnesium components, to explore the use of alternative materials to develop light weight vehicles and reduce production costs, fuel consumption and environmental impact. BCU has an unique partnership agreement with Meridian.

- The Insight Project in which BCU is working in collaboration with Westfield Sportscars Ltd, Heathrow Enterprises Ltd and other partners to develop and test autonomous vehicles which aim to cut congestion, lower emissions and improve transport access for people that are blind, visually impaired or have problems with mobility.

Innovation in practice

CASE STUDY: Built Environment

BCU's Integrated Design and Construction and Resilient Environment Centres are at the cutting edge of built environment practice, focusing on smart and natural cities, Building Information Modelling (BIM) and the use of Big Data to transform the industry's use of new technology and address issues in climate change and sustainability.

Key projects include:

- Automation in construction where the use of BIM is facilitating better informed design, cost and time savings, the reduction of off-site manufacture problems and closer adherence to completion and quality targets.

- The Facilities Management Framework (BCU is working with architects Wilmott Dixon) where smart sensors in service systems are being developed to detect and provide early warning of airborne elements and particles – providing operational efficiencies and potentially saving lives

- Funded by the RCUK and Innovate UK we are working in collaboration with the main universities in the region and Birmingham City Council on the Urban Living Birmingham project to address the major challenges facing the UK's second largest city. The work adopts an interdisciplinary, diagnostic and integrated approach comprising the co-design of innovative solutions to address the environmental, health, transport and energy challenges facing the city.

- Acting as a test bed for 'Clean Space', an i-phone App and Bluetooth device developed by Drayson technologies which measures carbon monoxide levels in cities (BCU is working with Drayson Technologies, which has developed the App and is a global leader in the development of applications for the Internet of Things in healthcare).

CASE STUDY: Digital Transformation and Data-Driven Innovations

Computing research at BCU's School of Computing and Digital Technology has a strong reputation of being collaborative, multi-disciplinary, impactful and underpinned by excellent science. So, not surprisingly, one of its collaborative computing research project was chosen by the British Computer Society and the Council of Computer Science professors in 2015 as one of the top impactful showcases in UK computer science research for the past twenty-five years. Applications of current research focus on enabling technologies for smart city applications, data platforms, IoTs, digital government, and digital transformation. These are underpinned by a wealth of cutting-edge expertise in areas vital to the new digital economy such as Agile Software Development, User-centric Design, Open Source Software, Data Analytics, Cyber Security, Digital Forensic, Communicating Systems, Cloud Computing and Computer Games. Key projects include:

- Big Data Corridor - a £2.2M EU funded project in partnership with Birmingham City Council, Innovation Birmingham, Aston University, Enable Id, Centro and Telensa to accelerate smart city innovations and regional business growth through the exploitation of new data streams, Internet of Things, associated technologies and digital transformation. BCU provides a platform that supports companies to tap the opportunities for developing new data-driven products, services, tools, insights and innovations.

- Birmingham Data platform –a single focal point for West Midlands regional data being developed in collaboration with Digital Catapult, local councils and regional organisations. The platform's data feed into the Big Data Corridor project to support long-term sustainable digital innovations. The analysis of accumulated data from multiple sources in the platform supports evidence-based deeper understanding of the challenges facing cities and allows policymakers, businesses and communities to co-create effective solutions.

- Digital Transformation - in collaboration with world leading UK Government Digital Services, international governments, public and private organisations. The project promotes wider adoption of citizen-centric open digital services co-created by innovative regional digital companies through customization of collaborative Open Source software and an agile process of iterative improvements based on citizen's passive and active feedback. The approach promotes openness, transparency and sustainability in government and supports the regional digital economy.

Emerging markets

Tech and digital firms have an opportunity to exploit a new wave of growth with an acceleration of technology adoption and digital media consumption in emerging markets. In particular key markets include[9]:

- <u>China</u>, which has a population of some 534 million people aged between 15 and 39 and a projected annual GDP growth rate of 7% over the next few years. Growing internet penetration has driven a tremendous surge in the adoption of digital content — the number of internet users increased from 457 million in 2013 to 618 million in 2016, reaching 46% of the total population. Half of these users are shopping online, growing the market at some 19% per annum, and in three years China has added 3.5 times as many digital video viewers as the US.

- <u>India</u>, another powerhouse among emerging markets. By 2020, with a population with an average age of just 29, India will be the world's youngest country. The Indian market is particularly open to foreign content and investment, India currently ranks 4th for content consumption; has the largest box office attendance of all the emerging markets, has 160 million pay - TV households and publishes 94,000 newspapers. While digital content consumption is tempered by low smartphone and broadband penetration, a surge in broadband adoption is taking place with the rollout of 4G services.

- <u>Russia</u>, which has a large urban population and strong consumer spending (the country is the 4th ranked emerging market in terms of per capita consumer spending). With 87% broadband and 50% smartphone penetration, Russia is a digitally active market. Media consumption is also high, both across traditional and digital media.

- <u>Mexico</u> which has the highest per capita consumer spending among the emerging markets. It has a business-friendly environment and Mexicans are avid consumers of traditional media watching nearly 6 hours of TV a day, the 3rd highest among emerging markets.

Demand is being driven by[10]:

- <u>Demographics</u> – 25% of consumers in emerging markets are aged under 14, compared to 16% in developed markets

- <u>Broadband penetration </u>- China now has more than 500 million wireless broadband connections and India has more than 300 million – with some 2 billion across all emerging markets

- <u>Smartphone adoption </u>- in the last 4 years there has been a 200% growth in smartphone shipments to emerging markets such as India, Indonesia and Russia

- <u>Disposable income </u>– there are 268 million households in BRIC countries with an income of more than $10,000 – more than the US and the Eurozone combined

Inward investment

The attraction of tech and digital inward investment has been a key driver of growth in the tech and digital sector. The UK has been the number one destination in Europe for inward investment for a number of years and the West Midlands has been one of the most successful regions.

Commissioned research indicates that, while the first step for investors may be to establish a virtual presence with a serviced office address with a handful of sales staff, many go in to establish a UK or European HQ with operational support roles such finance, IT and operations and R&D, manufacturing and distribution facilities[11].

A decision to relocate or expand into a new location is never taken lightly as it is (i) a huge business risk, (ii) can be disruptive and expensive and (iii) there is only a return on investment in the medium and longer term.

There are a number of key triggers, however, which increase propensity to invest and make particular destinations an attractive proposition[11] – for example:

- Access to skills and talent from junior to director level

- Market access – notably to European, UK, regional or local markets

- Specific sector strengths – with existing supply-chains and like-minded firms and local universities with strong R&D credentials and talent pipelines

- Transport Connectivity – good road and rail access to major centres and markets and close proximity to international airports

- Business/lifestyle environment - buzzing, multilingual, cosmopolitan business centres with established clusters of international investors (global brands and SMEs)

- Strong support networks – destinations which offer a strong brand profile, good networks of connections and intermediaries offering access to potential business opportunities, practical support with basics such as accounting, law, bank accounts, recruitment, sites and premises and products which help reduce risk such as financial incentives and soft landing zones

Analysis of activity across the UK in 2016 indicates that growth in inward investment is increasingly being driven by[11]:

SMEs and micro businesses, which accounted for more than three quarters of projects, and in particular:

- So called 'born globals' – which tend to be highly innovative and entrepreneurial - and aim from the outset to expand rapidly to gain leadership of specific niche markets

- So called 'going globals' – normally already strongly established in their domestic market and now seeking to expand internationally. The process is likely to be more organic and phased, with forms rolling out their products and services by setting up sales offices, using agents or partnering with other companies

The tech and digital sector, and in particular B2B activities such as:

- Software applications – for example for systems, graphics, communications, networking or security

- IT services – for example big data analytics, the internet of things, cyber security

Investment is emanating from a range of particular source markets. Some, like Silicon Valley in the USA, are now maturing after growing rapidly in recent years. Other emerging markets, with significant numbers of 'going globals' in particular, include Austin, Houston, Chicago, and Atlanta in the US, Toronto in Canada and London, Amsterdam and Copenhagen in Europe.

Skills issues

Access to the right skills and talent is vital to facilitate business growth. And, as highlighted above, skills can often be the number one factor for choice of location for tech and digital inward investment – with investors seeing a readily available talent pool as a key element of a 'tech friendly' community[12].

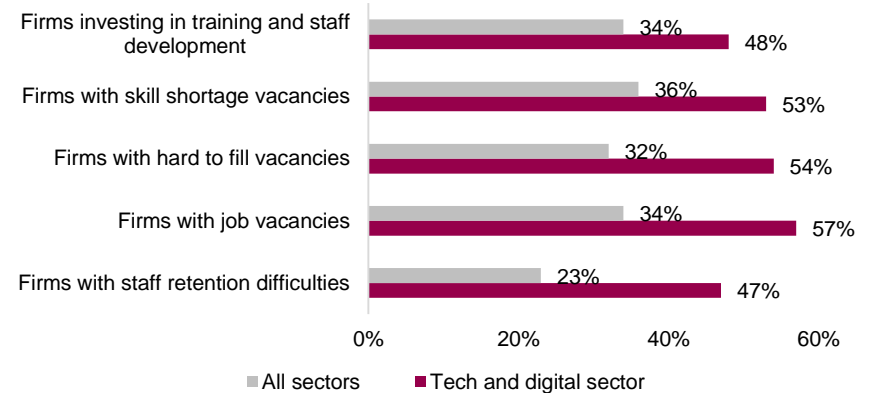**Emerging skills needs, skills gaps and shortages**

Looking forward, the UK tech and digital sector's particular strengths in emerging technologies such as the Internet of Things, wearable technologies, Big Data and Data Analytics, 5G and wireless technologies, robotics, autonomous vehicles, advanced manufacturing and building automation, for example[13], is leading to:

- Emerging demand for specialist technical skills in areas such as 3D printing, CAD, graphic design, Building Information Modelling (BIM), digital marketing and digital publishing[14].

- Specific shortages of critical technical skills and expertise in the labour market – which account for 85% of hard-to-fill vacancies in the sector, notably in areas such as Data Analytics, Big Data and Cloud Computing[15]. In 2015 57% of UK tech and digital firms had vacancies in higher skilled occupations compared to 34% across all sectors, of these 54% found these vacancies hard to fill (compared to 32% across all sectors) and 53% cited specific skill shortages as the reason for these hard to fill vacancies (compared to 36% across all sectors).

- Gaps and deficiencies in technical expertise relating to the latest developments among the existing workforce – which are adversely affecting the commercial performance of 93% of UK tech and digital firms - for example among data analysts, computer scientists and programme developers[16].

- 47% of UK tech and digital firms have staff retention problems compared to 23% across all sectors and 48%, compared 34% to across all sectors, are responding via investment in training and workforce development.
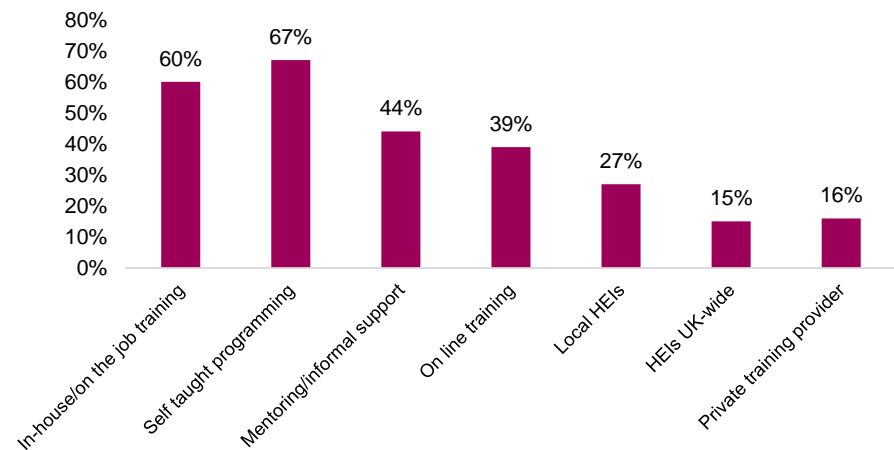
Which are a particular issue for SMEs and micro businesses

These are particularly critical issues for SMEs and micro businesses which, as mentioned earlier, make up the vast majority of the tech and digital sector. While larger tech companies have the resources recruit globally, collectively sourcing 16% of their talent from outside the EU, smaller firms are often constrained by immigration policies[17]. As a result additional job roles recently added to the tier 2 visa 'shortage occupation' list have included IT product manager, system engineer, data scientist and cyber-security specialist[18].

Labour market pressures in high skill occupations[4]

	All sectors	Tech and digital sector
Firms investing in training and staff development	34%	48%
Firms with skill shortage vacancies	36%	53%
Firms with hard to fill vacancies	32%	54%
Firms with job vacancies	34%	57%
Firms with staff retention difficulties	23%	47%

Approaches to workforce development adopted by UK tech and digital firms[19]

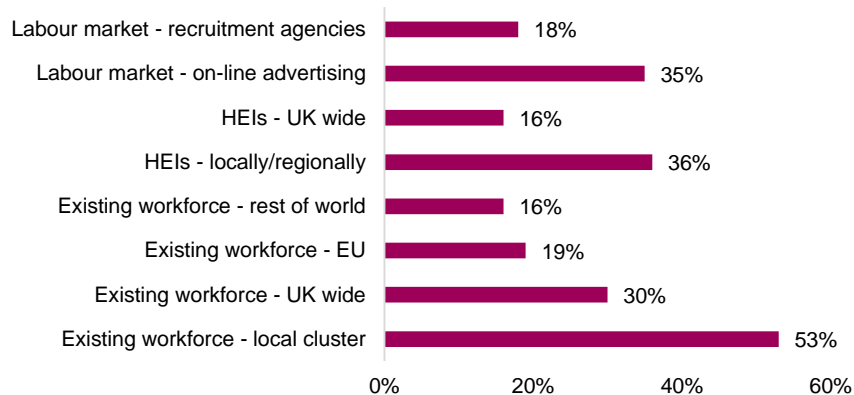|	
In-house/on the job training	60%
Self taught programming	67%
Mentoring/informal support	44%
On line training	39%
Local HEIs	27%
HEIs UK-wide	15%
Private training provider	16%

Skills issues

HEIs are a key source of talent and workforce development expertise

While a significant proportion of tech and digital firms recruit new talent from the existing workforce (with 53% targeting the local tech and digital cluster, 30% recruiting from across the UK and more than a third looking overseas) HEIs are also a key source of talent. Some 36% recruit from local universities and a further 16% look to HEIs across the UK. While tech and digital firms are most likely to develop their staff in-house and/or via informal approaches, meanwhile, it is notable that nearly 30% use local universities and a further 15% use HEIs based elsewhere in the UK.

Sources of skills & talent for UK tech and digital firms[19]

Source	Percentage
Labour market - recruitment agencies	18%
Labour market - on-line advertising	35%
HEIs - UK wide	16%
HEIs - locally/regionally	36%
Existing workforce - rest of world	16%
Existing workforce - EU	19%
Existing workforce - UK wide	30%
Existing workforce - local cluster	53%

Views of Industry

" *It is really interesting to see Birmingham City University students developing different types of new technological projects and the different versions of digital applications of the near future. This is next generation curriculum producing what we call potentials of the future.* "

Dr. Olivier Zephir, Technoport, Luxembourg

" *When it comes to digital skills development, BCU are true leaders. They've transformed their curriculum to focus on the needs of the industry - real world problem solvers, a strong focus on current technologies and fostering a can-do attitude in their graduates. I can't think of a better environment to educate the next generation of digital pioneers to help power the West Midlands economy forward.* "

Dr. Rob Pritchard, Digital Technology Leader and Consultant

Sources

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