

Digital solutions to the productivity puzzle

What could digital technology deliver for productivity growth?

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Background

“Digital skills can encourage innovation, boost productivity and deliver sustainable economic growth”

Nicola Sturgeon MSP, First Minister of Scotland

To make recommendations on how the successful utilisation of digital technologies could support the priority of improving productivity, SCDI and our partners ScotlandIS, the Royal Society of Edinburgh and BT Scotland have led a Digital and Productivity project. This has gathered evidence and involved discussions with representatives from across the Scottish economy. A Digital and Productivity Forum was organised to comment on commissioned research, case studies and proposals to improve productivity in Scotland's public and private sectors.

Discussions for SCDI's recently published policy Blueprint¹ have highlighted that digitalisation is a key priority across the Scottish economy and this project has also informed its recommendations. Participants in the Forum are listed opposite:

Tim Barraclough	Scottish Courts and Tribunals Service	Shonaig Macpherson CBE	BT Scotland
Ian Blewett	Scottish Enterprise	Prof. Donald MacRae OBE	Bank of Scotland
Lucille Brown	Scottish Cities Alliance	Ross Martin	SCDI
Atanas Christev	Heriot Watt University	Lindsay McGranachan	CGI
Jamie Coleman	CodeBase	Gordon McGuinness	Skills Development Scotland
Colin Cook	Scottish Government	John McLaren	Fiscal Affairs Scotland
Mark Dames	BT Scotland	Donald McLaughlin	CISCO
Suzanne Dawson	Interface	Alexandra Miller	The National Library of Scotland
Craig Denham	Royal Society of Edinburgh	Jane Morgan	Scottish Government
Gerry Docherty	Smarter Grid Solutions	Bristow Muldoon	Royal Society of Edinburgh
George Dodds	NHS Health Scotland	Vicki Nash	Ofcom
Robert Emmott	Comhairle nan Eilean Siar	Mike Neilson	Scottish Government
Michael Fourman FRSE	Royal Society of Edinburgh	Patrick O'Shaughnessy	VisitScotland
Danny Gallacher	The City of Edinburgh Council	Alastair O'Brien	ScotlandIS
George Hazel	Scottish Enterprise	Ian Osborne	KTN UK
Phil Hill	Scottish Environment Protection Agency	Freya Perez	Scottish Enterprise
Tommy Laughlin	ScotlandIS	Matthew Revett	Grayling Public Affairs
Stuart Mackinnon	FSB Scotland	Caroline Stuart	Oracle Scotland
Gemma MacNaught	Scottish Social Services Council	Caroline Thomson	Virgin Media
		Gareth Williams	SCDI
		Bob Yuill	SAOS

Key Recommendations

- Infrastructure:**
 - Everyone should have access to a minimum broadband speed of 10Mbit/s and 4G mobile coverage, and, after the current programmes, ultrafast broadband at 500Mbit/s and 5G mobile should be rolled out by 2025. Should there be market demand, this ambition should be raised to 1Gbit/s for key economic locations
- Business Transformation**
 - Digital should become integral to overall strategy and delivery in government, business and public services to capture the productivity gains (such as deeper understanding and engagement with customers) which can only happen if business models change, services are redesigned and if there is an understanding of the technology and leadership at the most senior levels
 - The first Chief Digital Officer for Scotland should be appointed to progress Digital Scotland development from infrastructure to economic growth and public service improvements
 - Chief Digital Officers should be appointed in all public bodies
 - The Scottish Government's Digital Transformation Service should be mandated to work with all public bodies and not just central government
 - Scotland should have clear targets (measured in 2017 and 2020) to develop businesses towards the upper end of the Digital Economy Maturity Index. The aiming point should be for all businesses in Scotland to be at "Enthusiastic Explorer" level or above
 - The role of the Digital Scotland Business Excellence Partnership (DSBEP) should be enhanced (or a new Digital Scotland group created) to identify and drive where smart utilisation of digital technology can increase productivity across all sectors and sizes of business (whether private or public sector)
 - Digital Champions should be appointed to all of Scottish Enterprise's Industry Leadership Groups and more businesses should be encouraged to consider appointing Chief Digital Officers
- A Scottish Productivity Commission, modelled on the international best practice such as those in Australia and New Zealand, should provide independent research, advice and performance monitoring to government and all sectors, under the direction of the Council of Economic Advisers
- Data:**
 - Government, following widespread consultation, should develop a long-term framework which allays public concerns about data sharing and encourages an open, joined-up and industry-friendly approach by public bodies
 - A lead partner should be appointed to make recommendations on access and utilisation across data streams to drive productivity and innovation
 - More open innovation forums should be established where anonymised data on challenges can be analysed by industry and solutions developed
- Skills:**
 - The national shortage of Computer Science teachers should be addressed with action to recruit, train and continually develop specialist teachers. The attractiveness of teaching careers, resources and profile of computer science should be raised so that the curriculum can be fully delivered, more young people study the subject and the gap in performance with leading countries closed
 - Digital should be infused into teacher training and in-service CPD for every teacher to pass skills to the next generation as developing a digital literacy for all should be integral throughout the Curriculum for Excellence
 - Work-based skills development should be strengthened to capture the potential productivity gains from digital technologies by ensuring that staff have the range of coinciding digital, analytical and 'soft' skills, for example through 'super users' in SMEs and the wider use of the Scottish Union Learning course on basic digital skills

Our Approach – Adding Value to Digital Scotland²

The Scottish Government has a vision, shared by a wide range of partners in the private, public and voluntary sectors, for Scotland to be a world-class digital nation by 2020. Partners, including members of the Steering Group, are working together in a coordinated and comprehensive approach in delivering a wide variety of programmes and projects on the four main themes of Connectivity; Digital Economy; Digital Public Services; and Digital Participation. Digital Scotland is a key part of Scotland's Economic Strategy, the Scottish Government's over-arching framework for increasing competitiveness and tackling inequality in Scotland.³ The National Performance Framework, which measures and reports on progress of government in Scotland in creating a more successful country, with opportunities for all to flourish through increasing sustainable economic growth.⁴

This Digital and Productivity report seeks to add value to the ongoing Digital Scotland approach. We believe that there is a clear and positive role for non-governmental organisations in creating and championing thought leadership for what is achievable, and in making positive recommendations to government and all sectors on a route-map. Influencing thinking and practice in businesses and public services, so that by 2020 Scotland is world-class in taking advantage of all the digital opportunities, is as much our objective as influencing government policy in Scotland.

This report seeks to build on the ICT Forum for Scotland, a short-life working group which examined exploitation of digital technologies following the first generation of broadband infrastructure development in its 2008 report Unlocking ICT's Potential to Boost Scotland's Economic Growth.

A recent report on the impact of digitalisation suggests that if Scotland became a world leader in digital it would lead to an increase in GDP of £13bn⁵ by 2030, compared to £4bn if Scotland were to experience only incremental improvements, with 99% of the population online, 75% of business selling online and a range of social benefits, particularly on health and education outcomes.

1. SCDI (2015), From Fragile to Agile: A Blueprint from Growth and Prosperity <http://www.scdi.org.uk/publications/reports-and-analysis/591-blueprint-2015-from-fragile-to-agile>

2. <http://www.gov.scot/Topics/Economy/digital>

3. <http://www.gov.scot/Topics/Economy/EconomicStrategy>

4. <http://www.gov.scot/About/Performance/purposestratobj>

5. http://www.scottishfuturetrust.org.uk/files/publications/Impact_of_digitalisation_in_Scotland.pdf

Productivity research

“We are on the verge of a boom once business gets used to new digital technology.”

Jamie Coleman, Director, CodeBase

Increasing productivity is seen as crucial to long-term economic growth and higher living standards in Scotland. Following the financial crash, productivity growth has been exceptionally weak in the UK and Scotland. Why this should be is not known for sure – this is the Productivity Puzzle. However, it seems likely that weak implementation of innovation, particularly digital technologies, is a factor.⁶

The steering group has gathered evidence on the links between digital and productivity; however, there was little information on the current and potential impact of digital on productivity specific to Scotland. The group commissioned John McLaren, a leading economist and commentator, to provide economic analysis for the Forum roundtables and inform the discussions.⁷

Key messages from the research paper are:

- Productivity, and its rate of growth, is a key measure of economic success
- Within the overall measure, multi-factor productivity (MFP) is a key element as it picks up the role of innovation and new practices in improving output
- Scotland has suffered less than the UK but has still performed poorly versus its pre 2007 record
- One of the key drivers of productivity in recent decades has been the on-going impact and rollout of new ICT developments and this is likely to continue
- While there is a crucial role to be played by invention and innovation as sources of productivity growth, there is an even greater role played by assimilation and ‘catching up’ by companies who are not at the forefront of technological progress.

The economic historian Nick Crafts⁸ has analysed the Scottish position and highlighted the lack of diffusion and low share of ‘innovation active’ businesses, which he sees as a key shortfall. Crafts believes that it is much better to incentivise innovation than to provide investment subsidies and that diffusion of innovation matters more than original invention, which can be imitated from elsewhere.

Digital technologies can diffuse innovation more rapidly through an economy and facilitate competition from innovative young companies or companies from overseas, displacing less productive businesses. Most important sources of innovation come from the market – from customers, citizens, suppliers and competitors – as a system of dynamic interactions between people and organisations.⁹ To innovate, companies are reaching beyond the boundaries of their own organisation to leverage these capabilities. Because digital technology enables many new problem-solving processes and novel ways of sharing ideas, technological tools are an essential enabler of these new practices.

New innovation communities represent networks of users, experts, activists and individuals – inside and outside firms – collaborating to create new customer and citizen value. This exploits diversity of supply to address diversity of demand. For business, this means re-defining the boundaries between customers and producers; for government, re-framing the contract between citizen and state.¹⁰

Digital is a major contributor to productivity growth and productivity is growing for those companies on the leading edge of technology. The development of new technology and connectivity led to increased productivity, and for 1995-2000, the ICT Forum¹¹ stated that ICT capital accounted for 47% of productivity growth in the UK and contributed up to 50% of the growth in GDP of many European countries. While, in other European countries the ICT contribution to productivity is still leading to growth, in the UK it has recently fallen significantly.¹²

Some believe that productivity growth will continue to stagnate. Others consider that the economy is at an inflection point following the recession and the onset of the move to digital, and that, following the deployment phase, productivity will be unleashed. They pointed to the emergence of many disruptive technologies, which mean that traditional business must “get digital or die”, and to automation. Examples include Mobility as a Service companies such as Uber. For digital innovators, there are opportunities for productivity improvements and increased profitability.

With regard to the future role of ICT, and in particular digital services, there are a number of reasons to consider that this route can deliver further improvements to productivity performance. The impact of ICT on U.S. performance continues to outstrip that seen in Europe, which suggests that there may still be scope for catch up. This improvement could come from ICT investment, management structures, skill levels or a combination of each. Realising the full potential from ICT investments requires organisational redesign. U.S. firms are better at employing management techniques that can facilitate such transformation.¹³ OECD¹⁴ analysis suggests that the contribution of ICT-using sectors – such as Retail & Wholesale, Finance & Real Estate and Other Business Services – to overall productivity growth rose significantly in the United States over the 1995-2009 period. This was much less evident in most European economies.

The post-recession collapse in the UK of productivity, both in absolute terms and relative to other countries, suggests that digital is a key area on which to concentrate. It is also the area most affected by the impact of innovation and re-organisation, both in terms of leading companies forging ahead and of the diffusion of new techniques to lagging companies. A lack of analysis on productivity data, and in particular, breakdowns by factor such as digital, in Scotland was identified by the research and participants in the Forum. Though there is sectoral breakdown for ICT, this is specific to the digital service companies and does not reflect the full impact of digital across all sectors. Furthermore, the data may fail to capture¹⁵ the impact of digital on GDP and other economic statistics.

Recommendations

- A Scottish Productivity Commission, modelled on the international best practice such as those in Australia and New Zealand, should provide independent research, advice and performance monitoring to government and all sectors, under the direction of the Council of Economic Advisers
- Digital should become integral to overall strategy and delivery in government, business and public services to capture the productivity gains (such as deeper understanding and engagement with customers) which can only happen if business models change, services are redesigned and if there is an understanding of the technology and leadership at the most senior levels.

6. <http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q201.pdf>

7. John McLaren, Productivity Briefing Note.

8. Crafts, ‘What Kind of Supply-Side Policy for the UK? What Implications for Scotland’, David Hume Institute, <http://www2.warwick.ac.uk/fac/soc/economics/staff/nfrcrafts/craftshume.ppt>

9. Mark Dames et al, Beyond open innovation: leveraging social capital, Proceedings of FITCE Congress 2008

10. Mark Dames et al, Innovation 2.0: Redefining Boundaries Between Producers and Consumers, The Journal of The Institute of Telecommunications Professionals • Volume 1 Part 2

11. ICT Forum for Scotland progress update, Scottish Government, December 2008

12. OECD: The Future of Productivity, <http://www.oecd.org/economy/the-future-of-productivity.htm> 2015

13. <http://www.itif.org/publications/2014/06/02/raising-european-productivity-growth-through-ict>

14. OECD: The Future of Productivity, <http://www.oecd.org/economy/the-future-of-productivity.htm> 2015

15. <http://blogs.ft.com/the-exchange/2015/08/20/12630/>

Digital infrastructure

“Access to the Internet shouldn’t be a luxury; it should be a right. Just as our forebears effectively brought gas, electricity and water to all, we’re going to bring fast broadband to every home and business that wants it.”

David Cameron MP, UK Prime Minister

Scotland’s Economic Strategy³ highlights in relation to digital technologies that these are increasingly critical in the day-to-day operations of businesses and households across Scotland, and in improving access to public services across Scotland’s more remote regions. A key part of the Economic Strategy will be delivery of a future-proofed infrastructure that will establish world-class digital connectivity across the whole of Scotland by 2020. The availability of Next Generation Broadband in Scotland has increased significantly since 2011, from 41% of premises to 85% in 2015,¹⁶ meeting the Scottish Government target; however, there is a need for further improvements in coverage and uptake.

The Scottish Government and its partners are investing in the Digital Scotland Superfast Broadband (DSSB) programme to extend superfast broadband infrastructure into areas which are not being reached by the market alone, such as parts of rural Scotland. In the Highlands premise coverage will increase from 4% to 84% in three years. Further investment has been announced in digital infrastructure in the draft Scottish Budget 2016-17.

As a result, at least 95% of premises across Scotland will be able to access fibre broadband by the end of 2017. The UK Government has pledged that by 2020 all premises will have access to a minimum broadband speed through the introduction of a Universal Service Obligation (USO) of 10 Mbps.¹⁷

Ofcom is undertaking a strategic review of digital communications. Since its last review, ten years ago, speeds have increased markedly and unforeseen or underutilised technologies have become the norm. With this new technology comes expectation and Ofcom notes that for premises coverage, Scotland has only 73% superfast broadband access,¹⁸ the worst in the UK, and 4G coverage at 79.7% is much less than the UK average. However, take-up for broadband is similar to the UK level and for 4G is the greatest for all the UK nations. Significantly, those premises without access to superfast broadband include 45% of SMEs¹⁸ due to their propensity in rural areas and in urban not-spots.

Smartphone ownership now dwarfs that of PCs with people buying phones every 2 years and this is now driving the online market as people expect to connect at all times and in all places.

Competitive digital connectivity will support higher productivity growth, innovation and internationalisation in Scotland’s cities, towns and rural communities, including the potential development of a network of TechHubs in them. For rural areas, the development of secure business cloud technology, video conferencing and mobile technology will significantly increase opportunities to live, work and grow businesses. There are potential solutions to address current gaps in coverage in them. For example, SCDI has members in the aquaculture sector which would be happy to consider hosting masts both to meet their own needs and to support the communities in which they operate. With the new broadband infrastructure in place, this would help to achieve coverage in some of the most remote areas of Scotland, including coastal areas and sea lanes.

Cyber-crime presents a great threat to the Scottish economy and action must be a strategic priority for government, businesses and public services. There is an urgent need to improve security systems at key industrial sites and for key infrastructure to protect sources of productivity and intellectual property in universities and sites of research and development to protect sources of innovation. This is a global challenge for which many are underprepared and taking a lead will create export opportunities for cyber security services and skills.

Recommendation

Everyone should have access to a minimum broadband speed of 10Mbit/s and 4G mobile coverage, and, after the current programmes, ultrafast broadband at 500Mbit/s and 5G mobile should be rolled out by 2025. Should there be market demand, this ambition should be raised to 1Gbit/s for key economic locations.

16. <http://stakeholders.ofcom.org.uk/binaries/research/infrastructure/2015/downloads/cn15-scotland.pdf>

17. <https://www.gov.uk/government/news/government-plans-to-make-sure-no-one-is-left-behind-on-broadband-access>

18. <http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr15/scotland/>

Utilisation of Digital by Public Services

“If we don’t do anything the future is unaffordable”

George Dodds, NHS Health Scotland and Digital Champion

There are significant pressures on public services. The UK Government Spending Review outlined cuts of £20 billion¹⁹ to eliminate the deficit by 2019-20.²⁰ The Scottish Government will be required to make almost a 6% cut to its day-to-day budget by 2019-20. Both governments have identified digital as key to meeting public service challenges. Following its creation, the UK Government Digital Service has redesigned and digitised more than 20 key public services, driving down transaction costs and improving service quality for citizens. A specific priority for the Spending Review was how greater use of big data and digital technologies could drive the next stage of efficiency and reform across government. The Scottish Government’s draft Scottish Budget 2016-17 outlines plans to take steps to extend digital applications in public services and says that the digital agenda will both produce savings and improve the quality of services.

Many participants at the Forum recognised the capacity of digital to reduce costs and increase efficiency. How this could be accomplished would be key in times of austerity due to the upfront costs required to put systems in place that would lead to future savings.

While making time to develop policy for the future of services was a common theme, it was also pointed out that future thinking can stop immediate needs being addressed. It was recognised that policy needed to be outcome driven and decisions to improve business and services should lead to digital solutions.

Many participants stated that a culture shift was needed in the public sector and that leadership was the key that changed organisations. The Digital Champions²¹ Development Programme was cited as a means to encourage culture change and while this had been successful there was a need to widen the scheme to increase the outreach beyond those with digital knowledge.

Both private and public sector participants called for collaboration between the sectors to not only deliver online services but also plan and manage digitalisation in the public sector. Scottish Ministers at the National Economic Forum recognised the lack of public service digitalisation and as John Swinney MSP pointed out; “There are many more ways to interact online in the private sector than the public. I can do a repeat prescription online and that’s about it.”

Whereas the vision espoused in the eHealth Strategy for Scotland²² is to use fitness devices to monitor the nation’s health.

To drive the reforms, a Chief Digital Officer should be appointed, with a similar role to the Chief Scientific Advisor, who can have a foresight of trends, address immediate concerns and be a consumer champion. They should have a high profile, reporting to and advising the First Minister, and be able to challenge government, the public sector and industry at the most senior levels.

Recommendations

- The first Chief Digital Officer for Scotland should be appointed to progress Digital Scotland developments from infrastructure to economic growth and public service improvements
- Chief Digital Officers should be appointed in all public bodies
- The Scottish Government’s Digital Transformation Service should be mandated to work with all public bodies and not just central government

19. <https://www.gov.uk/government/topical-events/autumn-statement-and-spending-review-2015>
 20. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/447101/a_country_that_lives_within_its_means.pdf
 21. <http://www.gov.scot/Topics/Economy/digital/digitalservices/workforce/dgp>
 22. <http://www.gov.scot/Resource/0047/00472754.pdf>

Case Study

National Library of Scotland²³

The collection of the National Library contains more than 24 million items most of which can only be consulted physically by visiting the Library in Edinburgh.

The Library has been working to put more of these precious and useful items online and has announced ambitious plans to have a third of the collection in digital format by 2025.

This will provide free online access to anyone living in Scotland to the history and culture of the nation. It is part of the Library’s determination to use technology to make the knowledge held within the collection as widely available as possible.



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The National Library of Scotland is a registered Scottish Charity, Scottish Charity No. SC011086.

23. <http://www.nls.uk/digital-resources>



Utilisation of Digital by Private Sector

“Digital is absolutely fundamental for our economy and productivity growth”

John Swinney MSP, Deputy First Minister of Scotland

According to Ofcom,²⁴ whilst most Scottish businesses are satisfied with voice communications they are less satisfied with broadband service. Furthermore, over a third of Scottish SMEs do not feel confident in their ability to identify new communications products or services.

As part of the Digital Scotland work, the Scottish Government commissioned a Digital Economy Business Survey.²⁵

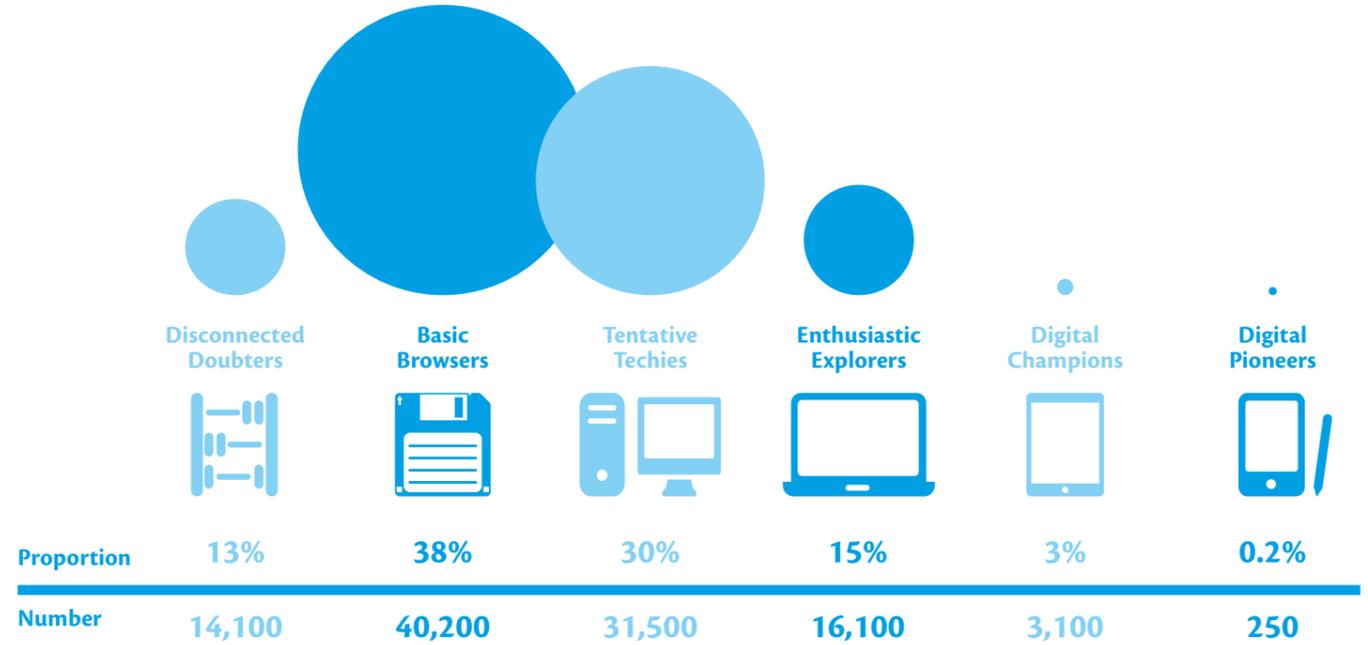
The key findings were published early in 2015 and included:

- 92% of businesses had access to a broadband connection
- The most widely adopted digital platforms and technologies were the use of a company website (73%), mobile technologies (64%) and using social media (53%).
- 71% of businesses that use digital technologies have used them to aid innovation.
- 75% of businesses stated that digital technologies are either essential or important for their current operations and future growth or competitiveness
- Overall, there is a desire amongst a majority of businesses that already use digital technologies to further develop their usage (77%).

However, the Digital Maturity Index²⁶ shows that most businesses are still not making full use of technology. It shows that only 18% of businesses are classified in the top three categories shown in Figure 1 and basic browsers still account for the largest proportion of the businesses surveyed.

24. Ofcom <http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr14/scotland/>
 25. <http://www.gov.scot/Topics/Economy/digital/digitaleconomy/businesssurvey-2014>
 26. <http://www.gov.scot/Topics/Economy/digital/digitaleconomy/DEMI>

Figure 1: Digital Maturity Index Source: Scottish Government



Utilisation may vary across sectors. For example, while digital connectivity, platforms and skills are key to the success of the Scottish tourism industry, of the 9000 businesses listed on visitscotland.com, 70% do not offer online bookings. To help the smaller tourist business get online, Digital Tourism Scotland was recently launched through the Scottish Enterprise portal.²⁷

Tech is a growth industry in its own right, while technologies are underpinning growth in all other industries.

The Forum noted that responsiveness to the customer is fundamental to making improvements in products and processes which create higher value output, but this is often overlooked. Scotland needs to aim to be a world-leading, customer-friendly and responsive nation. Digitalisation and data offer opportunities to do this more cost-effectively and accurately. However, there is a need for more leaders, managers and staff who understand, value and act on this information.

Digital specialists need to become integral to business strategy rather than support staff for technology infrastructure. Edinburgh University now includes digital in its MBA provision to ensure that graduates understand the importance of digital for business and marketing. This should be incorporated into all business courses, as digital marketing will drive productivity and is now essential.

A recent report commissioned by the FSB²⁸ pointed out the need for business to adapt to new technologies and that Scotland needs to develop new digital leaders. To enable SMEs to adapt, it suggests that owners of SMEs should look to use the expertise of younger people to teach them the digital skills and in return help them develop their business skills.

Participants in the Forum commented on the need to improve access to public data held by councils and government, while taking into account ownership and privacy issues. An extreme example was that data on traffic lights was considered private and could not be used for academic research.

Recommendations

- Scotland should have clear targets (measured in 2017 and 2020) to develop businesses towards the upper end of the Digital Economy Maturity Index. The aiming point should be for all businesses in Scotland to be at “Enthusiastic Explorer” level or above.
- The role of the Digital Scotland Business Excellence Partnership (DSBEP) should be enhanced (or a new Digital Scotland group created) to identify and drive where smart utilisation of digital technology can increase productivity across all sectors and sizes of business (whether private or public sector).
- Digital Champions should be appointed to all of Scottish Enterprise’s Industry Leadership Groups and more businesses should be encouraged to consider appointing Chief Digital Officers

27. <http://www.scottish-enterprise.com/services/develop-your-organisation/digital-tourism-scotland/overview>
 28. <http://www.fsb.org.uk/policy/rpu/scotland/assets/fsb%20scotland%20-%20disruption%20report%20-%20final.pdf>

Case Study

CodeBase

CodeBase is at the heart of the Edinburgh tech ecosystem and is the largest incubator in the UK. Many of its start-ups are exemplars on the use of digital to drive innovation and productivity.

Based at a disused government building it offers bespoke office spaces for 2 to 100 staff designed with tech start-ups in mind. It is a community of a diverse range of developers and entrepreneurs offering business-led peer support. It also acts as a focal point for local and international investors with track records in the tech industry.

Presently there are 62 start-ups which are due to grow to 80, with many success stories such as Fan Duel²⁹ which is now worth \$1 billion through developing online fantasy American sports. Many of the companies are able to export from the start due to their digital presence. Market entry can be harder in Scotland, particularly in the health service, due to approaches to procurement.

Innovate UK, the UK's innovation agency, has partnered with CodeBase, to invest up to £1 million in funding in Edinburgh's burgeoning digital media sector. The funding is being put in place to draw further investment and people into the city region, encouraging collaboration and networking to strengthen the cluster.

CodeClan,³⁰ the newly launched coding academy will have its first location in CodeBase.



29. <http://www.thisiscodebase.com/fanduel>
30. <http://codeclan.com/>

Case Study

Scottish Agricultural Organisation Society Limited (SAOS)

SAOS is a federal co-op providing development services to Scotland's farmers' co-ops including the largest dairy, meat, grain and vegetable businesses in Scotland worth a total of £2.3 billion. It develops and operates the ScotEID system that delivers tracing of individual livestock from birth to slaughter. It was set-up following the disastrous Foot and Mouth outbreak which led to pyres of livestock due to traceability at that time being slow, cumbersome and inaccurate.

ScotEID web enabled data systems provide real time access for farmers, livestock markets and abattoirs to record, check and refine information concerning livestock movement. Using ScotEID any animal moving through the supply chain with a suspected ailment can be found along with its cohorts, allowing for efficient eradication of infectious diseases. This has implications not only for livestock health but also on food security as movement of Scottish livestock is traced from farm to farm, through markets and eventually to meat processors. As an example, ScotEID verifies 'Scotch Beef' as having been born, reared and butchered in Scotland, providing consumers and export markets with confidence that Scottish meat has the highest integrity and quality. There are quite remarkable underlying systems to achieve this and it is believed to be unique, giving Scotland significant advantage concerning brand integrity, quality assurance, disease control and underlying research.

The system is a private/public partnership between the entire livestock supply chain and Scottish Government; this allows the core data to be consistently refined in real time to be as accurate as possible, providing for a wide range of industry, government and research purposes governed by 'data control in common' agreements. Accurate core data and common data control allows for flexibility and rapid response to industry needs and consumer concerns. ScotEID is providing Scottish farmers with the data tools to eradicate diseases such as Bovine Viral Diarrhoea and currently the new Beef Efficiency Scheme is being developed to provide farmers with data analysis and research to increase beef production efficiency, in particular to reduce greenhouse gas emissions.

The industry and government partnership, managed by SAOS, is providing accurate live data for a fraction of the cost of public data systems, whilst also reducing red tape for farmers³¹ e.g. by automatically recording livestock movements using electronic identification. Now the Scottish Government is using the system to allow farmers to submit statistical returns online and is using ScotEID data for other statutory purposes.



31. <http://news.scotland.gov.uk/News/Reducing-red-tape-for-farmers-1fa9.aspx>

Data

“It has been shown that cities which adopt a Smart City approach make services more effective and the cities themselves more attractive to investors”

Councillor Andrew Burns, Chair of the Scottish Cities Alliance

Digital technologies are increasingly an essential utility in our daily lives wherever we are and are changing the utilisation of economic, social and environmental infrastructure, for example through.³²

- The Internet, Broadband and Wireless Networks
- Smartphones, Telematics, and Cloud Computing
- Smart Infrastructure, Sensors, and Real Time Data
- E-Services, E-Government, E-Democracy and E-Commerce
- Smarter Resource Management, Energy Efficiency, and Smart Grid

The new sharing economy is wholly based on digital and allows people to share property, resources, time and skills across online platforms which can unlock previously unused or under-used assets. The five main sharing economy sectors are forecast to grow from \$15bn in global revenues to \$335bn by 2025.³³



An independent review for the UK Government identified opportunities across the private and public sectors.³⁴

The Scottish Cities Alliance has recently secured European funding³⁵ to support the development of Smart Cities in Scotland to utilise technologies to transform cities into world-leading digital hubs. However, only one council has a full-time resource on the project and there is a need for a higher commitment of support to ensure delivery.

Glasgow has a vision to share its data and has installed Wi-Fi across the city centre and an innovative partnership between the City Council and BT Scotland has allowed the design and creation of a network that is capable of using current and future wireless technology in council-owned street furniture and property.³⁶ The aim is to make everyday life easy and secure and, using technology, helping to do more with less to connect people to public services.

Bristol³⁷ is using smart technologies and digital connectivity to meet the city's environmental, social and economic challenges and opportunities and become a truly Smart City. Open Data Bristol is a key part of this as it opens up access to Bristol's data in order to make it easier for citizens, researchers and developers to access, analyse and share information. This will allow new solutions to the city's problems to be developed.

RAND Europe, on behalf of the UK Digital Catapult, has published a framework for productivity growth from sharing closed data.³⁸

This concludes that it can contribute through:

- enabling the development of core data infrastructure
- increasing the absorptive capacity of organisations to derive the value from data, assimilate it and use it towards commercial ends;
- convening expertise, providing leadership and fostering trust in key markets.

There is a need for a forum to bring together experts in digital and policy makers to discuss future steps. This will give space to allow future thinking as well as address immediate needs.

Recommendations:

- Government, following widespread consultation, should develop a long-term framework which allays public concerns about data sharing and encourages an open, joined-up and industry-friendly approach by public bodies.
- A lead partner should be appointed to make recommendations on access and utilisation across data streams to drive productivity and innovation.
- More open innovation forums should be established where anonymised data on challenges can be analysed by industry and solutions developed.

32. Tomorrow's City Centre: Glasgow Agenda http://uk.uli.org/wp-content/uploads/sites/73/2015/02/Tomorrows-City-Centre-White-Paper_Glasgow_ULI-UK_Camber-of-Commerce-Glasgow.pdf
33. <https://www.gov.uk/government/publications/unlocking-the-sharing-economy-independent-review>

34. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/378291/bis-14-1227-unlocking-the-sharing-economy-an-independent-review.pdf
35. <http://www.scottishcities.org/alliancepressreleases/2015/10/5/press-release-smart-cities-scotland-launched-with-10m-of-european-funding-confirmed-1>

36. http://www.heraldsotland.com/business/business_extra/14027743.BT_Special_Report__Smart_new_world_is_in_sight/

37. <https://opendata.bristol.gov.uk/>

38. http://www.rand.org/content/dam/rand/pubs/research_reports/RR1200/RR1284/RAND_RR1284.pdf

Skills

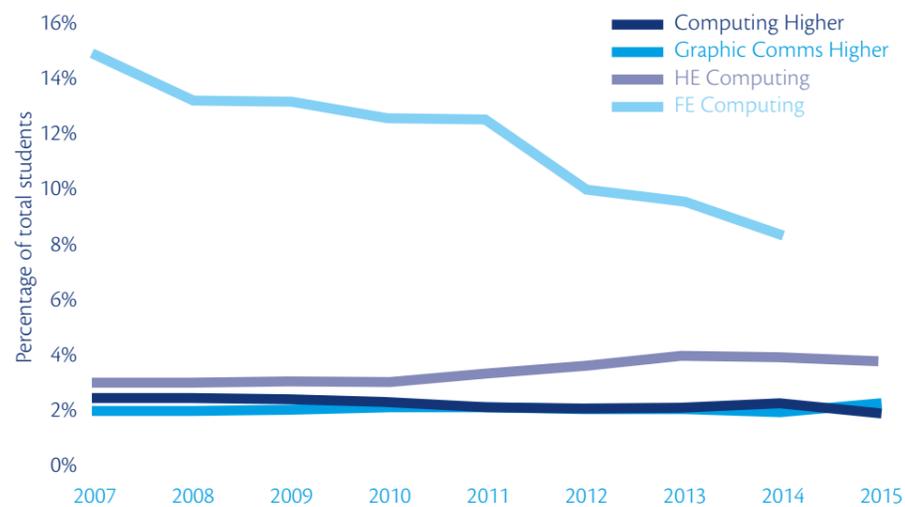
“It is also very important to have more people with the skills to take up jobs which use digital technology, and we need businesses of all sizes to take advantage of new technology.”

Nicola Sturgeon MSP, First Minister of Scotland,
(addressing National Economic Forum, Nov 2015)

RSE's report into digital participation states that if Scotland is to achieve its aspiration to become a 'world-class digital nation' by 2020, it will require a commitment to investment in accessibility, motivation and skills initiatives to increase digital participation. Broadband take-up and use in Scotland is particularly poor in some disadvantaged communities and there is a risk that they are left further behind as services from the private and public sectors increasingly become digitised.

Figure 2 shows the number of school pupils studying computing and graphic communications for the higher qualification is stable but relatively low, however with a dip in 2015. There is a large decline in further education from a high of over a 100,000 enrolments in 2001³⁹ to less than a quarter of that in 2014. There is a slight growth in the number of capped higher education places, which are presently oversubscribed, so instead UCAS applications are mapped in the figure as this more closely reflects demand and shows an increase in most years.

Figure 2: School and tertiary education computer qualifications uptake
Sources: SFC, UCAS and SQA.



39. <https://stats.sfc.ac.uk/infact/index.htm>

The digital skills deficit in the future is likely to be less profound as the online generation become a greater proportion of the workforce. They will find it incongruous to be taught handwriting in the classroom while online in the playground. However, there is concern these skills may not translate to those digital skills required for work. Skill levels can look good statistically, but utilisation is key.

There is concern about the recruitment of computer science teachers. Rural areas and the islands may face particular recruitment challenges and digital solutions utilising video teaching for schools have been met by a resistance to change. There has been a decrease in subject choices since the introduction of the Curriculum for Excellence that could explain the dip in Figure 2 for 2015. A range of digital courses, including Graphic Communication, can appeal to a diverse mix of pupils.

Digital skills should be embedded in the curriculum and developing a digital literacy for all has to be integral throughout the Curriculum for Excellence.

Teachers will require upskilling in digital technologies and the Forum recommended the infusion of digital into teacher training and in-service CPD for every teacher to pass skills to the next generation. This will be particularly true if the idea that in the future the classroom could be 'flipped' proves correct. In this, students watch online lectures, collaborate in online discussions, or carry out research at home and do their 'homework' in the classroom with the guidance of the teacher.

There are now schemes to address skills shortages in the digital industry, including CodeClan which offers a full-time 16 week

course to give graduates coding skills. CGI is working with Skills Development Scotland to offer a graduate scheme, modern apprenticeships and most recently 20 graduate level apprenticeships.⁴⁰

With 90% of the 2020 workforce already in work, upskilling the existing general workforce is essential. The latest analysis suggests an additional £875m is required to deliver basic digital skills to everyone in the UK by 2020, over and above the capital expenditure required for infrastructure and devices.⁴¹ These skills will be required by the whole workforce whereas specific ICT services could decline as future working practises change. A PC on everybody's desk is likely to be as obsolete as it is now obligatory with the advent of 'bring your own device' and mobile working. External server storage (the cloud) will ultimately render work based servers as rare as mainframes making remote working easier with access to all files from anywhere. While only 25% of business is presently using cloud technology, this is predicted to increase to 95%⁴² in a Scotland that is a world leader in digital.

Automation allows businesses and organisations to drive greater output for reduced costs. Most businesses and public services foresee further opportunities, including in back office areas of services, routine processes in manufacturing and offshore in oil and gas. The productivity improvements are seen as a key to maintaining competitiveness and, therefore, overall employment. There will be different ways of working and impacts on where we live and work, although not necessarily an overall loss of work. Young people will need to be equipped with higher level and digital skills, and there will be a need for flexibility and life-long learning opportunities for existing workforces.

Recommendations

- The national shortage of Computer Science teachers should be addressed with action to recruit, train and continually develop specialist teachers. The attractiveness of teaching careers, resources and profile of computer science should be raised so that the curriculum can be fully delivered, more young people study the subject and the gap in performance with leading countries closed
- Digital should be infused into teacher training and in-service CPD for every teacher to pass skills to the next generation as developing a digital literacy for all should be integral throughout the Curriculum for Excellence
- Work-based skills development should be strengthened to capture the potential productivity gains from digital technologies by ensuring that staff have the range of coinciding digital, analytical and 'soft' skills, for example through 'super users' in SMEs and the wider use of the Scottish Union⁴³ Learning course on basic digital skills

40. <https://www.skillsdevelopmentscotland.co.uk/news-events/2015/november/degree-level-apprenticeships-address-digital-skills-shortage/>

41. http://www.tinderfoundation.org/sites/default/files/research-publications/a_leading_digital_nation_by_2020_0.pdf

42. http://www.scottishfuturetrust.org.uk/files/publications/Impact_of_digitalisation_in_Scotland.pdf

43. <http://www.scottishunionlearning.com/content/work-digital-unions/>

Conclusion

The benefits of digital connectivity must be transformational, not incremental. Scotland should be a nation of Digital Pioneers, Digital Champions and Enthusiastic Explorers. The partners and participants in this work are committed to working with government and all sectors to make this happen.

Weak productivity is the key barrier to prosperity in the Scottish economy. Improving productivity in an increasingly competitive world means being at the forefront of innovation and continuous improvement. Digital technologies and digitally-enabled business models are magnifying the opportunities from innovation and the risks from lagging behind.

Scotland is developing a world-class digital infrastructure, but this investment will only achieve its full worth through world-leading utilisation. Increasing Scotland's productivity will require leadership and action at a national level but also in all the businesses across the economy.

Businesses which do not become fully digitally engaged are likely to fall victim to competition from digital disruption - conversely companies at the leading edge of digital use are likely to gain significant market advantage as the world becomes increasingly digitally engaged. Public services which do not become fully engaged face an unaffordable future – on the other hand bodies at the leading edge of digital use will be best-placed to meet the needs of society. All of this depends on population-wide digital access and skills.

Scotland rightly aims to be a Digital Nation. Great ambition has been shown in the development of infrastructure and now is the time for the same level of ambition for and by our businesses, public services and people.

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