

# SCOTLAND'S DIGITAL STRATEGY

## EVIDENCE DISCUSSION PAPER

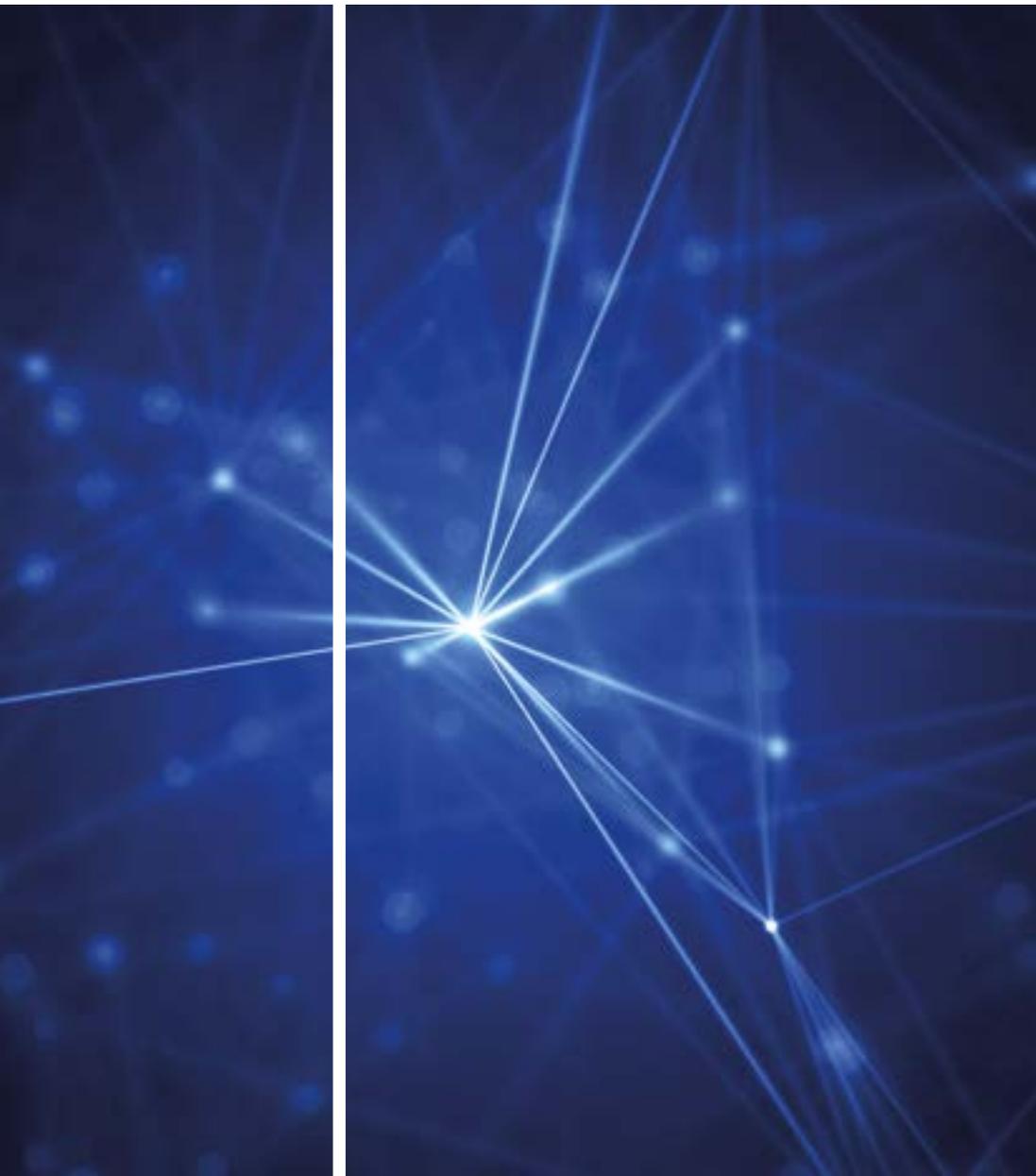
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**Digital  
Scotland**



**Scottish Government**  
Riaghaltas na h-Alba  
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## EXECUTIVE SUMMARY

Since 2007 the Scottish Government's central Purpose has been to create a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth. A digitally connected and skilled nation is a key component to achieving the mutually supportive goals set out in Scotland's Economic Strategy of boosting competitiveness and tackling inequality.

Digital is a key driver of economic productivity and innovation, job creation and internationalisation and supports inclusive growth that is broad-based across individuals and cities, regions and rural areas. Ensuring that everyone can benefit from the digital world, through supporting a digitally skilled and resilient nation, tackling barriers to digital inclusion and ensuring digital connectivity across the whole of Scotland will be key to realising the benefits of the digital world.

This paper provides an evidence base to accompany the publication of *Realising Scotland's full potential in a Digital World*. It summarises the important links between digital and economic productivity and inclusion and the ways in which digital is changing the way we live, work and do business in Scotland. Finally, it analyses Scotland's performance on various digital dimensions over time and in an international context.

### WHY DOES DIGITAL MATTER?

Digital technology is at the heart of daily life and continues to have an unprecedented impact on the wider economy through innovating household activities, education, employment, and public services.

Digital connectivity is an essential component of national infrastructure and its contribution to productivity growth is widely recognised.



## EXECUTIVE SUMMARY continued

- > A study for the Organisation for Economic Co-operation and Development (OECD) of 25 OECD countries between 1996 and 2007 estimated that a 10% increase in broadband penetration increased Gross Domestic Product (GDP) per capita growth by between 0.9 to 1.5 percentage points.<sup>1</sup>
- > In addition, a report commissioned by Scottish Futures Trust found that becoming a world leader in digitalisation could increase GDP in Scotland by £13 billion by 2030.<sup>2</sup>

Reliable digital infrastructure can reduce costs and enhance revenues for businesses, promote flexible and remote working, and has important inclusion impacts, presenting opportunities for those located in remote locations.

1 Czernich, N., Falck, O., Kretschmer, T. & Woesman, L. (2009), Broadband infrastructure and economic growth (CESifo Working Paper No 2861).  
2 The Economic and Social Impact of Enhanced Digitalisation in Scotland, July 2015.

Digital skills gaps and shortages have been identified globally and in Scotland. Ensuring the population is digitally literate and business needs for digital skills are met is key to driving economic competitiveness and capturing emerging opportunities.

Ensuring that all citizens are included and confident in the digital society that Scotland will become is critical to the future of a fairer Scotland. Digital connectivity and literacy have numerous benefits to individuals, including improving access to public services, education and skills development, reducing isolation, supporting health and wellbeing and increasing employment opportunities and flexibility. However, evidence suggests that within Scotland certain groups are less confident performing online activities. Closing the digital divide in Scotland will positively impact social cohesion, and improve both social and economic inclusion.

Digital technology also offers a wide range of opportunities for innovating public service delivery, including healthcare and education. Delivering online public services helps control

costs, reduce paper handling and transportation costs and enables users to be involved in service design and delivery. Delivering public services online may also enhance accessibility of services to rural and isolated communities, those with mobility difficulties and citizens that face other barriers to accessing conventional services.

While rapid digital developments have provided a huge amount of opportunity and potential sources of efficiency for individuals and organisations, these new technologies have also brought unprecedented threat. It is critical that individuals and organisations become resilient online, aware of the risks of using digital technologies and capable of responding to them.

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**ENSURING THAT ALL CITIZENS ARE INCLUDED AND CONFIDENT IN THE DIGITAL SOCIETY THAT SCOTLAND WILL BECOME IS CRITICAL TO THE FUTURE OF A FAIRER SCOTLAND.**

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## WHAT ARE THE RECENT DIGITAL DEVELOPMENTS IMPACTING ON SCOTLAND?

Over 3.6 billion people (50% of the world's population) are estimated to be internet users in 2016, an increase of over 900% since 2000.<sup>3</sup> Individuals are using global digital platforms to learn, find work and build networks.

Developments in digital technologies and data use continue to change the way we live our lives, from innovating workplace practices to disrupting traditional markets. Some of the key developments that are impacting how we live, work and do business in Scotland include:

- > Flexible working and workplace innovation enabled by the increase in remote working practices;
- > The adoption of cloud computing, which enables remote working and increased collaboration, while often improving cost and environmental efficiencies and providing security benefits;

- > The sharing economy – online platforms which allow people to share access to underutilised assets, resources and skills – which continues to innovate traditional markets and the way in which consumers access products and services;
- > The European Digital Single Market, a political priority of the European Commission, that aims to create an environment where individuals and businesses in the EU can easily carry out online activities under fair competition and a high level of data protection, irrespective of their place of residence;
- > Smart Cities which integrate Information and Communication Technologies (ICT) to innovate across sectors, including transport, health and energy, in order to manage resources efficiently, make cities greener and improve the population's well-being; and

- > The increasing cyber threat and importance of cyber resilience, which will be heightened as more devices – the 'internet of things' – become connected to the internet.

## HOW HAS SCOTLAND PERFORMED DIGITALLY?

### Connectivity

- > There has been a steady increase in the percentage of premises where next generation broadband access is available in Scotland, from 41% in 2011 to 88% in 2016, and Scotland performs well relative to international comparators.<sup>4</sup>
- > Although the gap in coverage between rural areas and the rest of Scotland has decreased over time, it remains 37 percentage points in 2016.<sup>5</sup>

- > Average broadband speeds have increased in both urban and rural areas over time, but the gap between the areas has widened and stands at 24 Mbits/s in 2016.<sup>6</sup>
- > 4G coverage has steadily increased in Scotland, with 92% of premises having outdoor 4G mobile coverage from at least one national mobile network operator and 58% having outdoor coverage from all four 4G networks.<sup>7</sup>

### Skills

- > There has been an increase in the number of students undertaking computing and digital technology-related qualifications, however a significant gender gap remains at all levels of qualification.<sup>8</sup>

3 <http://www.internetworldstats.com/stats.htm>

4 The Office of Communications (Ofcom), Connected Nations and Infrastructure Reports; Broadband coverage in Europe by IHS and Valdani, Vicari & Associati (VVA).  
5 Ofcom, Connected Nations and Infrastructure Reports.

6 Ofcom, Connected Nations and Infrastructure Reports.

7 Ofcom, Communications Market Reports.

8 SQA Annual Statistical Reports Higher, Skills Development Scotland 2016.



## HOW HAS SCOTLAND PERFORMED DIGITALLY?

### Skills (continued)

- > 26% of businesses in Scotland currently undertake activities to develop employees' digital skills, with a further 18% planning to do so in the future.<sup>9</sup>
- > There is a demographic divide in digital skills, with those in social housing, those with incomes between £10,000 and £20,000, and those over 60 consistently being less confident in performing a variety of online activities.<sup>10</sup>

### A Digital Society

- > The percentage of adults using the internet for personal use has increased over time, from 63% in 2007 to 82% in 2015, though use is strongly linked to age and income. Less than a third of people aged 75 and older used the internet in 2015, compared to 97% of 16-24 year olds. The gap in internet usage between the lowest and highest income brackets has decreased from 58% in 2007 to 21% in 2015.<sup>11</sup>

- > There are variations in internet take-up by local authority, with 89% of premises in Edinburgh and East Dunbartonshire having home internet access, compared to 73% within Glasgow.<sup>12</sup>

### The Digital Economy

- > According to Scotland's Digital Economy Maturity Index, which segments businesses in Scotland according to their level of digitalisation, the vast majority of businesses are classed within the second lowest or middle maturity segments, basic browsers (38%) and tentative techies (30%), and only 3% of Scottish businesses are classed within the top segment, digital champions.<sup>13</sup>
- > 87% of Scottish businesses have a website, but use of other digital tools, such as enterprise resource planning and customer relationship management, lags behind other advanced economies.<sup>14</sup>

### Public Service Reform

- > Increasing collaborative Information and Communication Technology (ICT) procurement has resulted in substantial monetary savings across Scottish Government public bodies, an estimated £54.4 million in 2015/16.<sup>15</sup>
- > In 2015, 86% of users were satisfied with the overall quality of online public services in Scotland.<sup>16</sup>

### Cyber Resilience

- > There is varying use of different online security measures, with two-thirds of adults in Scotland indicating that they avoid opening emails or attachments from unknown people, whilst just under a third said they make sure their mobile phone has up-to-date antivirus software.<sup>17</sup>

- > Use of the various online security measures varies by age, with those aged 60 and above generally less likely to adopt online security measures than those in younger age groups. In addition, adults living in the 20% most deprived areas of Scotland were generally less likely than those in the rest of Scotland to adopt security measures.<sup>18</sup>
- > Small businesses are less cyber resilient. One in five Scottish-based small businesses admitted that they failed to take any steps to protect their data.<sup>19</sup>

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**THE PERCENTAGE OF ADULTS USING THE INTERNET FOR PERSONAL USE HAS INCREASED OVER TIME, FROM 63% IN 2007 TO 82% IN 2015.**

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9 Scottish Government, Digital Economy Business Survey, 2014. <http://www.gov.scot/Topics/Economy/digital/digitaleconomy/businesssurvey-2014>

10 Scottish Household Survey, 2015.

11 Scottish Household Survey, 2015.

12 Scottish Household Survey, 2015.

13 Scottish Government, Digital Economy Maturity Index, 2014.

14 Scottish Government, Digital Economy Maturity Index, 2014.

15 Scotland's Digital Future: Delivery of public services, phase one benefits update.

16 Scottish Household Survey, 2015.

17 Scottish Household Survey, 2015.

18 Scottish Household Survey, 2015.

19 Small Business Reputation and The Cyber Risk, Cyber Streetwise and KPMG, December 2015.



# STRATEGY

## 1. INTRODUCTION

### WHAT IS DIGITAL?

The digital revolution continues to change the way we live our lives, to disrupt industries and transform our traditional expectations of service.

The term 'digital' is used to refer to those activities that involve internet or web-based technologies. This includes digital infrastructure (fibre, wireless etc.), digital platforms (websites, mobile etc.) and digital content (information, entertainment etc.). The term 'digital economy' comprises both the use of digital activities to conduct business and support growth across Scotland's economy as a whole (the demand side) and the extent of the business base that develops, delivers and supports such technologies at home and abroad (the supply side).

### SCOTLAND'S DIGITAL STRATEGY REFRESH

Scotland Digital Strategy, published in 2011, aimed to extend connectivity, promote the digital economy, digitise public services and promote digital participation. Significant progress has been made on these goals. Both technology and our understanding of the benefits that digital can provide

have changed significantly over the past five years, and the pace of change across the wider economy and society has accelerated. It is in this context that Scotland's digital strategy is being refreshed.

*Realising Scotland's full potential in a Digital World* sets out the actions for ensuring Scotland can fully benefit from the digital age.

The purpose of this paper is to provide evidence to inform the publication of the refresh of Scotland's Digital Strategy.

The document is structured as follows:

- > Section 2 discusses the key digital developments that are impacting the way in which we live, work and do business in Scotland;
- > Section 3 summarises the important links between different dimensions of digital and economic growth and inclusion in Scotland; and,
- > Section 4 analyses Scotland's progress to becoming a world-leading digital nation.

## 2. RECENT DIGITAL DEVELOPMENTS

Advances in technology are transforming the economy and wider society. The rapidly evolving nature of digital means that new technologies are continually being developed and integrated into our daily lives. This section outlines key digital developments that are changing how we live, work and do business across Scotland.

### 2.1 FLEXIBLE WORKING AND WORKPLACE INNOVATION

Advances in digital technologies are innovating workplace practices through enabling employees to work remotely and more flexibly. Remote working allows people to work from home as well as from other locations with secure internet access, such as client sites. Workers can now access documents on smart devices, work through virtual networks, and communicate with colleagues across the globe. In 2014, 6 in 10 Scottish businesses stated that using mobile internet and technologies enabled staff to work remotely.<sup>20</sup> Remote working reduces the need for travel and time spent commuting, as well as potentially reducing the need for office space and overhead costs.

<sup>20</sup> Digital Economy Business Survey, 2014.



According to a study by British Telecom (BT), productivity among homeworkers increased by between 15 and 31% due to increased focus and less office distractions.<sup>21</sup> In addition, it found remote working to be advantageous in recruiting and retaining staff. Monetary and environmental benefits from reduction in travel were also achieved. BT made a substantial saving of £500 million in their property portfolio and estimated that it saved around 97,000 tonnes of CO<sub>2</sub> emissions.

The increased flexibility that remote working offers has the ability to increase labour market participation by providing greater opportunities for those who are restricted by traditional working hours or the need to be located in a particular location. This may benefit workers who live in remote areas or have other difficulties accessing a place of employment, as well as care providers in families with young children.

However, research by Timewise suggests that flexible working options are not yet widely available.<sup>22</sup> In 2016, only 8.7% of UK jobs paying over £20,000 per year were advertised with flexible working options.<sup>23</sup> As salary rises, the availability of quality flexible jobs declines, with few positions offered within engineering, management, health and education.<sup>24</sup> For employers in areas with skill shortages, there are clear benefits of accessing a wider talent pool through offering flexible working.

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**IN 2016, ONLY 8.7% OF UK JOBS  
PAYING OVER £20,000 PER YEAR  
WERE ADVERTISED WITH FLEXIBLE  
WORKING OPTIONS.**

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## 2.2 CLOUD COMPUTING

Cloud computing is a key technological advancement that facilitates greater remote working and collaboration. Cloud computing allows data to be stored and accessed through a remote server rather than on a computer hard drive. Well known clouds include Google Drive and Apple iCloud which allow files to be shared across devices.

Cloud technology provides benefits for both personal and business use. The ultimate advantage of cloud computing is potential cost reduction, as the technology is cheaper than investing in ICT equipment and operates as a pay-as-you-go service, offering greater flexibility. In addition, cloud computing can store significantly more data than a traditional computer, saving businesses the need to upgrade their hardware and therefore reducing IT costs further.

Cloud computing provides greater scope for collaborative working as users can access and work on the same document simultaneously. Clouds are accessible from a variety of devices, such as smartphones and tablets, and from any location with internet access, providing a convenient way to access information outside of the workplace. Cloud technology also offers added security benefits as information stored on the cloud remains even if the computer hardware becomes lost or stolen. Lastly, cloud computing is more energy efficient as it requires less electricity and air conditioning than computer hardware and scales down when servers are not being used, meaning that less power is consumed.

21 Can homeworking save the planet? How homes can become workspace in a low carbon economy, The Smith Institute, 2008.

22 In this context, 'flexible' is defined by any job that is advertised as part-time or, full-time with either remote working opportunities, flexible shift patterns or location flexibility.

23 The Timewise flexible jobs index 2016.

24 Timewise and Joseph Rowntree Foundation, The impact of flexible hiring: How flexible hiring can improve business performance and living standards, 2016.

Although cloud computing offers numerous advantages to organisations, a survey of Scottish businesses revealed that only 25% of businesses were utilising cloud technology.<sup>25</sup> The most commonly cited reason for not taking advantage of cloud computing was

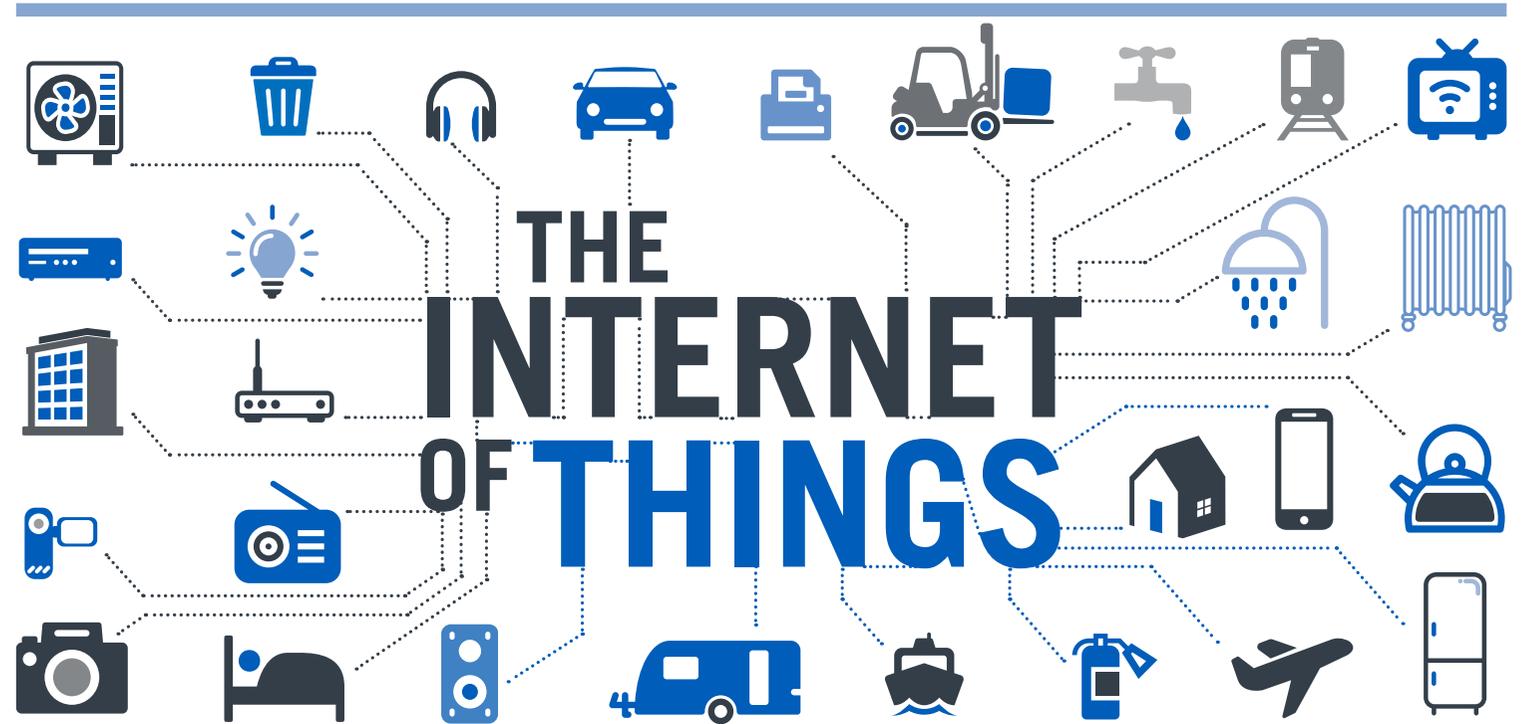
because businesses felt that it was not relevant to them, indicating that the benefits of cloud computing may not be fully understood. A further 8% of businesses who did not utilise cloud technology, cited security and privacy concerns as a constraint.

### 2.3 THE INTERNET OF THINGS

The Internet of Things (IoT) refers to an expanding network of interconnected devices, enabled by the internet. It is estimated that by 2020 there will be 50 billion IoT devices, able to connect with one another on a constant basis.<sup>26</sup> Key examples include driverless cars and smart meters.

The IoT offers new ways for businesses to add value and for public services to become more personalised, however the constant connectivity and data sharing also creates new opportunities for information to be compromised, making security by design and cyber resilience even more important. Figure 2.3 depicts how devices can be connected, impacting our daily lives.

FIGURE 2.3



25 Digital Economy Business Survey, 2014.

26 Ericsson's CEO Hans Vestberg, 2011.



ENABLING



## 2.4 THE COLLABORATIVE ECONOMY

As well as changing the way we work, digital technologies are impacting the wider economy through disrupting traditional markets. An example of this is the rapid growth of the collaborative economy which connects individuals or communities via online platforms, enabling the sharing or provision of

goods and services, assets and resources without the need for ownership. Figure 2.4 illustrates leading collaborative economy businesses that are significantly impacting major sectors.

FIGURE 2.4 The Collaborative Economy

<b>UBER</b>		The world's largest taxi company owns no taxis.
<b>AIRBNB</b>		The largest accommodation provider owns no real estate.
<b>SKYPE</b>		The largest phone company owns no telecoms infrastructure.
<b>FACEBOOK</b>		The most popular media owner creates no content.
<b>NETFLIX</b>		The world's largest movie house owns no cinemas.
<b>APPLE &amp; GOOGLE</b>		The largest software vendors do not write the apps.

Source: IBM



Pricewaterhousecoopers (PwC) has estimated that key collaborative economy sectors could generate £9 billion of UK revenues and \$335 billion of global revenues by 2025.<sup>27</sup> Additionally, a 2014 report by Nesta revealed that 25% of UK adults used the internet to share resources over the last year.<sup>28</sup>

A recent Eurobarometer poll found that a third of 25-39 year olds have used a collaborative economy service and were three times more likely to do so than those aged over 55.<sup>29</sup>

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**IN 2014, 25% OF UK ADULTS USED  
THE INTERNET TO SHARE RESOURCES  
OVER THE LAST YEAR.**

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Disruptive technologies bring significant benefits to consumers, competition and the economy through lower prices, greater choice and better service. Furthermore, disruptive technologies generate greater efficiency by allowing people to share underused resources through online platforms. This allows individuals to benefit from more flexible working arrangements, as well as new ways of supplementing their income. A key characteristic of disruptive technologies is the speed with which they transform markets. This is particularly important when compared with the speed of regulatory changes, in which agility is important to respond to market developments.

The benefits of the collaborative economy must be balanced with the need for regulation and for these new businesses and traditional operators to be treated fairly with no unfair competitive advantage.<sup>30</sup> A key element of debate surrounding disruptive technologies is the degree to which they should be regulated. As online platforms are a new phenomenon and aren't defined in the same way as traditional businesses, they are not necessarily bound by the same rules and regulations. Similarly, recent debate has centred around how the emergence of these new business models are impacting on employment practices. Concerns have been raised around whether new operators are gaining an advantage through how they classify their workers. The UK Government's Taylor Review is considering how employment regulation may need to change in order to keep pace with emerging business models.<sup>31</sup>

**2.5 THE EUROPEAN DIGITAL SINGLE MARKET**

Access to the European Single Market is a key benefit of Scotland's European Union (EU) membership, allowing us to trade freely with member states. However, the EU's regulation of the digital environment has not always kept pace with digital advances, impacting European companies' ability to compete internationally.

In May 2015, the European Commission published its strategy for creating the Digital Single Market.<sup>32</sup> This aims to allow consumers and businesses to trade online across borders, regardless of their place of residence or nationality. The commission outlines 16 key areas of work that will be taken forward in coming years to create the conditions required for EU citizens and companies to take advantage of the opportunities provided by developments in digital technology. Issues covered include reform of

27 PWC, Five key sharing economy sectors could generate £9 billion of UK revenues by 2025, August 2014.  
28 Nesta, Making sense of the UK collaborative economy, 2014.  
29 European Commission Flash Eurobarometer 438: the use of collaborative platforms, June 2016.

30 <http://www.gov.scot/Publications/2016/06/5280>

31 <https://www.gov.uk/government/groups/employment-practices-in-the-modern-economy>

32 European Commission, A Digital Single Market Strategy for Europe, 2015. [https://ec.europa.eu/priorities/digital-single-market\\_en](https://ec.europa.eu/priorities/digital-single-market_en)



# SMART CITIES

VAT regulation, a review of cross-border broadcasting regulations and proposals to enhance online security.

The European Commission estimates that the Digital Single Market has the potential to contribute up to €415 billion per year to Europe's economy and create hundreds of thousands of new jobs. A digital single market generates opportunities for Scottish businesses to grow and access a market of over 500 million customers, as well as increasing the choice of services available to consumers.

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**SMART CITIES PRESENTS A WAY OF USING DIGITAL TECHNOLOGIES TO MANAGE RESOURCES AND INFRASTRUCTURE IN A SUSTAINABLE WAY.**

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## 2.6 SMART CITIES

Our world is becoming increasingly urban. In 2015, 85% of global GDP was created in cities<sup>33</sup> and 1.5 million people are joining the global urban population every week.<sup>34</sup> Within Scotland, our seven cities are home to many high growth sectors and world-leading academic institutions that foster innovation and inward investment.

However, increased urbanisation places huge demands on our infrastructure, public services and the environment. Smart cities present a way of using digital technologies to manage resources and infrastructure in a sustainable way, making our cities more efficient and greener places to live and do business. The evolution of 'big data' means that we are able to collect and analyse information on a greater scale than ever before, providing scope to deliver innovative solutions to city problems.

Smart city technology can reduce litter in cities through using sensors to recognise when to collect full bins and share information about traffic congestions and the availability of parking spaces. Energy consumption can be reduced through dimming streetlights when nobody is around, controlling temperature in public buildings and notifying maintenance staff to water leaks as soon as they occur.

It is estimated that cities consume 75% of global natural resources and account for 80% of the world's greenhouse gas emissions.<sup>35</sup> Smart city technology has the potential to help improve air quality, cut pollution and reduce traffic congestion and energy use. By monitoring flows of information, digital technology allows supply and demand of resources to be better aligned, improving efficiency and optimising the use of scarce resources. Smart city technology gives us greater insight into the way cities work, allowing us to better prepare for the future.

33 The New Climate Economy, Seizing the Global Opportunity.

34 Pwc Megatrends, Rapid Urbanisation. Pwc analysis of United Nations, Department of Economic and Social Affairs, Population Division 2014.

35 United Nations 2015.



### 3. WHY DOES DIGITAL MATTER?

Enhanced digitalisation presents unprecedented opportunities for economic growth. A digitally-enabled Scotland underpins our core commitment to creating opportunities for all to flourish, through increasing sustainable economic growth, opportunity and equality.

#### 3.1 CONNECTIVITY

Connectivity is a vital part of our national infrastructure. It is an essential determinant of economic success and individual learning, and enables citizens to access online public services.

The economic impacts of increased digital connectivity are widely recognised. A study for the Organisation for Economic Co-operation and Development (OECD) of 25 OECD countries between 1996 and 2007 found that a 10% increase in broadband penetration increased GDP per capita growth by between 0.9 to 1.5 percentage points.<sup>36</sup>

Similarly, a World Bank study focusing on 66 developed countries between 1980 and 2002 found that an equivalent increase in broadband penetration resulted in a rise in GDP growth of 1.2 percentage points.<sup>37</sup> In addition, a report commissioned by Scottish Futures Trust found that becoming a world leader in digitalisation could increase GDP in Scotland by £13 billion by 2030.<sup>38</sup>

Availability of reliable digital infrastructure enables businesses to utilise digital technologies which offer significant cost saving and revenue-enhancing benefits. Furthermore, digital connectivity allows consumers to access a wider market, thus improving competition and increasing the incentives for businesses to innovate and introduce new products and services. Enhanced connectivity fosters time saving and greater flexibility due to increased opportunities for remote working and online shopping.

However, Scotland faces unique challenges due to its low population density and geography, meaning that there is a lack of incentive for the market to provide digital infrastructure in certain areas. Government support is necessary to address market failure and ensure that broadband infrastructure reaches areas of Scotland where the market would otherwise not serve.

Digital connectivity has important implications for inclusion, presenting significant opportunities for rural businesses to grow and reducing isolation for those living within remote areas. Availability and affordability of digital infrastructure also encourages non-users to go online. The offline population tends to include those who are older, on low incomes or may have a form of disability, who stand to gain significantly from being digitally connected.<sup>39</sup>

The forthcoming 5G revolution is likely to significantly improve connectivity across Scotland. 5G will run on a high spectrum band, using higher frequency signals than current 4G mobile network technology. This means that 5G can support significantly higher speeds of delivery, allow many users to connect simultaneously without any compromise in speed and is vital to use of the internet of things.

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**CONNECTIVITY IS AN ESSENTIAL  
DETERMINANT OF ECONOMIC SUCCESS  
AND INDIVIDUAL LEARNING.**

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36 Czernich, N., Falck, O., Kretschmer, T. & Woesman, L. (2009), Broadband infrastructure and economic growth (CESifo Working Paper No 2861).

37 Qiang, C. Z & Rossotto, C. M. (2009) Economic Impacts of Broadband. In Information and Communications for Development 2009: Extending Reach and Increasing Impact, 35-50. Washington, DC: World Bank.

38 The Economic and Social Impact of Enhanced Digitalisation in Scotland, July 2015.

39 Scottish Household Survey.

FIGURE 3.1: The six key pillars

## 6 KEY PILLARS PRINCIPAL ENABLERS INTERLINKED



Source: Scottish Futures Trust.

**IT IS CLEAR THAT 5G NETWORKS WILL REPRESENT A GENUINE STEP TO CHANGE IN MOBILE CONNECTIVITY.**

Although technical standards for 5G are still being developed, it is clear that 5G networks will represent a genuine step to change in mobile connectivity. The International Telecommunications Union has defined that 5G ready networks will be capable of supporting speeds of up to 20Gbps. If this is to be delivered in Scotland, our digital infrastructure will need to be enhanced. Figure 3.1 outlines the six key pillars, identified by Scottish Futures Trust, that are needed to create the environment for Scotland to adopt 5G connectivity.

As existing copper infrastructure is unable to support such high speeds, fibre is an essential component to delivering 5G. In addition, the ability to access and efficiently install underground ducting is vital to enable the deployment of fibre and a significantly higher concentration of masts and antennas is needed, particularly within urban areas. It is also necessary to have more efficient use of spectrum – the bands of radio waves over which data and voice communications travel. Greater spectrum capacity is needed to cope with higher data demand. Furthermore, increasing the capacity of the internet exchange point (IX)

located in Scotland is necessary, as relying on information being stored in the internet exchanges in London or Manchester may not provide anticipated 5G speeds to users.

This new equipment will require innovation to ensure that there is sufficient power supply in both urban and rural areas. Support for sustainable energy supplies and battery power technology will be a key success factor. Collaboration between government, regulators and businesses is necessary to ensure the integration of the six key pillars and hence the delivery of world-class 5G connectivity across Scotland.



### 3.2 SKILLS

Digital skills, ranging from basic digital literacy to more specialised knowledge, are required across all sectors, not just within technology companies. Digital skills are vital to the life chances of our people through significantly increasing employment opportunities and contributing to economic growth.

For Scottish businesses to be able to fully exploit the opportunities offered by digital technologies to drive growth, improve productivity and stimulate innovation, it is essential that the workforce has the skills and confidence to do so. However, there is a shortage of skills required to meet the demand for digital roles, restricting growth within the digital sector and the wider economy.

In 2014, there were 35 vacancies per 1,000 jobs in the digital and creative industry compared to 24 per 1,000 jobs across the economy as a whole, according to a UK study.<sup>40</sup> Approximately 28% of these vacancies were due to skills shortages. Furthermore, only 37% of businesses in Scotland stated that they were fully equipped in terms of having the skills to meet the business' digital technology needs.<sup>41</sup> 25% of firms within digital technologies and other sectors believed that recruiting people with the right technical skills or experience would be an issue for their business over the next 12 months.<sup>42</sup> A global study of business executives, in IT and non-IT companies, revealed that more than half felt that improving the talent capabilities of current IT staff would lead to better use of technology within their organisation.<sup>43</sup>

The provision of formal education and in-work training increases the supply of digital skills and helps to address shortages. A degree qualification is currently a requirement for many occupations within the digital sector, with almost three-quarters of employees in the sector having attained a higher education or equivalent qualification.<sup>44</sup> The demand for high level digital skills is predicted to increase in the future, as job growth is expected to be particularly concentrated in areas such as software development, software engineering and web development. Furthermore, the demand for graduates is anticipated to rise as firms continue to seek to employ skilled applicants directly from university.<sup>45</sup>

Moreover, the rapid rate of technological innovation requires the existing workforce to continually update their skills. Up-skilling the current workforce is an important way of responding to the immediate demand the sector faces. In-work digital training is low with only 26% of Scottish businesses reporting that they provided digital training to their staff in 2014.<sup>46</sup> A survey of Scottish businesses within the digital sector and firms with significant digital activity found that 53% would like to see more digital technology skills training for their staff.<sup>47</sup>

There is a significant gender imbalance in both digital-related education and employment. A study by Edinburgh Napier University found that the proportion of women in digital occupations is approximately 18%, compared to 48% for the aggregate workforce.<sup>48</sup> Findings from the study suggest that features of the working conditions within the digital sector deter females from entering or staying within the industry.

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**DIGITAL SKILLS, RANGING FROM BASIC DIGITAL LITERACY TO MORE SPECIALISED KNOWLEDGE, ARE REQUIRED ACROSS ALL SECTORS.**

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40 UKCSE (2014) Sector Insights: Skills and Performance Challenges in the Digital and Creative Sector.

41 Digital Economy Business Survey 2014.

42 Ekosgen Digital Technologies Survey 2016

43 McKinsey (2011) A Rising role for IT: McKinsey Global Survey Results.

44 Technologies Insights Scotland 2012, e-skills UK 2012.

45 Scottish Technology Industry Survey 2015, ScotlandIS 2015

46 Digital Economy Business Survey 2014.

47 Ekosgen Digital Technologies Survey 2016.

48 Edinburgh Napier University (2016) Women in ICT and Digital Technologies (Draft Report).



For example, lack of part-time positions, little flexibility of working arrangements and long hours constrain participation, particularly for women with caring responsibilities.

Attracting more women into the industry has the potential to increase sector growth and productivity, as well as furthering inclusion. Research by the European Commission estimated that if women held digital jobs as frequently as men, the European GDP would be enhanced by €9 billion per year.<sup>49</sup>

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**A STUDY OF THE FRENCH ECONOMY FINDS THAT FOR EVERY JOB THAT IS DISPLACED DUE TO TECHNOLOGY, ANOTHER 2.4 ARE CREATED.**

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More broadly, digital technologies are changing the nature of the labour market, meaning that digital skills are more important than ever before. Digitalisation has the potential to impact jobs through improving productivity, meaning that fewer employees are needed to provide a service or manufacture a product. However, job creation due to the increased business opportunities and innovation that digital technologies provide is likely to outweigh the loss in jobs due to increased productivity. A study of the French economy finds that for every job that is displaced due to technology, another 2.4 are created.<sup>50</sup> A report by Scottish Futures Trust suggests that if Scotland fully embraces digitalisation, the benefits to the labour market are likely to be higher than the losses.<sup>51</sup>

A recent report by Deloitte highlighted the potential scale of automation in the public sector based on the type of role performed.<sup>52</sup> The report suggested that in the public sector administrative and operative roles are likely to be automated over the next two decades, while frontline roles and those requiring strategic and complex thinking are to be highly resilient to automation. While on balance the evidence suggests that the impact of digital technologies will be positive across the economy and labour market, the effects may not be evenly distributed, highlighting the importance of continuing to invest in education and up-skilling of workers.



### 3.3 A DIGITAL SOCIETY

A key challenge of the digital age is ensuring that everyone has the opportunity to benefit from the advantages that digital technology has to offer. As well as investment in digital infrastructure, affordable access and sufficient skills are needs to maximise the personal, societal and economic benefits. The power of the internet has the ability to tackle persistent inequalities and enable social mobility. It is vital that citizens not only have access to digital technologies, but the confidence, motivation and resources to use them.

Digital inequalities are more likely to be experienced by those who are already more likely to be disadvantaged according to other measures. Within Scotland, a digital divide remains along a number of dimensions, including age and socio-economic deprivation. For example, 26% of adults living in the 20% most deprived areas in Scotland reported not using the internet compared with 16% in the rest of the country. In addition, 70% of those aged 75 and over do not use the internet, which is more than triple the Scottish average.<sup>53</sup>

49 European Commission (2013) Digital Agenda: bringing more women into EU digital sector would bring €9 billion annual GDP boost, EU study shows, Press Release, IP/13/905, 3rd October 2013.

50 Internet Matters, McKinsley Global Institute.

51 The Economic and Social Impact of Enhanced Digitalisation in Scotland, July 2015.

52 <https://www2.deloitte.com/uk/en/pages/public-sector/articles/state-of-the-state.html>

53 Scottish Household Survey 2015.



Furthermore, certain groups were found to have lower levels of digital literacy – the capabilities required for living, learning and working in a digital society. Among those that have access, a lower proportion of adults in social housing were confident using the internet to complete online activities such as shopping and sending emails, compared to those in private rented housing. Those aged over 60 and those on incomes between £10,000 and £20,000 consistently reported being less confident than average across online activities.<sup>54</sup> In addition, Citizens Advice Scotland surveyed clients seeking advice or assistance with social security benefits.<sup>55</sup> Of those surveyed almost three-quarters (72%) said that they would struggle to apply for a job online and only 28% felt that they would be able to complete an online job application unaided.

Evidence suggests that key groups who do not take advantage of the internet in their lives are actually those who might benefit most. Internet use presents opportunities for cheaper online purchasing, a way to keep in touch via social media and awareness of employment vacancies. A report by the UK Government revealed that offline households miss out on savings of £560 per year from shopping, paying bills online and being able to keep in contact with family and friends.<sup>56</sup> In addition, further saving can be achieved through price comparison websites that allow people to access information about different goods and services to find the best deal. Those within lower income households would particularly benefit from reductions in the cost of living enabled by digital.

Moreover, digital technology creates educational opportunities for users to participate in online learning, supplementing formal means of education. Internet access has the potential to reduce social isolation by providing new channels to increase social interaction and meet others with similar interests. Another key benefit is increased access to online public services and greater civic engagement. This is suggested to positively impact health, due to increased connections with healthcare professionals.<sup>57</sup>

Closing the digital divide is critical to the future of a fairer Scotland and is likely to positively impact social cohesion. Enhanced use of digital can help marginalised groups access public services and feel more engaged in society. It is suggested that once the digital divide has been minimised in Scotland, the economically disadvantaged will also be more employable. Access to the internet provides information about job vacancies and the ability to apply for jobs online and, in turn, increased digital skills enhance employability.<sup>58</sup>

### 3.4 A DIGITAL ECONOMY

Digitalisation is a key driver of business success. Utilising digital technologies can help to transform any business regardless of its size and location, increasing international competitiveness and the ability to innovate.

The vast majority of Scottish businesses have internet access, although larger firms are more likely to use Next Generation Access (NGA) broadband and mobile technologies.<sup>59</sup> 25% of Scottish companies use cloud computing and 34% of firms utilise data analytics, rising to 75% of larger businesses.

Research by the Centre for Economics and Business Research found that increasing the usage of cloud computing in the UK from 32% of businesses to 56% within a five-year period resulted in an increase in GDP of 1.26%.<sup>60</sup> Based on similar analysis, Scottish Futures Trust estimates that if Scotland adopts cloud technology and big data to a world-leading extent, the economic benefits could be over

54 Scottish Household Survey 2015.

55 Citizens Advice Scotland, Bridging the Digital Divide: Measuring the progress of digital inclusion amongst Scottish CAB clients.

56 UK Government Digital Inclusion Strategy 2014.

57 Carnegie UK Trust, Digital participation and social justice in Scotland, 2016.

58 The Economic and Social Impact of Enhanced Digitalisation in Scotland, July 2015.

59 Digital Economy Business Survey 2014.

60 Centre of Economic and Business Research, "The Cloud Dividend".



£5 billion.<sup>61</sup> In addition, enhanced digitalisation could create an additional 175,000 jobs by 2030 and generate up to 6000 new home-office firms and small and medium enterprises within Scotland. Increased demand for workers also has the potential to raise earnings by up to £2000 per worker. As over 80% of the productivity advantages US multinationals have over domestic UK businesses is suggested to be due to better use of IT, increased digitalisation across Scottish businesses could result in significant productivity gains.<sup>62</sup>

In addition, digitalisation helps Scottish businesses to become more internationally competitive. Digital technologies allow businesses to more effectively communicate with customers through social media and online advertising. A third of exporting businesses in Scotland reported making 20% of their export sales via their website and two-thirds agreed that using digital technologies

increased the number of international markets they export to.<sup>63</sup> Scottish businesses classed as having high levels of digitalisation were also much more likely to export compared to companies that had low adoption of digital technologies.<sup>64</sup>

Digital technologies facilitate innovation, which is key to increased productivity and long-term growth in GDP and earnings. Digitalisation makes collaboration easier and can help innovators to achieve a faster time to market. Among Scottish businesses using digital technologies, 71% reported using digital technologies aided in the development of new products and services.<sup>65</sup> A survey of global business executives in 2011 revealed that the majority of respondents expected digital technology to support future innovation and would be willing to spend more on such technologies in the future.<sup>66</sup>

### 3.5 PUBLIC SERVICE REFORM

Our approach to public services and to public service reform continues to be informed by the findings of the Christie Commission on the Future Delivery of Public Services, giving us consistent and clear strategic direction built around the four pillars of reform: partnership; prevention; people; and performance.<sup>67</sup> This includes a sharp focus on improving performance, through greater transparency, innovation and use of digital technology.

Digital technology offers a wide range of opportunities to improve and change the way that public services are delivered in Scotland. Driving resilient online public services will help to control costs, reduce paper handling and transportation costs for citizens and organisations. Online enquiries can result in significant cost savings compared to equivalent traditional in-person enquiries.<sup>68</sup> In addition, digital technology can capture patterns of service use and feedback, meaning that users can

be directly involved in service design and improvements can be made on an ongoing basis. The provision of online services results in increased efficiency by freeing up resources for face-to-face delivery where it is required.

In particular, digital technology has the ability to improve public services such as education and healthcare. The internet can enable greater access to educational materials, improve the quality of resources and make education delivery more inclusive. Materials, such as lectures and texts, may be accessed outside of the classroom meaning that learning is not limited to schools, but is continuously happening within other environments. Studies show that online education provision is effective in supporting learning for disengaged students, where attending school is difficult due to personal circumstances.<sup>69</sup>

61 The Economic and Social Impact of Enhanced Digitalisation in Scotland, July 2015.

62 Office for National Statistics, 'IT Investment, ICT Use and UK Firm Productivity' Rafaella Sadun, Shikeb Farooki, Giles Gale, Mark Lever, August 2005.

63 Digital Economy Business Survey 2014.

64 Digital Economy Maturity Index 2014.

65 Digital Economy Business Survey 2014.

66 McKinsey, A rising role for IT: McKinsey Global Survey Result, 2011.

67 DR Campbell Christie CBE, Commission on the future delivery of public services, June 2011.

68 John McClelland, Review of ICT Infrastructure in the Public Sector in Scotland.

69 The impact of ICT in schools – a landscape review, Becta Research 2007.



### 3.6 CYBER RESILIENCE AND DATA

Furthermore, digital technology can improve the quality and reduce the cost of healthcare, transforming the way people look after their own health and wellbeing and interact with health and care services. Access to health-related information online allows people to gain increased knowledge about their own health and how best to manage any existing conditions they may have. In addition, citizens can use digital technologies to book appointments online, order repeat prescriptions and monitor their health and fitness via devices and apps.

Technology can allow patient records to be transferred to an electronic database, saving time and reducing manual errors. The majority of NHS patient records are now electronic, enabling better access and allowing aggregation and analysis to improve clinical practice, public health and business management. Digital healthcare is also addressing major health issues in Scotland, such as an ageing population. Telemedicine provides medical care from a distance through telephone and video appointments, reducing costs and waiting times.<sup>70</sup>

The digital age presents substantial opportunities for economic growth, however it also increases the risks associated with cyber security. As businesses increasingly invest in mobile and cloud technologies to access information remotely, the threat of security breaches intensifies, with the sophistication of cyber-attacks also growing.

Integrating cyber resilience into business operations across the private and public sector is vital. Failure to address security concerns could damage future growth, hinder business reputation and lose consumer trust. Cyber resilience is a business enabler – when businesses become more cyber resilient, they build consumer confidence and ultimately increase their profitability.

Increased awareness of the threats that cyber breaches present has led to demand for cyber security skills to increase by 70% since 2012.<sup>71</sup> This is likely to continue as businesses seek to manage cyber risk to ensure they continue to take full advantage of the digital revolution. Currently, 16% of Scottish businesses believe that they have the necessary information and

skills to ensure their organisation's systems are secure, with a further 42% reporting having most of the required skills.<sup>72</sup> However, small businesses are more vulnerable when using digital technology. Research conducted by KPMG and Cyber Streetwise demonstrated that small businesses across Scotland were the least likely out of any in the UK to have taken steps to protect their data. One in five Scottish-based small businesses surveyed admitted that they failed to take any steps to protect their data.<sup>73</sup>

Digital technologies allow greater amounts of data to be collected which can generate enhanced knowledge when information is shared with others. Sharing data across public services has the potential to significantly improve outcomes for the people of Scotland, increase the quality and efficiency of public services and reduce costs.

The new European Union General Data Protection Regulation (GDPR) comes into effect from May 2018 and will result in data security and protection being increasingly important. The GDPR changes how personal data should be collected, stored, accessed and utilised and how organisations are legally obliged to respond in the event of a personal data breach. One major consequence of the new legislation is that companies can be fined up to €20 million or 4% of their annual global turnover if they fail to inform authorities about a data breach within 72 hours and inform users of data breaches without delay. The regulation also requires organisations with more than 250 employees to have a Data Protection Officer in place to ensure compliance.

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**DIGITAL TECHNOLOGIES ALLOW GREATER AMOUNTS OF DATA TO BE COLLECTED WHICH CAN GENERATE ENHANCED KNOWLEDGE WHEN INFORMATION IS SHARED WITH OTHERS.**

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70 The economic and social impact of enhanced digitalisation in Scotland, July 2015.

71 <http://www.apsco.org/article/demand-for-cyber-security-professionals-continues-to-rise-2601.aspx>

72 Ekosgen Digital Technologies Survey 2016.

73 Small Business Reputation and The Cyber Risk, Cyber Streetwise and KPMG, December 2015.



4. SCOTLAND'S DIGITAL PERFORMANCE

SCOTLAND'S KEY ACHIEVEMENTS



88%

OF PREMISES HAVE NEXT GENERATION BROADBAND ACCESS



92%

OF PREMISES HAVE 4G COVERAGE.



98%

OF BUSINESSES HAVE INTERNET ACCESS.



87%

OF BUSINESSES HAVE A WEBSITE.



15

UNIVERSITIES PROVIDE COMPUTER SCIENCE COURSES.



81%

OF CITIZENS HAVE BASIC DIGITAL LITERACY.



82%

OF ADULTS USE THE INTERNET FOR PERSONAL USE.



86%

OF ADULTS WHO USED A PUBLIC SERVICE WEBSITE WERE SATISFIED WITH THE OVERALL QUALITY.



92%

OF ADULTS WHO USE THE INTERNET TAKE SOME FORM OF ONLINE SECURITY MEASURES.

This section tracks progress to becoming a world leading digital nation based on currently available data. This highlights where Scotland performs strongly and where there are opportunities for further development.

Where possible, comparisons have been made with the UK and European nations and where comparisons over time are made, this will generally cover the period over which the data has been collected. The selected comparator countries have been chosen

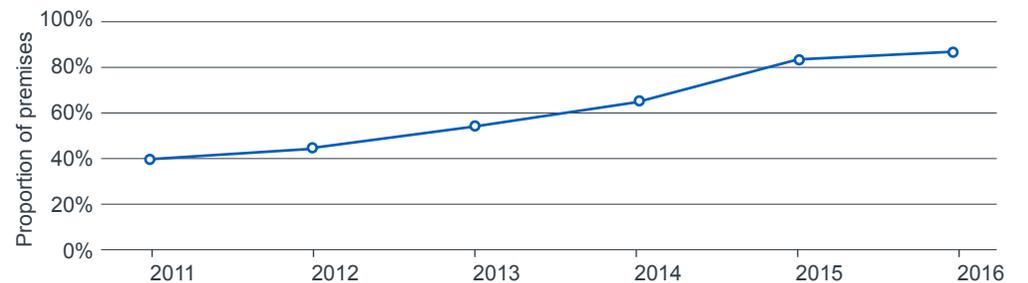
because they have similar economic characteristics to Scotland, in that they are small, open to trade and advanced economies.

4.1 CONNECTIVITY

In 2016, the option of subscribing to a next generation broadband network was available to 88% of residential and business premises in Scotland. As shown in figure 4.1.1, this was up 3 percentage points from the previous year and 47 percentage points from 2011.

FIGURE 4.1.1

Proportion of premises where next generation broadband access is available.<sup>74</sup>



Source: Ofcom, Connected Nations and Infrastructure Reports

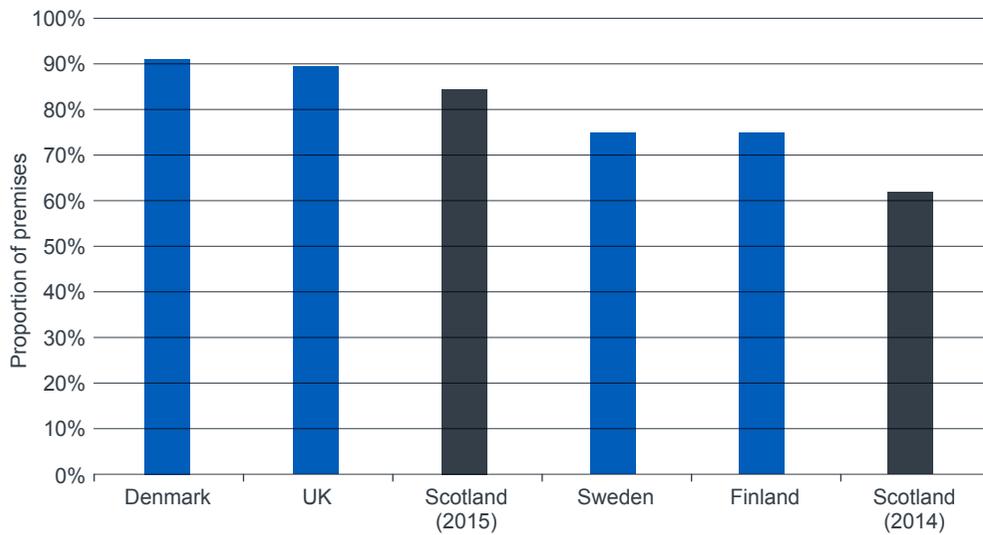
74 Next Generation Broadband is defined based on networks rather than speed including cable, fibre to the cabinet (FTTC) and fibre to the premise (FTTP) networks.



Although next generation access data for comparator countries in unavailable for 2015, Scotland performs well in relation to similar countries. Next generation access within Scotland is slightly lower than the UK figure of 89% but has increased significantly between 2014-15.

**NEXT GENERATION BROADBAND ACCESS WITH SCOTLAND HAS INCREASED SIGNIFICANTLY BETWEEN 2014-15.**

**FIGURE 4.1.2**  
Next generation broadband access for European Countries and Scotland, 2014 and 2015.



Source: Ofcom, Connected Nations, Broadband coverage in Europe by IHS and VVA.

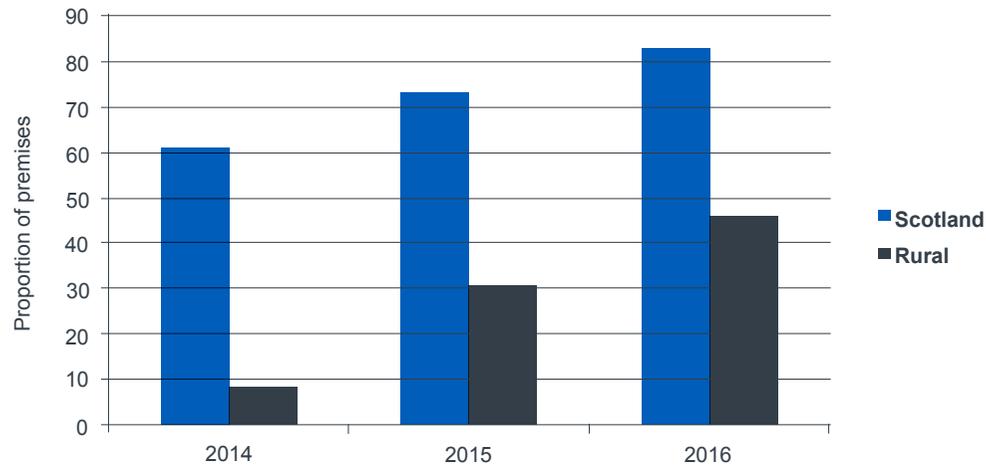


In addition, access to superfast broadband across Scotland has increased over time, with 83% of premises having access in 2016 (Figure 4.1.3). Although the difference in coverage between rural areas and the rest of Scotland has decreased over time, a gap of 37 percentage points still remains in 2016.

Average broadband speeds across Scotland in 2016 were 35 Mbits/s (Figure 4.1.4). Although average broadband speeds have increased within both urban and rural areas, the gap has widened over time and a difference of 24 Mbits/s still remains in 2016.

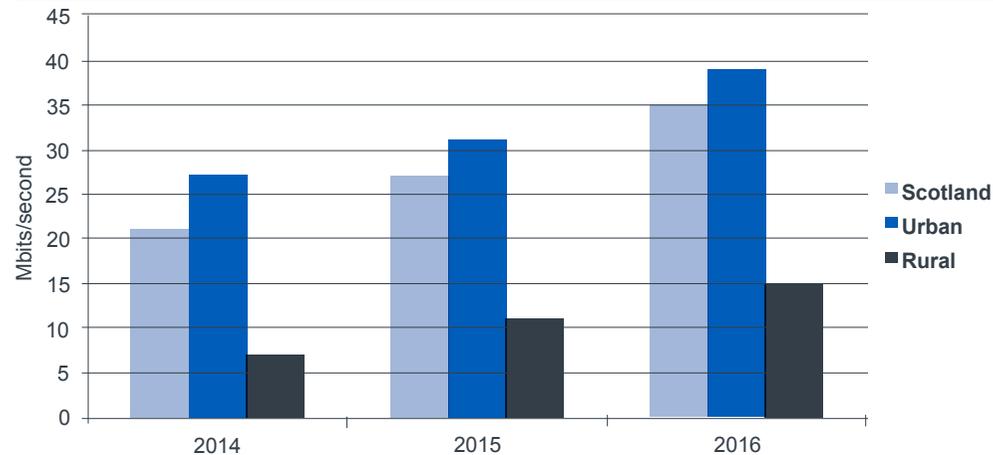
As well as fixed coverage, people increasingly rely on good quality mobile connectivity. The proportion of Scottish premises in areas with outdoor 4G mobile coverage from at least one national mobile network operator was 92% in May 2016, an increase of 35.6 percentage points from 2014. Additionally, more than half (58.4%) of premises have outdoor coverage from all four 4G networks.

**FIGURE 4.1.3**  
Proportion of premises where superfast broadband access is available.<sup>75</sup>



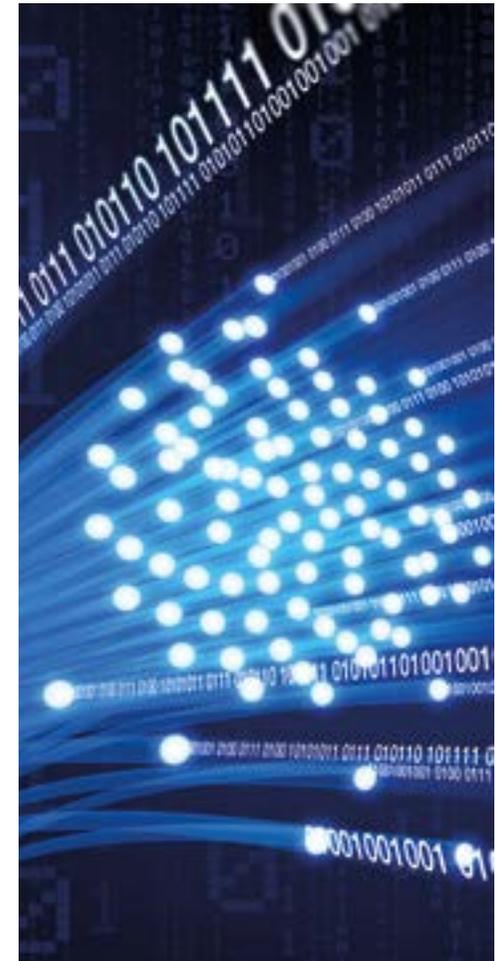
Source: Ofcom, Connected Nations and Infrastructure Reports.

**FIGURE 4.1.4**  
Average broadband download speeds.



Source: Ofcom Connected Nations and Infrastructure Reports.

**AS WELL AS FIXED COVERAGE, PEOPLE INCREASINGLY RELY ON GOOD QUALITY MOBILE CONNECTIVITY.**

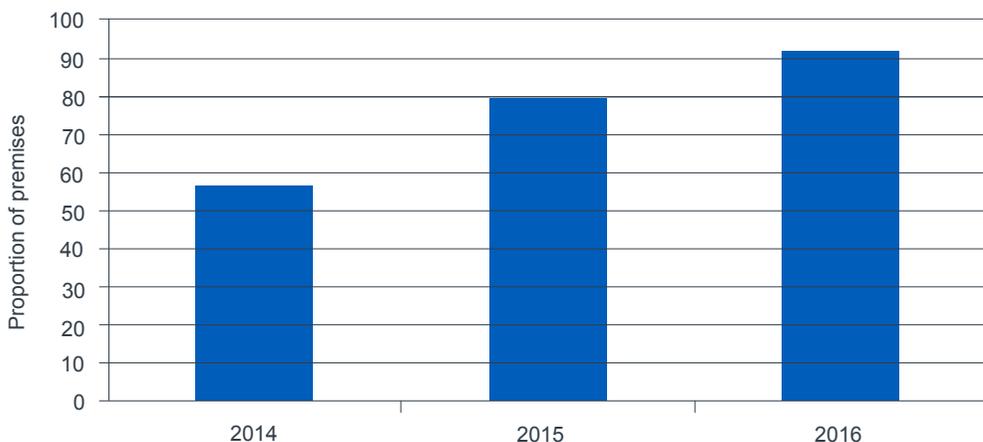


<sup>75</sup> Superfast broadband is defined as delivering headline download speeds of greater than 30 Mbit/s.



**FIGURE 4.1.5**

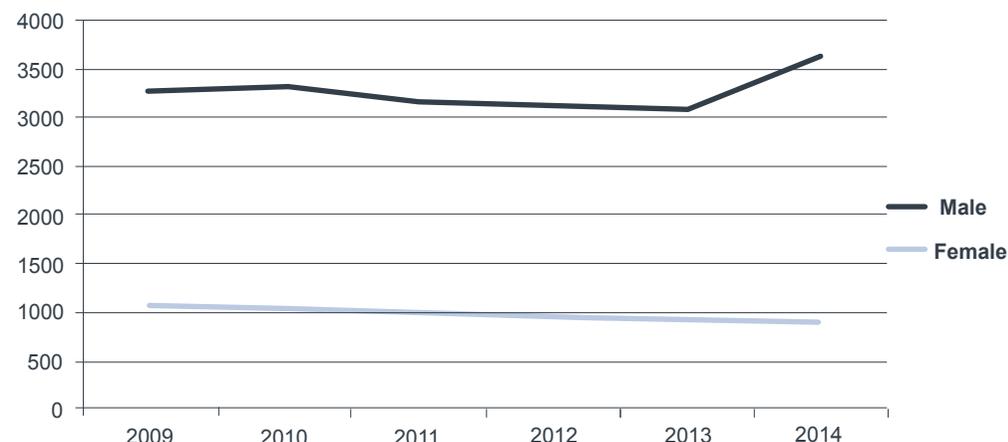
Proportion of premises with outdoor 4G mobile coverage.



Source: Ofcom Communications Market Reports.

**FIGURE 4.2.1**

Number of entries in Higher Computing by gender, 2009–2014.



Source: SQA Annual Statistical Report, Higher

## 4.2 SKILLS

### Education

There are a range of qualifications which can be undertaken by individuals to support the development of digital skills, including national qualifications, modern apprenticeships and university degrees.

### National Qualifications

Enrolment in Scottish Qualification Authority (SQA) Higher Computing increased by 8.25% between 2011-14, with 71% achieving an A to C grade pass in 2014.<sup>76,77</sup> Furthermore, enrolment in Advanced Higher Computing increased by 10.4% between 2011-15.<sup>78</sup>

However, there is a strong gender divide within computing education. Figure 4.2.1 demonstrates that the number of females enrolling in Higher Computing has steadily declined over time. Although the number of male entries has fluctuated, enrolment is consistently above females. In 2015, only 19% of Higher Computing students were female.

### Modern Apprenticeships

There is growing acknowledgment of alternative routes into a career in digital such as modern apprenticeships, which are being increasingly utilised by larger companies. During 2015-16, there were approximately 950 people enrolled in modern apprenticeships in digital technology-related subjects in Scotland, with an achievement rate of 73%. 85% of those enrolled in digital-related modern apprenticeships were male.<sup>79</sup>

<sup>76</sup> SQA Annual Statistical Reports Higher.

<sup>77</sup> As the “new higher” was introduced in 2015, the latest attainment data is not directly comparable.

<sup>78</sup> SQA Annual Statistical Reports Advanced Higher.

<sup>79</sup> Skills Development Scotland 2016.



Employers of digital-related posts who do not use modern apprentices tend not to do so because they do not believe they are at the right level for the business or because they prefer recruiting graduates.<sup>80</sup>

### University and College Education

Around three quarters enrolled in ICT and computing college courses in 2014-15 were male. Males also accounted for a much higher proportion of credits (85%), indicating they are more likely to select more intensive courses than females.<sup>81</sup>

Higher education remains a key route into a career within the digital technologies sector, with many roles requiring degree qualifications and specific skills and knowledge.

The vast majority of universities in Scotland offer digital technology-related courses. Fifteen Scottish universities currently provide computer science courses at undergraduate level, with the majority offering additional postgraduate qualifications.<sup>82</sup> The number enrolled

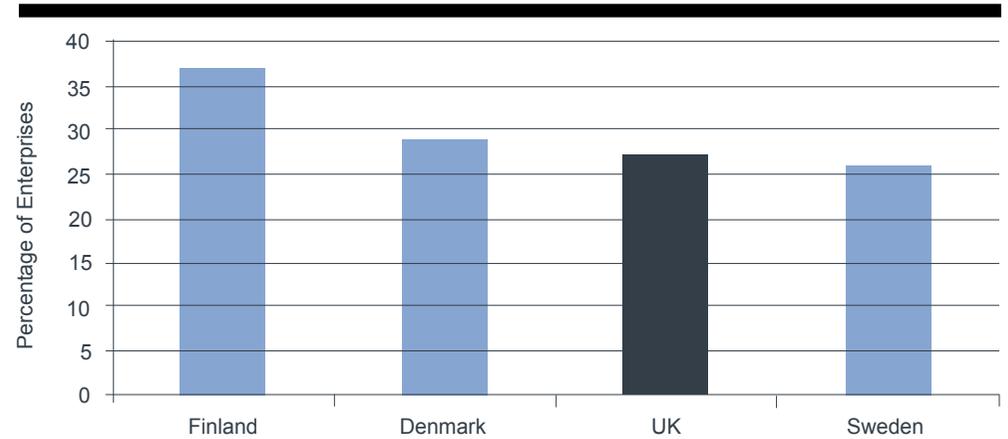
in computing and ICT-related courses at Scottish universities was 15,111 in 2014/15, an increase of 4% from the previous year. 75% of those enrolled were male.<sup>83</sup>

### IN-WORK TRAINING

Up-skilling the current workforce is an important way of responding to the digital skills gap and keeping pace with new digital developments. The proportion of employers that provide training to develop their employees' digital skills is low, with only 26% of businesses in Scotland reporting that they were taking action to develop employees digital skills and a further 18% planning to do so in the future.<sup>84</sup>

Although internationally comparable data is unavailable for Scotland, the UK as a whole lags behind comparator countries in terms of the provision of training to develop ICT skills of existing staff. Figure 4.2.2 demonstrates that 27% of UK enterprises provided ICT training to their current workforce.

**FIGURE 4.2.2**  
Percentage of enterprises that provide training to develop/upgrade ICT skills of their staff, 2015.



Source: Eurostat.



80 Ekosgen Digital Technologies Survey 2016.

81 Scotland's Digital Technologies Sector Analysis, Draft Report, Ekosgen, 2016.

82 Ekosgen Scotland's Digital Technologies Sector Analysis, Draft Final Report for Skills Development Scotland 2016.

83 Scottish Funding Council 2016.

84 Digital Economy Business Survey 2014.



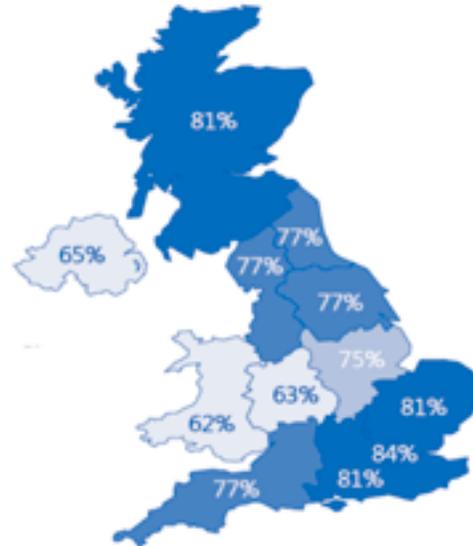
## BASIC DIGITAL SKILLS

According to study conducted by Ipsos MORI which examined digital capabilities across the UK, Scotland has one of the highest percentages of adults with basic digital skills.<sup>85</sup> 81% of adults in Scotland reported having basic digital competency. Individuals were classed as having basic digital skills if they reported being competent in all five basic digital skills areas, including: managing information, problem solving, communicating, creating, and transacting.

However, certain demographic groups in Scotland are less confident in carrying out online activities. Among those that have internet access, a lower proportion of adults in social housing were very or fairly confident in their ability to perform a variety of online activities than those in private rented housing. Those aged over 60 and those on incomes between £10,000-£20,000 consistently reported being less confident than average across all activities.

<sup>85</sup> Basic Digital Skills, UK Report 2015, Ipsos MORI for Go ON UK, in association with Lloyds Banking Group.

**FIGURE 4.2.3**  
Percentage of adults with basic digital skills across the UK regions.



Source: Basic Digital Skills Tech Tracker 2015.

**81% OF ADULTS IN SCOTLAND REPORTED HAVING BASIC DIGITAL COMPETENCY.**

**FIGURE 4.2.4**  
Confidence in pursuing activities when using the internet by tenure.

Adults who make personal use of the internet	Owner occupied	Social rented	Private rented	Other	All
Send and receive e-mails	93	86	95	*	92
Use a search engine	96	92	99	*	96
Shop online	88	77	91	*	87
Use public services online	86	69	89	*	84
Identify and delete spam	83	73	88	*	83
Be able to tell what websites to trust	80	73	88	*	81
Control privacy settings online	74	74	85	*	76
<i>Base (minimum)</i>	<i>1,470</i>	<i>390</i>	<i>310</i>	<i>20</i>	<i>2,190</i>

Source: Scottish Household Survey 2015



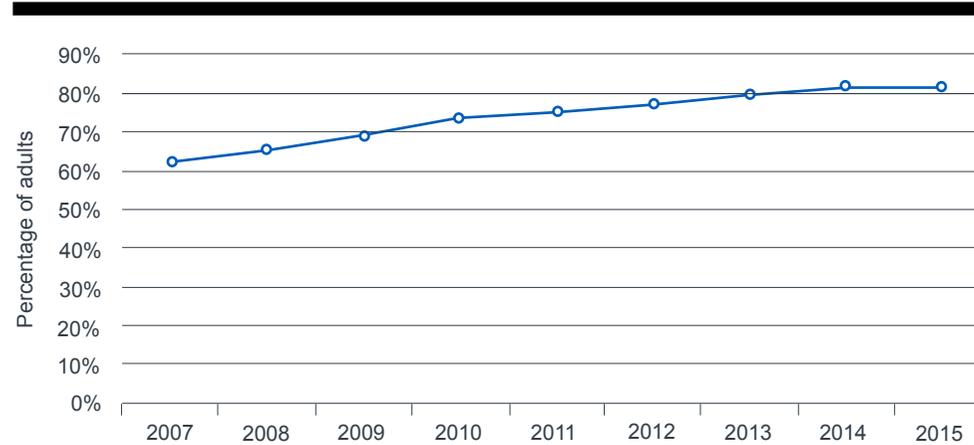
### 4.3 A DIGITAL SOCIETY

In 2015, 81.9% of adults reported using the internet outwith work, an increase of 19.2 percentage points from 2007.

Although Scotland as a whole has high rates of internet use, this is strongly linked to age and household income. In 2015, 96.5% of 16-24 year olds used the internet, compared to 68.7% of 60-74 year olds and under a third of people aged 75 and older. Since 2007, the proportion of people making use of the internet has increased across all age groups. Those aged 60-74 have seen the greatest increase. However, internet use by age is expected to improve over time as young people, who are the primary users, transition into older age groups.

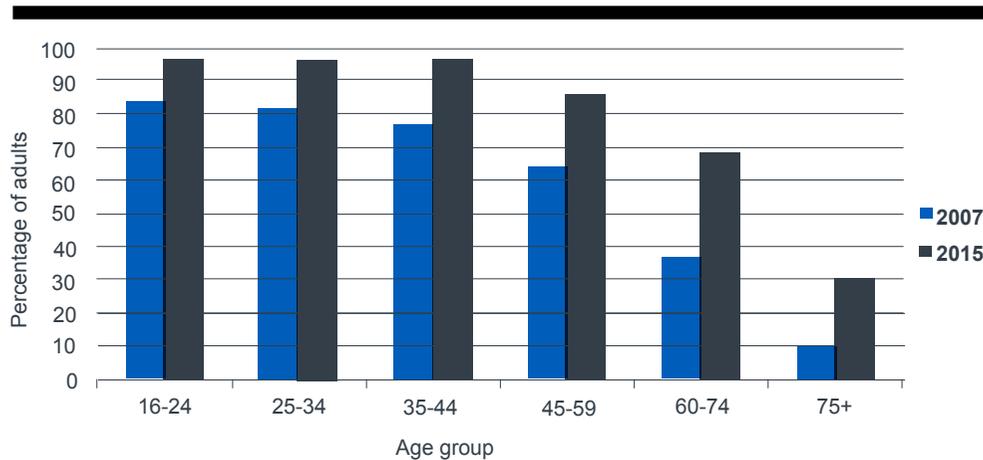
**ALTHOUGH SCOTLAND AS A WHOLE HAS HIGH RATES OF INTERNET USE, THIS IS STRONGLY LINKED TO AGE AND HOUSEHOLD INCOME.**

**FIGURE 4.3.1**  
Percentage of adults using the internet for personal use.

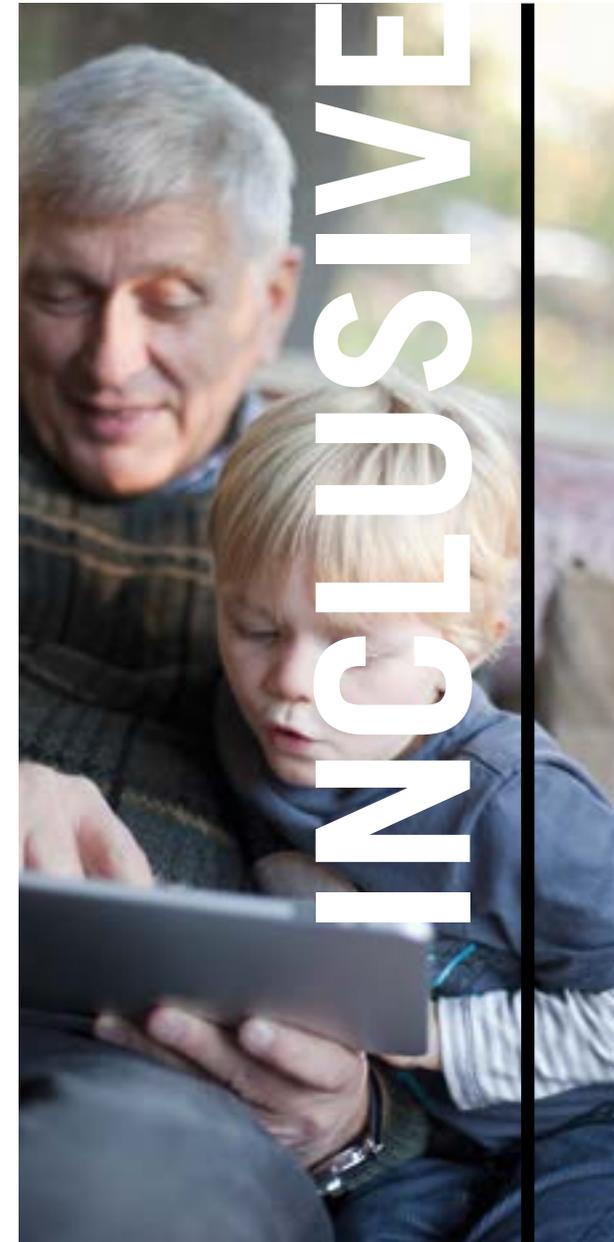


Source: Scottish Household Survey.

**FIGURE 4.3.2**  
Percentage of adults using the internet by age.



Source: Scottish Household Survey.

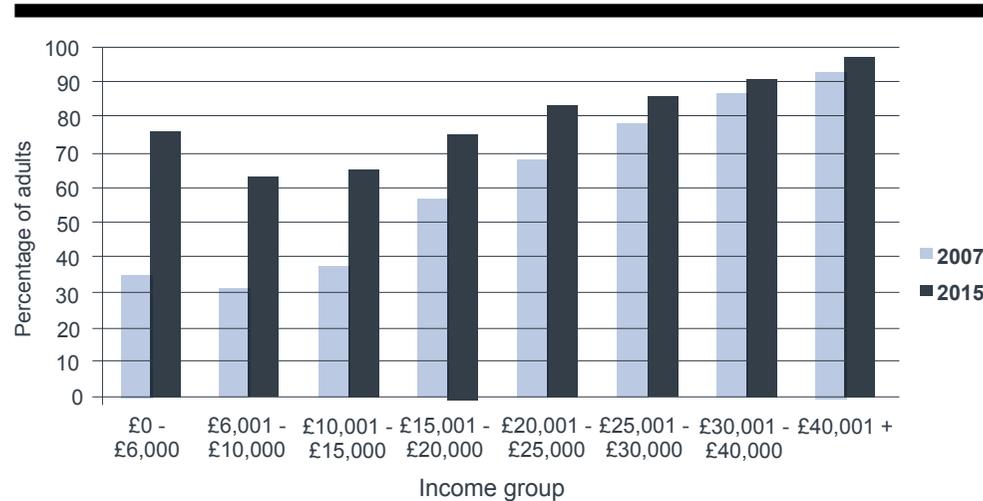




In addition, there is a positive relationship between internet usage and household income, although a break in the pattern for income bracket £6,001-£10,000 is present. This is because students are overrepresented in the lowest income bracket of below £6,000, and are very likely to have internet access at home. The gap in internet usage between households within the lowest and highest income brackets has decreased from 58% in 2007 to 21% in 2015.

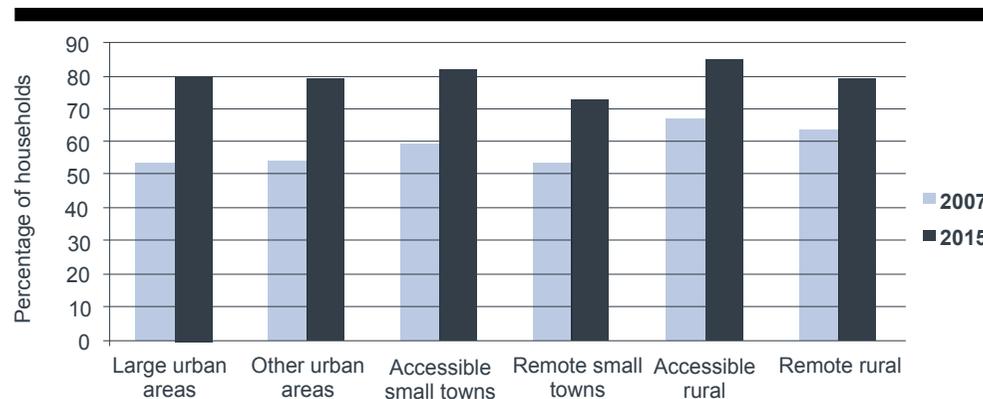
The proportion of households with home internet access is highest in accessible rural areas at 85% (Figure 4.3.4). Internet take-up within urban and rural areas is broadly similar. However, there are differences between local authority areas, with 89% of premises in Edinburgh and East Dunbartonshire having home internet access, compared to 73% in Glasgow.

**FIGURE 4.3.3**  
Percentage of adults using the internet by annual household income.



Source: Scottish Household Survey.

**FIGURE 4.3.4**  
Households with home internet access by urban/rural classification.



Source: Scottish Household Survey.

#### 4.4 THE DIGITAL ECONOMY

The Digital Economy Maturity Index segments businesses in Scotland according to their level of digitalisation.<sup>86</sup> The index is based on four aspects of digital technologies: adoption, usage, benefits, and skills.

The vast majority of Scotland's businesses are classed within the second lowest or middle maturity segments, basic browsers (38%) and tentative techies (30%). Businesses classified within these segments tend to have broadband access and adopt a few digital technologies, such as a website and mobile technologies. However, they tend to lag behind in the adoption of more advanced technologies, such as cloud computing and management software. Such businesses are likely to not see the full potential of how technologies can benefit the business.

Only 3% of Scottish businesses were classed as digital champions. These businesses are among the most likely to have adopted next generation broadband access, tend to have a digital strategy, and use digital technologies extensively.

<sup>86</sup> Digital Economy Maturity Index, 2014.

**FIGURE 4.4.1**  
Scotland's Digital Economy Maturity Index, 2014.

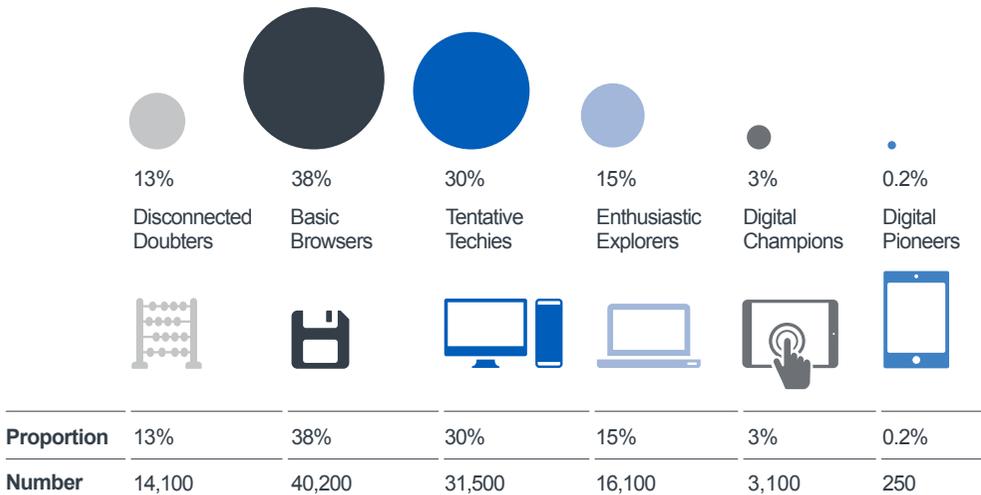


Figure 4.4.2 demonstrates the general characteristics of businesses that were classed within the highest and lowest digital maturity segments. Businesses within the 'disconnected doubters' segment tend to be small, have little growth expectations, and lower annual turnover compared to other segments. Comparatively, businesses classed as 'digital champions' tend to be medium sized, expect to grow, export and have a higher annual turnover.

**THE VAST MAJORITY OF SCOTLAND'S BUSINESSES ARE CLASSED WITHIN THE SECOND LOWEST OR MIDDLE DIGITAL MATURITY SEGMENTS.**

**FIGURE 4.4.2**  
Business characteristics of digital maturity segments.

Characteristic	Disconnected Doubters	Digital Champions
<b>Size</b>	Small and micro businesses are overrepresented in this segment.	Medium businesses are overrepresented in this maturity segment.
<b>Sector</b>	Wholesale/retail, agriculture and construction sectors are overrepresented in this segment	Transport/Communications, Manufacturing and other services are overrepresented in this segment.
<b>Age</b>	Are often over 10 years old (84%).	Are often between 3-10 years old (48%).
<b>Growth Expectations</b>	Expect to stay about the same size in the coming year (62%).	Expect to grow moderately (50%) or expect to grow substantially (22%) in the next 12 months.
<b>Turnover</b>	Relative to other segments tend to have an annual turnover of less than £100,000 (37%).	Tend to have an annual turnover of more than £250,000 but below £1million (31%).
<b>Export</b>	Tend not to export (5%).	Tend to be exporters.
<b>Adoption of digital</b>	Tend to have adopted one technology - either website or mobile technologies.	Tend to have adopted most of the six technologies.
<b>* All percentage figures throughout exclude don't knows</b>	16%	100%                      98%                      98%                      94%                      82%                      81%

Source: Digital Economy Maturity Index 2014.



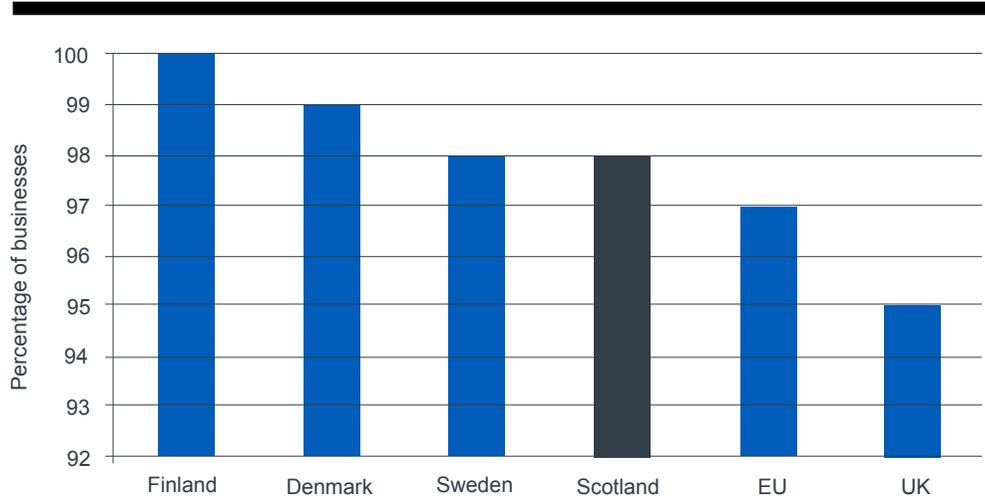
The vast majority of businesses in Scotland have access to internet connection. Figure 4.4.3 demonstrates that 98% of Scottish businesses have internet access, compared to 95% within the UK and 97% across the EU. In addition, internet access across smaller Scottish businesses is high. 94% of small and medium enterprises reported having access to the internet for work in 2015.<sup>87</sup>

Figure 4.4.4 demonstrates that although a greater proportion of Scottish businesses have a website than the UK and the EU average, Scotland tends to perform worse on the use of more advanced digital business tools, including Enterprise Resource Planning, Customer Relationship Management and Supply Chain Management.

In addition, a Lloyds survey of small businesses and charities ranked Scotland with a digital index score of 57, compared to the UK average of 54.<sup>89</sup> 23% of Scottish businesses surveyed reported using digital to trade overseas, in comparison to 21% in the UK. Moreover, 51% actively create social media communications which is 6% higher than the UK average.

87 Small Business Survey Scotland 2015.  
89 UK Business Digital Index 2016.

**FIGURE 4.4.3**  
Proportion of businesses with internet access, 2014.<sup>88</sup>



Source: Eurostat, Digital Economy Business Survey.

**FIGURE 4.4.4**  
Business use of digital tools, 2014.<sup>88</sup>

Rank	Businesses with a website (%)		Businesses using Enterprise Resource Planning (%)		Businesses using Customer Relationship Management (%)		Businesses using Supply Chain Management (%)	
1	Finland	95	Sweden	43	Denmark	28	Denmark	26
2	Denmark	91	Denmark	42	Norway	28	Finland	21
3	Sweden	89	Finland	39	Sweden	26	EU	17
4	<b>Scotland</b>	<b>87</b>	EU	31	UK	22	Sweden	13
5	UK	80	UK	12	<b>Scotland</b>	<b>19</b>	UK	13
6	EU	74	<b>Scotland</b>	<b>6</b>	EU	18	<b>Scotland</b>	<b>8</b>

Source: Eurostat, Digital Economy Business Survey.

88 A different questionnaire was used in Scotland compared to the EU so results are not directly comparable. EU data only includes businesses with 10 or more employees, thus the Scottish data sample is weighted to improve comparability between datasets.

## SCOTLAND'S DIGITAL SECTOR<sup>90</sup>

The digital sector in Scotland has experienced strong growth in recent years, providing an important source of employment and contributing to wider economic growth. The digital sector definition used consists of the service side of digital, including telecommunications, consulting and programming activities, as well as manufacturing of digital infrastructure and related equipment.

### THE DIGITAL SECTOR IN SCOTLAND HAS EXPERIENCED STRONG GROWTH IN RECENT YEARS.

90 In this context we are defining the digital sector by the following Standard Industry Classification (2007) Codes: 26.1, 26.2, 26.3, 26.4, 26.8, 46.5, 58.2, 61, 62, 63 (apart from 63.9) and 95.1.



## ENTERPRISES

- > The number of registered enterprises in Scotland's digital sector was 9,200 in 2016, making up 5.3% of all enterprises in Scotland.<sup>91</sup>
- > The number of digital enterprises increased by 8.2% from the previous year and by 46% since 2009.

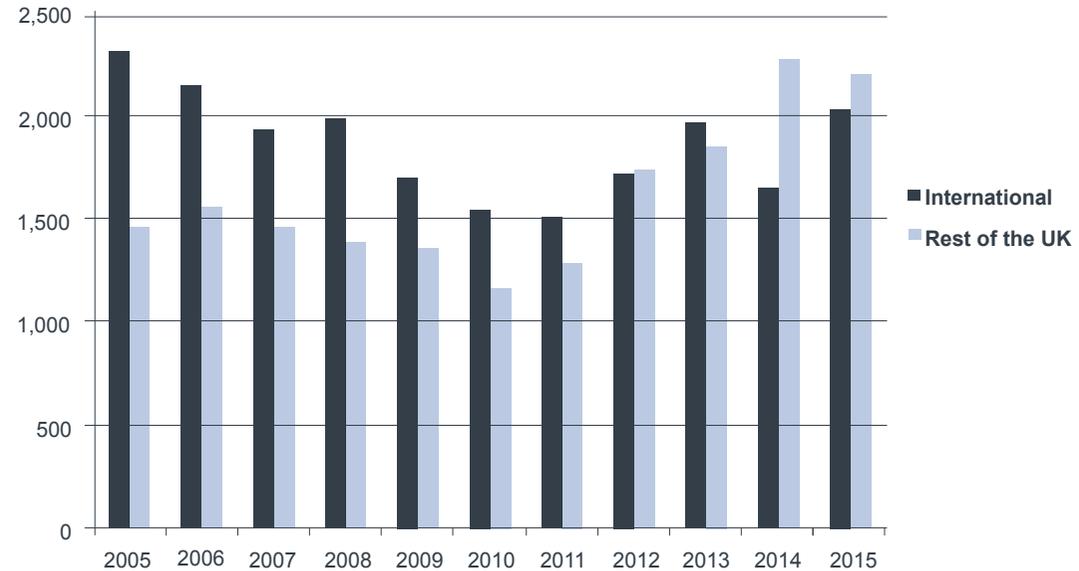
## GROSS VALUE ADDED (GVA)

- > GVA was approximately £4.45 billion for the Scottish digital sector in 2014.
- > Digital sector GVA increased at a greater rate than the Scottish economy, at almost 8% between 2008-14.
- > Digital sector GVA per job was £78,001 in 2014, an increase of approximately 2.5% since 2008.<sup>92</sup> This is significantly higher than the Scottish average GVA per job of £48,928.

## EMPLOYMENT AND EARNINGS

- > Employment in the digital sector was 64,100 in 2015, accounting for 2.5% of total Scottish employment.<sup>93</sup>
- > Digital sector employment has grown by 2.7% between 2009-15. This is primarily driven by an increase in professional and skilled trade occupations.<sup>94</sup>
- > Females made up 19.4% of employees within the digital sector in 2015. 10.6% of digital sector employees worked part-time, compared to 31.7% for the whole of Scotland.<sup>95</sup>
- > In 2016, gross median weekly earnings in the digital sector were £598, almost 12% higher than the Scottish average of £535.<sup>96</sup>
- > 8% of employees in the digital sector earned less than the living wage in 2016, compared to 20.1% for the whole of Scotland.<sup>97</sup>

**FIGURE 4.4.5**  
Scottish Exports (£ millions) for the digital sector.



Source: Exports Statistics Scotland 2015.

## EXPORTS

In 2015, digital sector international exports were £2.04 billion, 7% of Scotland's total international exports. The digital sector's exports to the rest of the UK were £2.2 billion, making up 4.4% of aggregate Scottish exports to the rest of the UK.<sup>98</sup>

Figure 4.4.5 demonstrates that although digital sector exports to the rest of the UK have declined slightly between 2014-15, international exports have increased by approximately 23% over the same period.

<sup>98</sup> Exports Statistics 2015.

<sup>91</sup> Inter-departmental business register, ONS.

<sup>92</sup> Annual Business Survey and Annual Survey of Hours and Earnings, ONS.

<sup>93</sup> Business Register and Employment Survey.

<sup>94</sup> Business Register and Employment Survey and Annual Population Survey, ONS.

<sup>95</sup> Annual Population Survey.

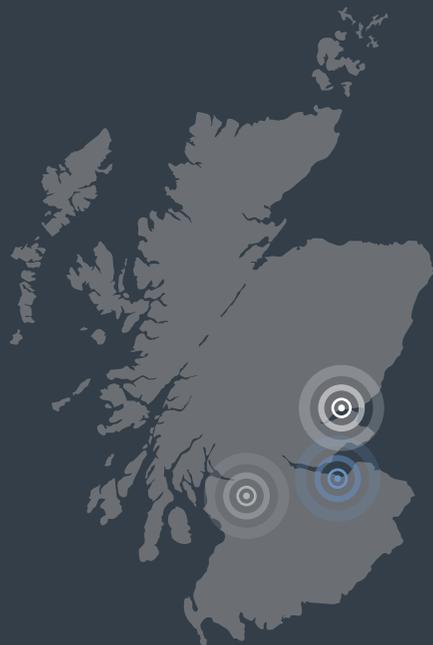
<sup>96</sup> Annual Survey of Hours and Earnings.

<sup>97</sup> Covers employees age 18+ on the PAYE system on adult rates and whose pay was not affected by absence. Hourly earnings excludes any overtime payments. The living wage is based on a rate of £8.25 per hour.



## DIGITAL CLUSTERS AND SPECIALISATION WITHIN SCOTLAND<sup>99</sup>

DIGITAL TECHNOLOGY CLUSTERS ARE GEOGRAPHICAL CONCENTRATIONS OF DIGITAL BUSINESSES THAT SPECIALISE IN PARTICULAR AREAS OF DIGITAL TECHNOLOGIES. SCOTLAND IS THE HOME TO THREE MAIN DIGITAL CLUSTERS: EDINBURGH, GLASGOW AND DUNDEE. THE INFORMATION BELOW HAS BEEN EXTRACTED FROM THE 2016 TECH NATION REPORT.



### EDINBURGH

Edinburgh is Scotland's leading digital cluster, with key strengths in financial technology (fintech), cyber security, digital marketing and advertising and cloud computing. Edinburgh is also the birthplace of billion dollar companies such as Skyscanner and Fanduel.

- > Digital businesses make up 18% of all businesses in Edinburgh.<sup>100</sup>
- > GVA grew by 58% between 2010-14.<sup>101</sup>
- > Digital employment has increased by 23% between 2011-14.<sup>102</sup>
- > Turnover increased by 48% between 2010-14.<sup>103</sup>
- > The majority of digital businesses cited access to local networks and commercial property as key benefits for locating in Edinburgh.<sup>104</sup>
- > 47% of digital businesses reported that limited talent supply would be a future challenge.

### GLASGOW

Glasgow is an incubator for digital start-ups, with specialities in social networks, e-commerce and fintech.

- > Digital businesses make up 18% of all businesses in Glasgow.
- > GVA grew by 45% between 2010-14.
- > Turnover increased by 42% between 2010-14.
- > Digital jobs increased by 13% between 2011-14.
- > The key benefit from locating in Glasgow were cited as access to commercial property.
- > Limited access to finance and weak digital infrastructure were reported to present challenges by 55% and 48% of businesses, respectively.

### DUNDEE

Dundee is best known for its prominent gaming industry and is home to the internationally recognised Grand Theft Auto. Dundee also has strengths in app and software development, as well as online gambling.

- > Digital businesses make up 16% of all businesses in Dundee.
- > GVA grew by 42% between 2010-14.
- > Turnover increased by 129% between 2010-14.
- > Productivity, measured by sales per worker, increased by 67% between 2010-14.

99 TechNation 2016, Transforming UK industries.

100 Annual Business Survey/ Business Structure Database.

101 Annual Business Survey

102 Annual Population Survey

103 Annual Business Survey/Business Structure Database

104 Tech Nation Survey 2016



## 4.5 PUBLIC SERVICE REFORM

The use of online public services in Scotland has increased over time. The percentage of internet users reporting having used government websites increased from 50% in 2007 to 64% in 2014.<sup>105</sup> The most common reason for accessing public services online is to look up information and fill out forms. Furthermore, the majority of users agreed that online public services are easy to use and helped them save time and money.

The transition to increased delivery of public services online may enhance accessibility of services to rural and isolated communities and those with mobility difficulties. However, as only 59% of Scottish households with an income of £15,000 per year or less have home internet access marginalised groups may become more excluded from public services.<sup>106</sup>

Resilient digital technologies can enable the provision of cost-effective public services that are designed around the needs of users. Data and other forms of performance information also allow for continuous improvement of services.

### Cost Savings

Increasing collaborative ICT procurement has resulted in substantial monetary savings across our public bodies. The figures opposite demonstrate our year-on-year savings:<sup>107</sup>



**FIGURE 4.5.1**

Cost savings achieved through collaborative ICT procurement.

Year	2015/16	2014/15	2013/14	2012/13	2011/12
Savings	c. £54.4 million	c. £48.7 million	c. £46.3 million	c. £32.7 million	c. £23.4 million

### User Satisfaction

Figure 4.5.2 shows the percentage of online public service users that were satisfied with various aspects of public service delivery. 86% of users were satisfied with the overall quality of online public services.

**FIGURE 4.5.2**

Perception of using public service websites, 2015.

Accessing public services online helps me save time	89
Accessing public services online helps me save money	54
It is easier to access public services online than in person	78
I am satisfied with the ease of finding information on public services websites	81
Public services websites are easy to use	77
I am satisfied with the overall quality of the public services I have used online	86
<b>Base (minimum)</b>	<b>1,440</b>

Source: Scottish Household Survey 2015.

In addition, satisfaction amongst mygov users is high. Over a five month period from September 2015 to February 2016, approximately 73% of users were satisfied with the usefulness of the content.<sup>108</sup>

<sup>108</sup> Scotland's Digital Future – Delivery of public services strategy measurements and benefits reports, May 2016.

<sup>105</sup> Scottish Household Survey.

<sup>106</sup> Scottish Household Survey 2015.

<sup>107</sup> Scotland's Digital Future: Delivery of public services, phase one benefits update.



## 4.6 CYBER RESILIENCE

The increasing use of technology at home and at work means an increased risk of information, operations and finances being stolen, compromised or disrupted. Developing cyber awareness and resilience across Scotland is a key priority.

Figure 4.6 illustrates the security measures that people take to protect themselves when online. It is clear that some measures are used more widely than others, with two-thirds of adults indicating that they avoid opening emails or attachments from unknown people, whilst just under a third said they make sure their mobile phone has up-to-date antivirus software.

Use of the various online security measures varies by age, with those aged 60 and above generally less likely to adopt each of the measures than those in younger age groups. In addition, adults living in the 20% most deprived areas of Scotland were generally less likely than those in the rest of Scotland to adopt each of the security measures and more likely to say that they took none of the suggested actions.

**FIGURE 4.6**  
Online security measures by age and deprivation, 2015.

Adults	16-24	25-34	35-44	45-59	60-74	75 plus	20% Most deprived	Rest of Scotland	Scotland
Download and install software updates/patches when promoted	60	65	64	61	54	31	49	62	60
Avoid opening emails or attachments from unknown people	64	71	68	68	63	44	55	69	66
Use different passwords for different accounts	63	68	62	62	55	34	50	64	61
Set complex passwords	64	56	55	47	40	22	41	53	51
Change passwords for online accounts regularly	37	36	31	32	24	7	29	32	31
Avoid giving personal information online	67	67	65	65	62	50	54	67	65
Make sure my computer has up-to-date anti-virus software	42	40	36	28	20	6	32	32	32
Make sure my home wi-fi is protected with a user-name and password	58	61	64	58	55	28	45	61	58
Back-up important information	53	42	39	38	33	16	30	42	40
None of these	6	3	6	11	12	21	13	8	8
Base (minimum)	230	340	420	670	510	110	380	1,900	2,280

Source: Scottish Household Survey 2015.



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Any enquiries regarding this publication should be sent to us at  
The Scottish Government  
St Andrew's House  
Edinburgh  
EH1 3DG

ISBN: 978-1-78652-861-2 (web only)

Published by The Scottish Government, March 2017

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA  
PPDAS89533 (03/17)

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