Scotland's Digital Future

Supporting the Transition to a World-leading Digital Economy

Emerging Findings – April 2013

The Scottish Government
Riaghaltas na h-Alba

Contents

1 Foreword

We are on the cusp of a new digital revolution which will transform economies around the world. We want Scotland to be at the forefront of that revolution and to have cemented its place as a world-class digital nation by 2020.

Scotland's Digital Future – The First Annual Progress Report and Update 2012 states that: "We need to build on existing partnerships to create a genuine 'Team Scotland' approach to promoting Scotland's digital economy with a clear shared strategic direction and understanding of our respective roles within the team. Scottish Government is committed to putting this in place by April 2013. We invite our partners to work with us to review our collective efforts to date and to consider how we should position ourselves for the future."

This report marks the initial outputs from this process. It has been put together by a team of partners from Scotland's enterprise and skills agencies, along with representatives from the digital industry. It sets out a series of ideas and proposals for building upon current activity and better supporting Scottish businesses to make the most of the opportunities of the digital age.

The document includes a set of recommendations to meet our shared ambition. These recommendations are offered as a contribution to *Scotland's Digital Dialogue*, the national debate about how we achieve our world-class ambitions by 2020. They are offered in the hope and expectation that stakeholders across Scotland will use this process of dialogue to refine and build upon them and help map out a strategy for ensuring a world-class, vibrant and successful digital economy in our country.

2 The Digital Economy

Introduction

Scotland's future is a digital future.

The disruptive power of digital and the convergence of more established technologies are transforming business models and operations, changing our expectations of service and creating new business opportunities at home and abroad.

We must ensure that all businesses have the confidence, capability and skills to take full advantage of the benefits the digital economy can bring.

Scotland faces this challenge from a position of considerable potential strength in areas such as big data, digital health and care, smart mobility, and sensor systems. Inward investment is attracted by the skills we can offer and the quality of the research taking place in our leading universities.

However, we recognise that the digital economy is a global economy and there is no room for complacency. New opportunities are emerging in areas such as Big Data and Machine to Machine Technology and a reliance on the successes of the past is not sufficient. There are still too many businesses in Scotland that have not yet embraced digital technology. We are still missing out on the full extent of the economic benefits that can flow to a truly digital nation. We need to do more to ensure that our computing and informatics skills continue to lead the world, that we continue to innovate and that digital businesses of all sizes are encouraged to develop in our country.

This document looks at what more we can do to ensure that we are fit for a digital future. It aims to stimulate a debate about the action that is required to sustain a world class digital economy. In so doing, it describes a new kind of partnership between the public, private and third sectors that is uniquely suited to the challenges of the digital age and, for the first time, it pulls together the work of our enterprise and skills agencies into a seamless programme of action to stimulate the digital economy.

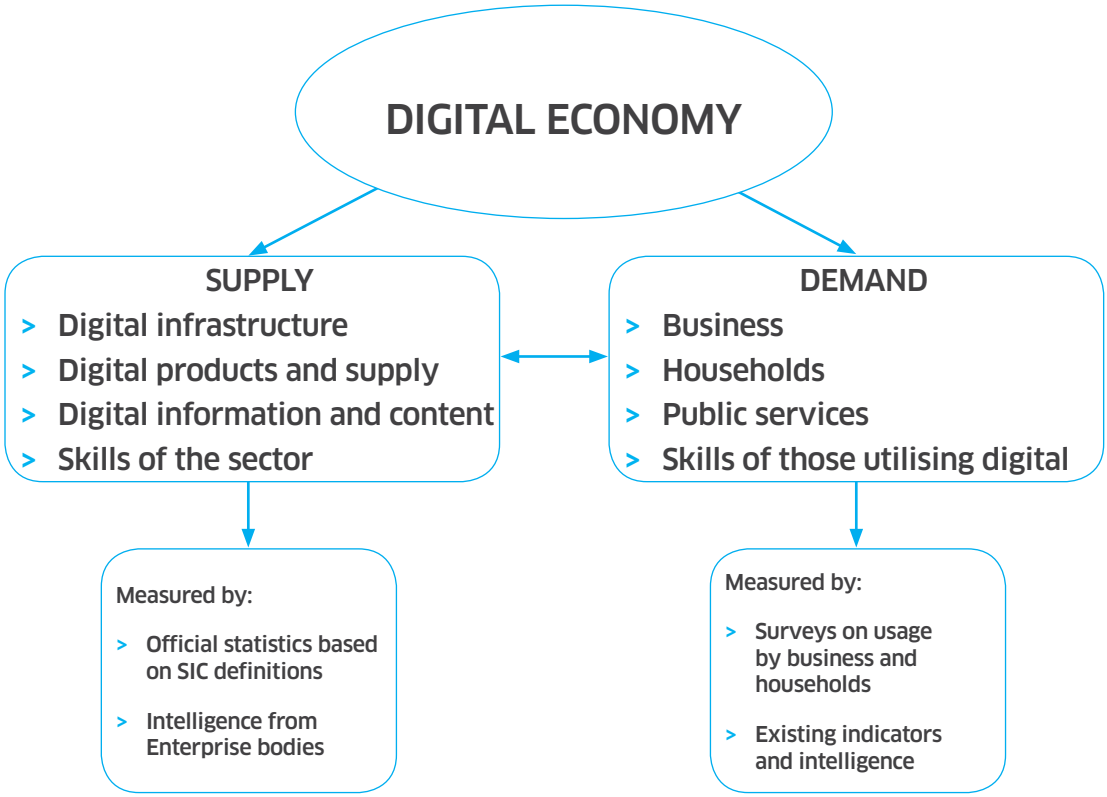
What is the digital economy?

The term "digital" in this context 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' therefore 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).

2 The Digital Economy

Figure 1: Scotland's Digital Economy

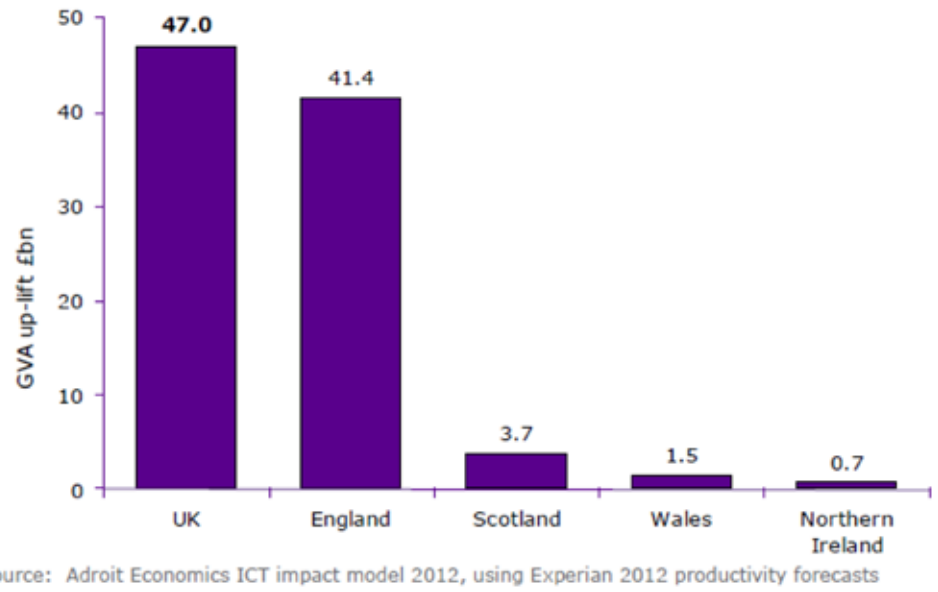


2 The Digital Economy

Why is it important?

Digital technologies are widely recognised as enablers of productivity and drivers of innovation and international trade. They underpin business growth across every sector of the economy and help to boost jobs and generate export income. A recent report by e-skills UK, the Sector Skills Council for Business and Information Technology, suggests that Scotland could increase its GVA by up to £3.7 billion[1] over the next 5-7 years if action is taken to stimulate the digital economy by increasing the range and quality of online services, promoting digital literacy and skills at home and at work and encouraging innovation and enterprise across different sectors.

Figure 2: GVA uplift at the national level over the next 5.7 years



Source: e-skills

1 'Technology Insights 2012', *e-skills UK*, http://www.e-skills.com/research/research-publications/insights-reports-and-videos/technology-insights-2012/

2 The Digital Economy

Scottish businesses have the opportunity to benefit from:

Improved productivity – studies suggest that US multinationals are, on average, 8.5% more productive than domestically owned firms in the UK[2] and that over 80% of this productivity advantage is explained by their better use of IT[3].

Increased turnover – it is estimated that total annual turnover of SMEs could be boosted by £18.8 billion p.a. across the UK if all firms sold and marketed their goods and services online[4].

Reduced costs – with a 2011 survey for the European Commission suggesting that 80% of organisations could reduce costs by 10-20% by moving back office operations to the Cloud[5].

Better customer service – with 54% of SMEs noting improved levels of customer interaction and service from increased used of the internet[6].

Technology has also become a key enabler for internationalisation. Through online channels and applications such as e-commerce, digital marketing and social media, companies can access and trade in international markets more readily than ever before. With more than 90% of Scottish e-commerce already being conducted with other UK or overseas customers, this is a key opportunity for Scotland – and in particular for our globally competitive sectors such as food and drink, tourism, textiles and creative industries.

How are we doing?

There are a plethora of international rankings and benchmarking studies comparing progress of countries across a range of digital measures such as next generation broadband coverage, market concentration in broadband market, uptake and adoption of digital technologies and the skills of users to exploit digital services. Underpinning each study lies different methodologies, data sources and indicators making comparisons between different studies problematic.

Internationally comparable data from these studies is generally more readily available at the UK level with limited focus on the nations and regions within the UK. However, as illustrated below, these studies consistently rank the UK highly in terms of its progress in the digitisation process.

- The Booz & Company Digitization Index[7] (2012) ranks the U.K. 12th among 150 nations, based on the speed, reliability, and ubiquity of infrastructure; affordability of access; usability of services; and skills of the population.
- The World Economic Forum's Networked Readiness Index[8] (2012) ranks the U.K. 10th, on the basis of the impact of technology on international competitiveness.

2 'It Ain't What You Do, It's the Way that You Do I.T.:Testing Explanations of Productivity Growth using US Affiliates', Nick Bloom, Raffaella Sadun and John Van
3 Office for National Statistics, 'IT Investment, ICT Use and UK Firm Productivity' Rafaella Sadun, Shikeb Farooki, Giles Gale, Mark Lever, August 2005
4 Booz & Co 'This is for Everyone' The Case for Universal Digitisation
5 'Unleashing the Potential of Cloud Computing in Europe', European Commissions 2012
6 'Britain's Digital Opportunity: A Study of Digital Maturity Within Britain's Businesses and Charities' Lloyds Banking Group, 2012 http://businesshelp.lloydstsbbusiness.com/assets/pdf/Britains-Digital-Opportunity.pdf
7 http://www.booz.com/media/uploads/BoozCo_Maximizing-the-Impact-of-Digitization.pdf
8 http://www3.weforum.org/docs/Global_IT_Report_2012.pdf

2 The Digital Economy

- The Economist Intelligence Unit[9] (2010) ranks the UK 14th, based on a range of digital economy measures covering infrastructure, business, legal and cultural environment and consumer and business adoption.
- Boston Consulting Group's e-Intensity index[10] (2012) ranks the UK 5th, on the basis of the relative maturity of Internet economies on the basis of three factors: enablement, engagement, and expenditure.

Measurement

Figure 1 describes a measurement framework, adapted from OECD's measurement framework for the information society, that will enable us to:

- track Scotland's progress in the digital economy and in comparison to other countries (set out in the headline indicators described in **Annex A**);
- inform policy and the development of support programmes to accelerate the rate of adoption of digital infrastructure and technology and the exploitation of its full economic potential.

The use of this framework will provide a more accurate measure of the progress that Scotland is making towards sustaining a world-class digital economy.

9 http://www-935.ibm.com/services/us/gbs/bus/pdf/eiu_digital-economy-rankings-2010_final_web.pdf
10 https://www.bcgperspectives.com/content/articles/digital_economy_public_sector_adapt_adopt_government_role_internet_policy/

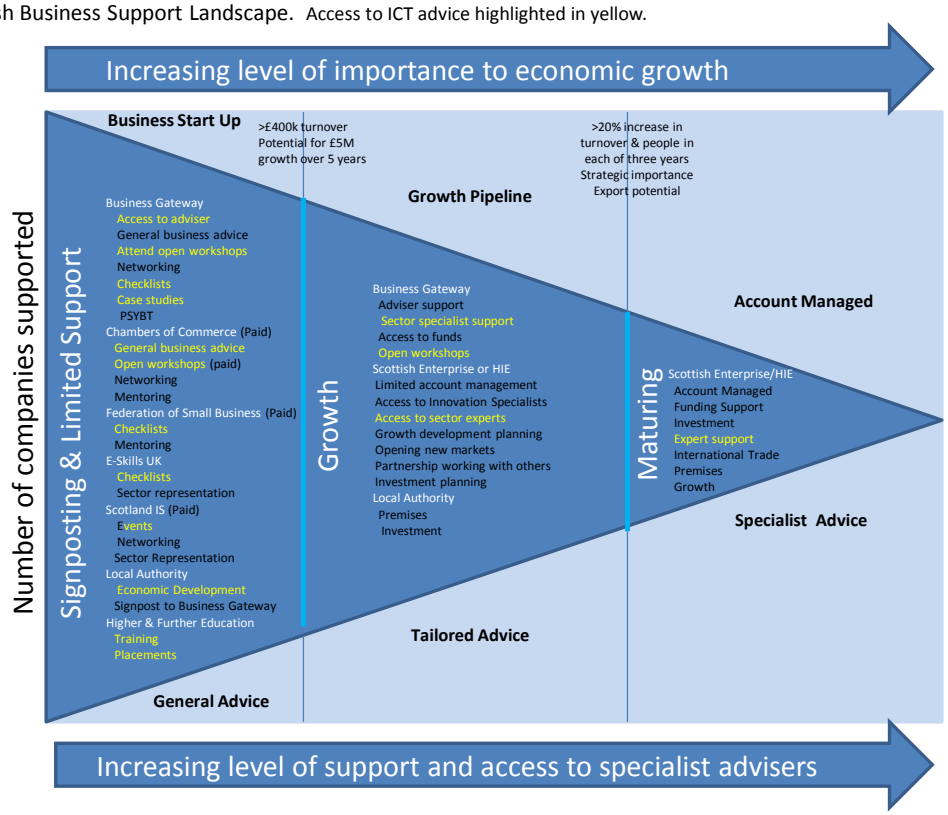
3 Supporting Scottish Business

Current position

Scotland's enterprise agencies (Scottish Enterprise and Highlands & Islands Enterprise) and the local authority-led Business Gateway deliver independent and impartial advice to businesses on a variety of digital topics. This ranges from generic advice to all sizes and types of business on topics such as website development, social media, broadband and e-commerce through to more specialist support focused on digital strategy, cloud computing, inbound marketing, data analytics and customer relationship management (**Figure 3**). This support is delivered through both on and off line channels depending on the size, potential and preference of the customer.

Figure 3: Existing Digital Business Support

Scottish Business Support Landscape. Access to ICT advice highlighted in yellow.



3 Supporting Scottish Business

Ambition

We must ensure that Scottish companies, particularly in future growth sectors, lead the world in their knowledge and application of digital technology. This starts with the leadership and vision of those who lead Scottish businesses and flows through to the development of the skills and resources required to drive business efficiency, growth and competitiveness (**Figure 4**).

Figure 4: Digital ambition

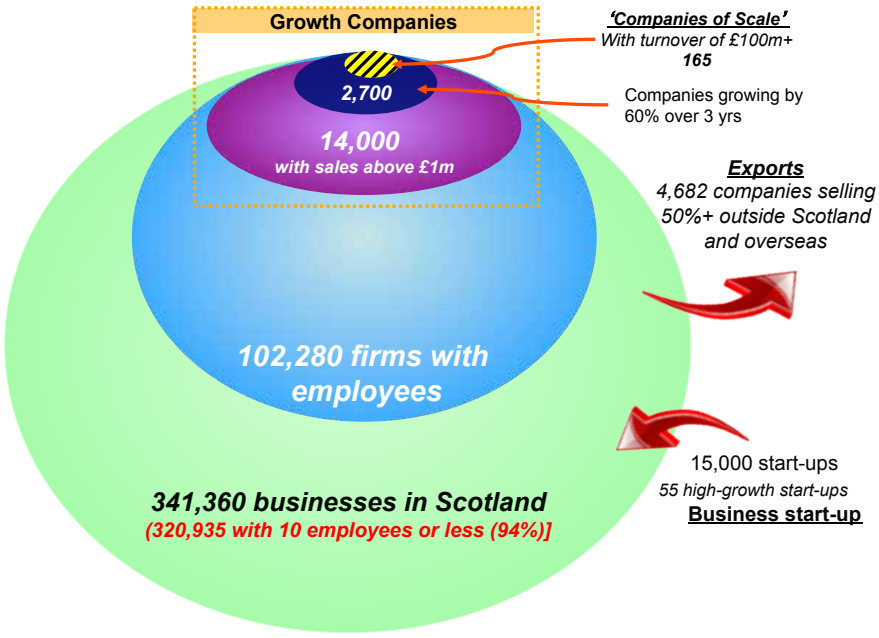
	ELEMENT	DIGITAL AMBITION
VISION	**Leadership**	Business leaders have the vision, awareness and confidence in using digital technology to deliver business improvement and product development.
	Strategy	The business/sector strategy embraces enabling technologies to drive growth and competitive advantage. The digital vision is reflected in operational strategy which is owned and implemented by staff across the business.
ENABLERS	**Resources and Investment**	The level of digital technology investment in the business is optimal relative to their size, sector and business requirements.
	People and Skills	Staff have the skills and confidence to deploy and utilise digital technology across the business.
RESULTS	**Productivity and Efficiency**	Clear business efficiency benefits are realised from digitally enabled processes.
	Sales and Performance	The success in using digital sales channels to increase effectiveness and drive down the cost of customer acquisition.

3 Supporting Scottish Business

Approach

Supporting Scotland's 340,000 businesses to fully exploit the benefits of digital technologies requires concerted, joined-up action across all sectors of our economy. Our business base is necessarily diverse and a one-size-fits-all approach to support and advice is never going to be appropriate (**Figure 5**). Specifically, we need to be able to take businesses on a journey that starts with the basic digital literacy and understanding that is increasingly required for survival, through to the use of technology forecasting and support for the more specialist and sophisticated levels of skills development that can support businesses in competing on a global scale.

Figure 5: Scotland's Business Base



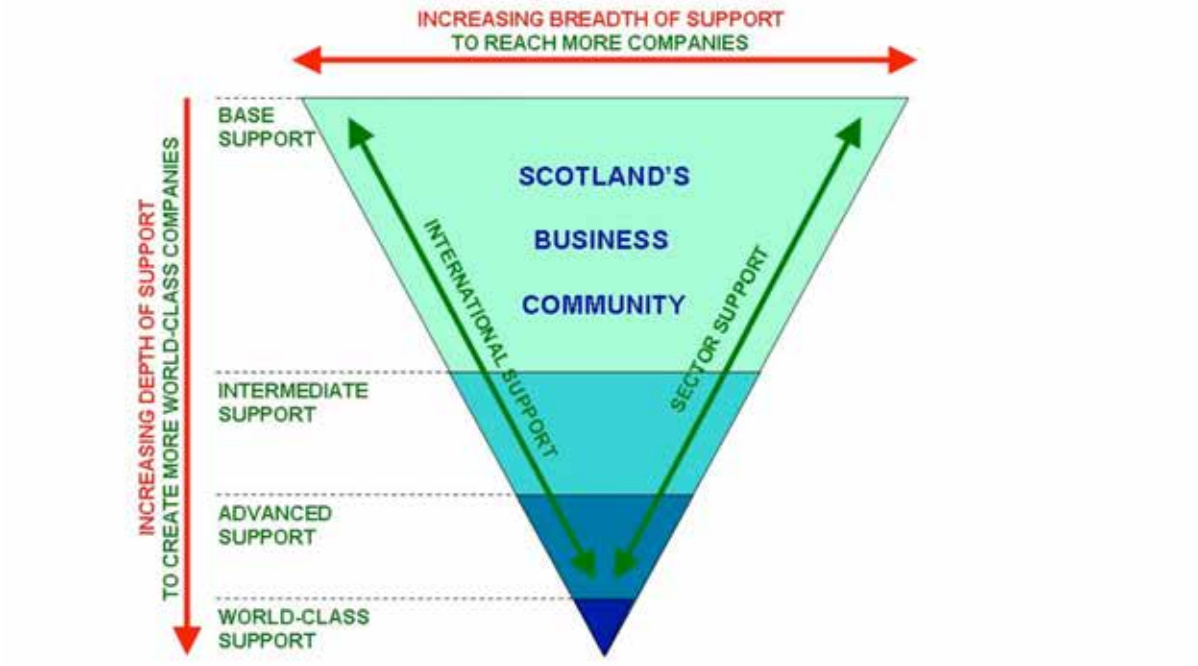
3 Supporting Scottish Business

Our support programmes must:

- Reach across our base of small and medium sized enterprises to create a 'digital buzz' that stimulates innovation, encourages investment in ICT and encourages the use of digital approaches to customer and supplier engagement.
- Understand and reflect the varying needs of different sectors of our economy and focus support accordingly.
- Provide in-depth and tailored support for our growth companies so that they recognise the transformational potential of digital technologies and stay ahead of their domestic and international competitors.

By working together, Scotland's enterprise agencies can provide a seamless range of support that reflects differences in business opportunity, the needs of different sectors and the starting point of a business in terms of digital sophistication. **Figure 6** illustrates the overarching business support framework and highlights the need to combine breadth and depth initiatives to encourage world-class digital sophistication at all levels.

Figure 6: Business Support Framework



3 Supporting Scottish Business

Recommendations

3.1 We should adopt a 'Team Scotland' approach to the delivery of business support on digital issues. An agreed operating framework is required that allows businesses to access different levels of support through different channels as their needs change in terms of the skills they require, the sectors within which they work and the extent of their international ambitions.

3.2 There should be a single on-line access point for this support, regardless of which agency is best placed to deliver it. This should aggregate the support that is available throughout Scotland's support agency network and help signpost/ deliver this support to a broad range of Scottish businesses. This will enable cost effective and collaborative delivery of self-diagnostic tools, webinars and online advice facilities.

3.3 The reach of traditional support activities through events, workshops, and one-to-one advisory support should be extended. There is a strong rationale for increasing the level of public sector investment in this area.

3.4 We should consider the benefits of a 'digital voucher' scheme to provide financial incentives to encourage risk-averse businesses to invest in technology.

3.5 A 'Digital Excellence' programme of strategic support for companies should be launched. This should provide a highly intensive and bespoke package of support to a small number of existing growth businesses in order to improve their global competitiveness, inspire others and confirm the international reputation of Scotland and Scottish businesses as international innovators in the digital economy. Public sector grant support for deeper one-to-one support should be weighted towards projects that are either strategic in nature or have the potential to make a transformational impact on the company.

3.6 A programme of specific sector based support developed in conjunction with The Technology Advisory Group (TAG) and Scotland's Industry Leadership Groups should be pursued. A 'Digital Tourism' initiative is already underway with the Scottish Tourism Alliance, the Scottish Government, VisitScotland and Scottish Enterprise as key partners. These programmes may be a combination of breadth and depth interventions.

3 Supporting Scottish Business

3.7 A comprehensive programme of digital education and training for advisers should be put in place and enhanced continually. We must ensure that both specialist digital and general business advisers in all of Scotland's enterprise and business support agencies are able to offer the up-to-date advice to companies to help improve their digital sophistication. Particularly for the specialist advisers working on more in-depth engagements with growth companies, their knowledge and expertise must be sufficient to not only respond to digital demand, but also to spot opportunities that exploit emerging digital trends.

3.8 We should further improve our understanding of the current state of digital sophistication amongst Scottish businesses and develop an innovative 'digital knowledge exchange' that brings together experts in government, business and academia. This Digital Knowledge Exchange will establish a robust and reliable 'supply-chain' of knowledge which will enable us to anticipate global trends and ensure that our business support remains current, world class and appropriate to the challenges of a rapidly evolving digital economy.

3.9 We should consider whether co-location of activities to create a Digital Excellence & Demonstration Centre in partnership with industry would have added value. This could be a physical space to share facilities, deliver training programmes, support start-up activities, demonstration facilities, knowledge exchange events and potentially locate innovation centres.

4 Supporting the Enabling Technologies or Capability Sector

Current position

Through the Technology Advisory Board (TAG), Scottish Enterprise and its partners have identified a series of near and medium-term market opportunities for Scotland in the technology and engineering sector. These are:

- *Digital Health & Care* – the ability to improve patients' and clients' care and outcomes (and providers' productivity) through the use of appropriately structured service delivery, integrated ICT data systems and digital devices.
- *Big Data* – deriving value from the huge amounts of unstructured data. Big data opportunities exist in most sectors, but in particular energy, retail, financial services, life sciences, engineering, manufacturing and the public sector.
- *Smart Mobility* – the ability to access applications, provide information or reach customers on the move.
- *Smart Sensor and Sensor Systems* – the combination of a sensing element with processing capabilities (embedded intelligence) provided by a microprocessor.
- *Smart Built Environment* – the ability to improve public and private civic services through the use of appropriately structured service delivery, integrated ICT data systems and digital devices.

Market forecasting intelligence and industry analysis has been used in each of these areas to assess the current structure and relative strengths and weaknesses of Scottish business, the strength and dynamics of critical links and relationships across key value chains and the quality of the supporting business environment (**Annex B**). This has produced a strong evidence-based view of the unique areas of competitive advantage for Scotland and the strategic priorities for development and action required to support and accelerate growth. TAG Working Groups have now been established to drive focused development activity in each of the first four areas (**Annex C**). In addition, initial analysis has been undertaken of the enabling role of digital technologies across Scotland's industry sectors and some of the potential constraints in deploying these (**Annex D**).

The initiatives outlined in Annex C will develop the capability sector by:

- increasing the pace of innovation through the provision of shared resources;
- increasing the scale of overall innovation through collaboration co-design and co-development across academia, companies and agencies;
- increasing the market focus of innovation through agglomeration around well-proven global opportunities for the sectors;
- increasing the market reach of innovation by creating and promoting technology demonstrators that give confidence to the market;
- strengthening supply-chains and clusters through shared market and capability information.

4 Supporting the enabling technologies or capability sector

Consultation between public agencies, companies and Scottish universities confirms that the emerging commercial focus on enabling greater exploitation and tailoring of data assets underpins the future productivity and profitability of several sectors (as diverse as oil and gas, health and care, financial services) as well as the need to open up service opportunities around public sector data. Scotland has assets and opportunities in this area that could be further exploited and Industry has signalled that a Scottish Funding Council (SFC) Innovation Centre would be of benefit in realising Scotland's potential.

Scotland has a long track record of attracting high quality technology jobs. This continues to this day, with recent successes including Amazon, Avaloq, HP and Wipro, projecting almost 3,000 new jobs. The Technologies (TAE) and Creative Industries team in Scottish Development International (SDI) provides support for companies in this sector looking to develop or enhance overseas opportunities and provide a platform to facilitate inward investment. It provides specialist international development support on a one-to-one basis and also runs a number of activities such as exhibitions, missions and learning journeys that are designed to provide a platform for companies to access overseas business as well as providing a showcase of Scotland's capabilities.

Digital exports are supported by both SDI's Accelerated Export Support Programme (Export Explorer) and the digitally focused Smart Explorer programme, a European Structural Fund sponsored initiative that provides in-depth support to new exporters with the capability of achieving £500,000 of export sales over a 5-year period. Smart Exporter provides a range of free services designed to help companies meet the challenges of expanding overseas – from market awareness advice, to strategy development assistance and technical support.

Ambition

Our ambition is for Scotland to be a recognised global player in each of these identified capabilities and a leader in developing the global market opportunities. Our reputation for innovation will attract further investment to strengthen our sector and will open up an increasing share of market opportunities.

This will be achieved through continuous renewal of the sector's capabilities and skills combined with increased agility in adapting to emerging market opportunities. As a result, the sector's own productivity and export performance will improve continuously, while simultaneously helping to raise overall productivity through providing and supporting smarter ways of working and living.

To achieve this will require associated action on issues which are wider than the sector, but certainly apply to it such as encouraging innovation and entrepreneurship, access to necessary investment capital for these sectors so that technology companies prosper and stay in Scotland and action to develop the specialist skills necessary through Scottish schools, colleges and Universities.

The partnership approach between industry, academia and the public sector will ensure that developing opportunities are identified and realised quickly and public sector interventions are responsive to changing needs.

4 Supporting the enabling technologies or capability sector

Recommendations

4.1 The business case for a Scottish Funding Council (SFC) Innovation Centre focused on data innovation should be co-designed and developed by public and private sector partners. If this case proves robust and the relevant quality thresholds can be met and SFC investment is approved, the development of such a centre would provide a major spur to the sector and help strengthen Scotland's future competitiveness in the digital space.

4.2 Scottish Enterprise should lead work to improve Scotland's capability and capacity for innovation in the field of communications technology. Partners should be invited to consider whether it is in the national interest to further develop indigenous capability or whether Scotland would be better served by 'buying-in' global capability and focusing attention on adopting and adapting such technology for our specific needs.

4.3 The Glasgow City Council's *Future Cities Demonstrator Project* should be recognised as an initiative of national significance and action taken to ensure that we learn lessons that can accelerate the development of smart cities across our country.

4.4 Scottish Government should convene a group comprising public and private sector members to scan the horizon on an annual basis for opportunities and threats to economic performance which may arise from demand or supply issues relating to future connectivity, resilience and security expectations and requirements.

5 The Skills Agenda

Sustaining economic success within an increasingly competitive digital economy requires a workforce with the skills and confidence to harness the potential of digital technologies to drive growth, stimulate innovation and improve productivity. This requires Scotland to ensure that it can both call upon the number and range of IT and Telecoms professionals required to support the digital economy and enjoy levels of digital literacy across the whole of our workforce that enable us to recognise, deploy and use digital technologies to transform business operations and service delivery.

Current position

The Scottish ICT sector is healthy and vibrant. It employs 73,000 people, primarily in high-value jobs and makes a direct contribution of £3 billion per annum to the Scottish economy. Between now and 2020, the number of IT professionals within the Scottish IT industry is forecast to grow 1.91% per annum to 84,000. This is nearly four times faster than the Scottish average. Software professionals are in particular demand, with growth in employment predicted to be 2.4% per annum.

In all, the IT and Telecoms sectors require 9,600 new entrants p.a. over the next 3 years. However, the pipeline of talent that supplies this demand is coming under increasing pressure and continues to be marked by a significant gender imbalance. There has been a general decline in the number of students taking computing courses in schools with a 27% decline in Standard Grade, a 17% fall in intermediate 1 and a 1% fall in Higher uptake from 2007–2011[11]. The number of enrolments onto IT and Telecoms related courses in Further Education colleges has fallen to 51,840, a drop of 31% from 2005/06. Moreover, whilst there has been an encouraging 19% increase over the past 2 years in the number of people applying to IT related courses in Higher Education in Scotland, this is set against a backdrop in which numbers declined by 29% between 2002-10, at a time when applications to Higher Education more generally were increasingly significantly[12].

SMEs, in particular, face challenges in attracting and retaining talent as people with experience in emerging professional disciplines are targeted by larger multi-national organisations.

Skills shortages within specialist industries are matched by a lack of digital literacy amongst the Scottish workforce and a lack of awareness about the opportunities that new technology can provide. Research shows that a high proportion of decision-makers in SMEs are often unfamiliar with the demands of ICT projects, do not fully appreciate the benefits, risks and costs of an ICT investment and often lack the skills to define the business requirements properly. Levels of digital literacy vary widely even among those who use the internet regularly. An Ipsos Mori poll for the BBC published in July 2012 highlights

11 These figures should be viewed with a degree of caution, given the fact that this must be set against schools' decision to increasingly favour Intermediate qualifications (for example, there was a 18% increase over the same period in take up of intermediate 2 qualifications).
12 Technology Insights 2012 is the source for the data relating to the Scottish ICT and Telecoms sectors, http://www.e-skills.com/Documents/Research/Insights-2012/TechnologyInsights_2012_Scotland.pdf

5 The Skills Agenda

an appetite for up-skilling amongst a range of on line groups; females, older age groups, disadvantaged groups and those with basic skills[13].

Ambition

Our ambition is that Scotland continues to produce and attract the skills necessary to promote Scotland's digital economy. In particular that:

- Scotland has the skills required to develop and exploit its strengths in digital health and care; big data (data analytics, cyber-security, data industrialisation); smart mobility; sensors and sensor systems; smart environment.
- There is extensive collaboration across Higher and Further Education and an extension of the research and innovation capability into Continuing Professional Development (CPD) and advanced teaching, at a scale and pace commensurate with the economic opportunity.
- Our growth sectors have access to the ICT professional skills they require to embrace digital technologies as a key driver of business transformation, business efficiency and growth. Industry Leadership Groups will be fully engaged to ensure comprehensive and sustained communication on the Digital Skills Challenge.
- Our SME base understands the potentially transformational impacts of enabling technologies and can access appropriately skilled ICT professionals that can help them across all aspects of their business.

Our ambition is for our SME base to have the digital leadership skills to recognise the potential that digital technologies can offer in promoting productivity benefits, innovation and growth. Our ambition is also for Scotland's workforce to have relevant digital literacy skills as part of their overall employee competence.

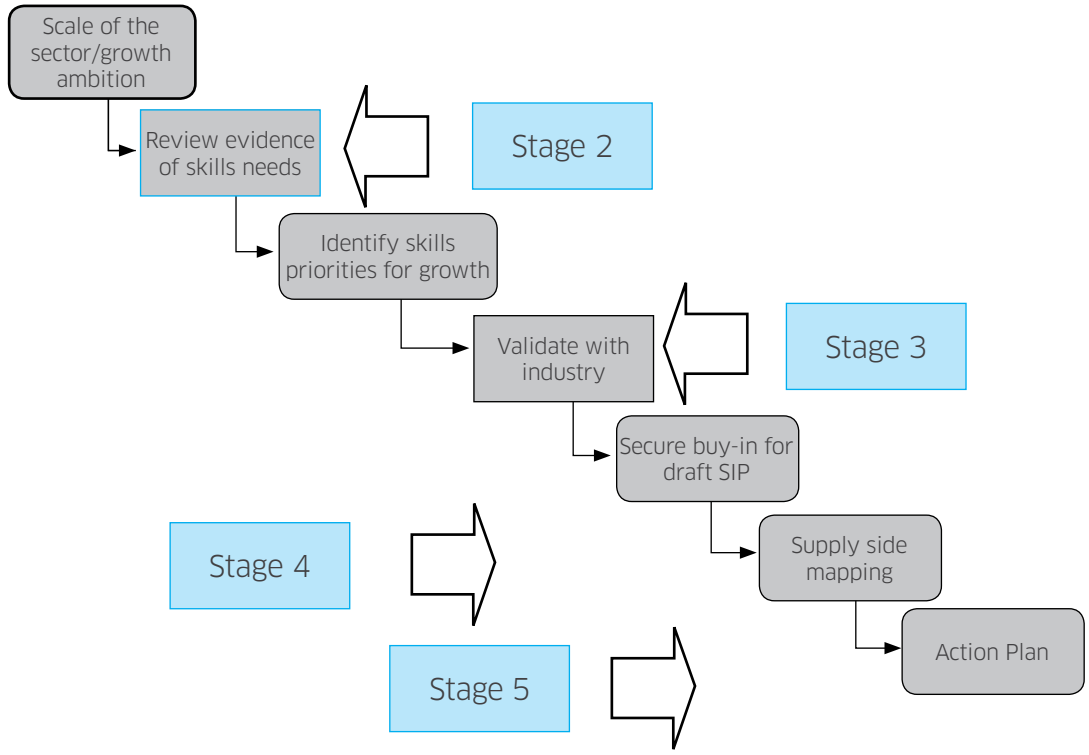
Approach

A Skills Investment Plan will be completed in early May 2013 in line with the 5-stage process described in Figure 7. This concludes with the development of a comprehensive action plan in conjunction with partners and stakeholders for consideration by the Joint Skills Committee. This will then be publicised to key stakeholder groups through a series of presentations and workshops. The completed plan will provide industry insight for suppliers of education and training and facilitate an improved alignment of the publically funded skills supply system to the needs of industry.

13 Media Literacy: understanding digital capabilities: July 2012 Ipsos MediaCT for BBC Marketing and Audiences

5 The Skills Agenda

Figure 7: Skills Investment Plan Development Process



In a dynamic technology driven environment, maintaining the relevance of both the educational curriculum and methods of delivery is a significant challenge. Curriculum for Excellence provides a framework for young people to develop their ICT skills through learning across the curriculum as a whole and through specialist study in computing science. There is a clear opportunity for industry to support the delivery of the curriculum, and to enable access to resources and materials which are up to date and relevant. They can also provide access to the work environment through project development and work placements, for both students and teaching staff.

Resolving skills shortages will require action at both tactical and strategic levels. A tactical response to increase the existing pool of suitably trained workers in the short term backed up by a longer term strategic approach to ensure that the future workforce at all levels have the skills and understanding to adapt flexibly to new applications of digital technologies.

There are a range of options for bridging the existing skills gap. At the higher end conversion courses\digital boot camps for recent graduates which augment their digital skills and increase employability for those currently underemployed. This could be particularly relevant across the Science,

5 The Skills Agenda

Technology, Engineering and Maths (STEM) subjects, business, marketing and broader creative industries. The introduction of Professional and Technical Modern Apprenticeships would provide a clearer route for advancement for those already in the workplace with lower level entry qualifications.

Innovative partnership activity between Highlands & Islands Enterprise Business Gateway and e-skills Scotland is already proving popular with the SME business community and offers the potential for scalability and adaptation to incorporate additional optional learning components.

Grants and subsidies for businesses and individuals who want to increase skills levels already exist through a range of national and local funding mechanisms, including Individual Learning Accounts and Flexible Training Opportunities. Improved communication, bundling and marketing of services will be required to broadcast opportunities and keep it simple for business.

Key Recommendations

5.1 We should publish and implement a Skills Investment Plan in conjunction with key industry partners and stakeholders. This will focus on meeting industry demand through increased collaboration between industry and academia. Maximising the impact of existing investment through greater alignment of the skills system and focusing on the skills required to maintain global competitiveness in the identified growth areas.

5.2 Education Scotland should work with Skills Development Scotland (SDS) to test current awareness of the career opportunities within the digital economy and make recommendations to ensure that they are fully understood and acted upon by our current and future workforce. We should continually enhance industry awareness, career management skills and information sources such as *My World of Work*.

5.3 We should work through the Industry Leadership Groups and newly formed Regional Advisory Boards to raise awareness and promote sectoral initiatives to encourage adoption and implementation of digital technologies as a key driver of business transformation, business efficiency and growth.

5.4 Enhanced vocational training opportunities should be explored to support gaps in supply, including:

- Increased promotion of the existing Modern Apprenticeship Frameworks.
- Development of Professional/ Technical Modern Apprenticeships Frameworks.
- Enhanced CPD programmes.
- Conversion courses.
- Increased number of undergraduate places at universities.

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5.5 Education Scotland, working in collaboration with SDS and industry, should examine how digital literacy skills are promoted in our primary and secondary school and benchmark international practice, making recommendations on improvements that should be made.

5.6 We should introduce a Digital Excellence Leadership Programme targeted at Managing Directors and senior management within our SME base.

5.7 We should build on the positive experiences of the Business IT Guide pilot within the Highlands and Islands and enhance it with an associated skills development programme.

5.8 Through the Digital Participation Charter and the Scottish Trade Union Learning Network we should work with industry to promote digital literacy skills across Scotland's workforce – introducing volunteer mentoring programmes to upskill and support people and businesses to get online.

6 Ways of Working

Previous sections have looked at the actions that the Scottish public sector can take collectively to develop the capability and capacity of Scotland's digital businesses. This section goes further and looks at the way in which the public sector operates; the 'how' rather than the 'what'; and identifies ways in which new operating practices could provide a powerful stimulus to Scotland's digital economy.

Current activity

Scottish Government is changing its old models of service delivery to drive improvement across public services. In *Scotland's Digital Future: Delivery of Public Services* published in 2012[14], it set out its ambitions to make online services accessible and easy to use in order to encourage individuals and businesses to make a positive choice to use them. This requires the public sector to work collaboratively across Scotland, making best use of existing infrastructure, crossing organisational boundaries and adopting a 'digital first' approach under which the use of a digital channel is a positive choice.

Early progress towards this vision is being made through the procurement of the Scottish Wide Area Network (SWAN) which will deliver a single, holistic telecommunications service available for use of any, and potentially all, public sector organisations within Scotland. This is the first project for the overarching SWAN programme. It is also seen in the development of the *Mygov programme* which will aim to deliver the single access point to all public services across Scotland.

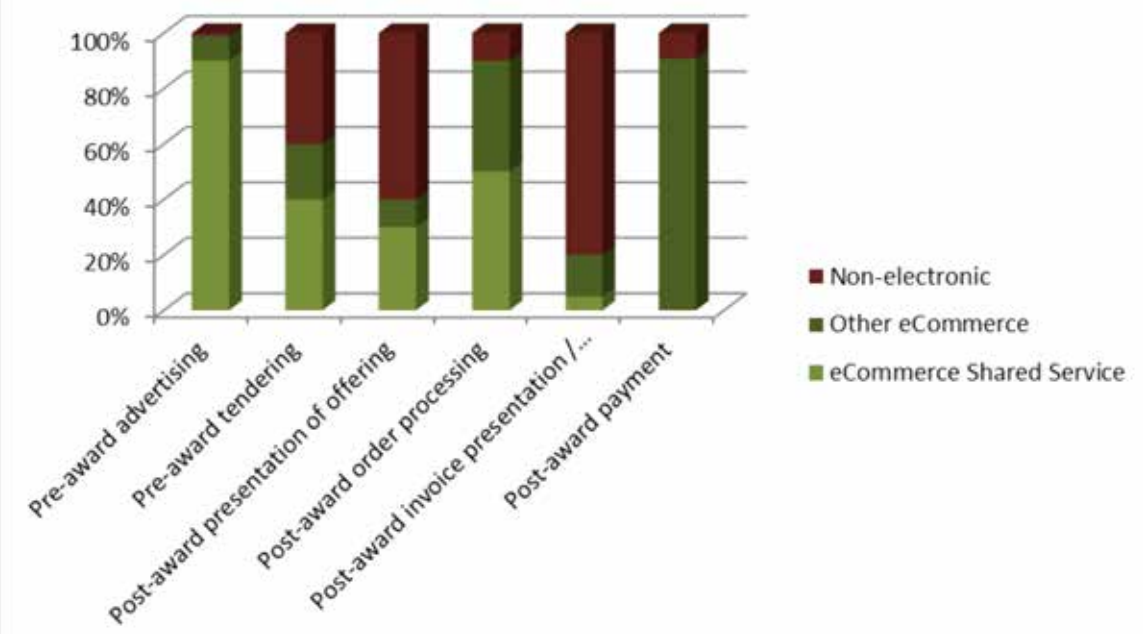
Aligned to this Local Government has developed the *Local Government ICT Strategy – Delivering Better Services for Communities*[15]. This focuses on how ICT can enable Local Government to meet customer demands, reduce costs and address Public Sector Reform. A key objective of the strategy is to increase the number of online services available to the customer, both citizens and business.

On the demand side, the Scottish Government's eCommerce Shared Service brings together all the steps involved in supplying the public sector in Scotland. It is a collaborative electronic environment, which promotes improved capability across public procurement in Scotland. It enables business to be conducted more simply, consistently and effectively, and plays a key strategic role in delivering and sustaining procurement benefits and best practices.

14 Scotland's Digital Future: Delivery of Public Services, http://www.scotland.gov.uk/Publications/2012/09/6272
15 Local Government ICT Strategy – Delivering Better Services for Communities, http://www.improvementservice.org.uk/library/download-document/3728-local-government-ict-strategy-delivering-better-services-for-communities-draft-for-consultation/

6 Ways of Working

Figure 8: Current procurement channels



However, whilst initiatives such as this have helped support the wider adoption of e-procurement systems, the main impact has been on the process of advertising such opportunities rather than the totality of the customer – supplier relationship (**Figure 8**). Many Scottish businesses that respond to digitally initiated opportunities continue to limit their digital engagement to e-mail and have not developed e-commerce capabilities more generally. In post-award order processing, for example, only 20% of transactions make use of advanced machine readable formats. The remaining 80% are either emailing pdf images or faxes. A number of businesses are not able or willing to develop the required supporting systems despite the opportunity they offer to speed up the order, invoice and payment cycle. It has been estimated that a 10% increase in the use of e-procurement and e-sales could increase productivity by between 1.2% and 3.6%[16].

Ambition

As digital technology disrupts and rewrites the rules in different markets, it is important that we think again about the role of the public sector in the digital age. We want to make more of the reach, footprint and economic importance of the public sector, to create the kind of industry we want to see in Scotland. Our ambition is that, the Scottish public will add value to the digital economy in Scotland in the way that it chooses to both procure and deliver services. It will provide opportunities for Scottish business to develop digital

16 The Connected Kingdom, http://www.connectedkingdom.co.uk/downloads/bcg-the-connected-kingdom-oct-10.pdf

capabilities and provide a platform for such businesses to compete internationally in increasingly competitive digital markets.

This requires a Scottish public sector in which:

- suppliers are encouraged to adopt and embed digital technologies.
- innovative approaches to procurement that reflect the strengths and ways of working of new digital businesses are encouraged.
- the digital sector has the opportunity to engage in and add further value to the delivery of public services.
- the potential of open data as a driver of economic growth is recognised and realised.

Approach

The starting point for a transformation of this nature has to be a commitment to develop the digital capabilities of staff across the Scottish public sector. Organisations should be encouraged to join and participate in the work of Scotland's Digital Participation Charter to encourage the development of digital literacy across their entire workforce. This should be supported by the development of workplaces and IT policies that enhance access to and familiarity of digital technology.

The Scottish public sector spends around £9 billion on goods and services. Support provided in transacting this business digitally tends to be structured in a way that is of benefit only for the transaction with the public sector, and not in a way which would have a more lasting benefit for the company. A new partnership between procurement specialists and Scotland's enterprise and business support agencies that combines the more comprehensive adoption of advanced e-procurement practices with targeted support for the development of e-commerce capabilities within Scotland's business base would be capable of stimulating digital capabilities across the country. This, in turn, opens up the potential for the public and private sectors to share the benefits that come from enhanced productivity due to a more integrated approach to ecommerce.

With the increasing move towards European standardisation of digital business documentation, the size and consistent nature of the Scottish public sector e-commerce platform provides a unique opportunity to build skills and capabilities within Scottish business in a way that can be a stepping stone to European public sector procurement. A company that develops a capability to transact electronically with the public sector in Scotland will be in a position to capitalise on opportunities to bid for public sector contracts across Europe.

6 Ways of Working

Our approach to procurement of digital services should also be adapted to ensure that the public sector is able to take full advantage of a fast moving environment which is characterised by dispersed skills and new business start-ups. This demands the development and application of an agile approach which is underpinned by a commitment to use procurement to encourage the development of a sustainable digital sector that can innovate within Scotland and use this innovation as a platform upon which to compete internationally for business.

Through the provision of APIs (Application Programme Interfaces) the Scottish Government can enable third party suppliers to offer services and information, in a distributed services model. This provides an opportunity to improve the customer's experience of such services, grow demand for online services and provide a stimulus to Scotland's digital economy by offering opportunities for adding value to public information. A commitment to open public services puts choice and control in the hands of individuals and neighbourhoods, so that public services will become more responsive to people's needs.

Open Data can, in itself, be a driver of economic growth. By making public sector data available in a standardised format for use and re-use, there is the opportunity to stimulate new ideas and business opportunities for Scottish companies. This, in turn, will attract talented entrepreneurs and skilled employees, creating high value-added services for citizens, communities, third sector organisations and public service providers, developing auxiliary jobs and driving demand for skills.

Recommendations

6.1 A partnership of public sector procurement leaders and Scotland's enterprise and business support agencies, including the Supplier Development Programme, should use the public procurement platform as the basis of action to build the capability of Scottish suppliers to both engage with the public sector electronically and then use that capability to compete for business with public bodies across Europe. This requires targeted business support to develop the capability of Scottish suppliers both before and after contract award.

6 Ways of Working

6.2 This partnership should further develop e-commerce Shared Service integration to open European standards. Procurement leaders within this partnership should ensure that Scotland is involved and engaged with establishing a consistent business to business taxonomy for public procurement, based on open European standards, and be pro-active in sharing that standard with business in Scotland.

6.3 The Scottish public sector should build upon its existing commitment to open public data and recognise the potential economic benefit of making such information available to the business community. The availability of such data should be signposted.

6.4 Scotland's commitment to the development of digital public services should include proactive action to open up government system API's to promote market creating opportunities to integrate systems and offer value added services to organisations. This requires action to set-up the market and partner development of digital services, including accreditation of all digital delivery partners.

6.5 The Scottish Government should develop an agile approach that provides public sector organisations with a greater opportunity to access and stimulate agile skills from across the business base and support the implementation of agile software development methodologies. This would be particularly useful in the communications, proposition/product definition and agile software sectors.

7 Conclusions

This review was carried out in partnership with our enterprise and skills bodies with participation from ScotlandIS, (the trade body for the digital technology sector in Scotland) and the Technology Advisory Group. It was clear from the outset that there is common recognition of the opportunities to be capitalised on by seeking to position Scotland as a world-leading digital economy.

A considerable amount of work is already underway across our enterprise and skills bodies: providing specialist technology advice and support to our SME base; designing bespoke programmes to help some of our key sectors better understand the role that technology can play in enhancing productivity and boosting growth; working with industry and academia to exploit key capabilities within the digital economy, such as digital health and care, big data, smart mobility, and sensor systems; working with industry to understand future skills requirements and tailoring programmes to suit.

Our review has found that support programmes across the different agencies have evolved over time in a pragmatic fashion in response to new opportunities arising, seeking to keep apace with ever advancing technologies and applications. The different agencies continue to strengthen their partnership working with each other and with industry, primarily via ScotlandIS and the Technology Advisory Group. Significant knowledge, expertise and commitment to promoting Scotland's digital economy can be found across these partnerships. It is therefore the conclusion of this review that the cornerstones of the required landscape are in place to support Scotland's transition to a world-leading digital economy.

The key recommendations to improve outcomes and ensure that we deliver our collective ambition for Scotland to be a world-leading digital nation by 2020, can be summarised as follows:

1. *Strengthen strategic partnerships:* There should be greater strategic co-ordination between our enterprise and business support agencies to promote agile and integrated responses to emerging opportunities and deliver fully integrated and effectively deployed programmes of intervention. This should be ensured by establishing a Digital Excellence Partnership to take forward the recommendations of this review and to create a 'digital buzz' within Scotland. The appointment of a Digital Excellence Champion or co-ordinator would help to spearhead this Partnership.

2. *Strengthen the breadth and depth of support offered to Scottish companies of all sizes:* A seamless programme of support and advice should be offered that integrates and builds upon the range of current support that is available. This should include the development of a Digital Excellence Programme, a highly intensive and bespoke package of support targeted at growth companies on a one-to-one basis. Serious consideration should also be given to the merits of a 'digital voucher' scheme that might encourage businesses to adopt new digital technologies.

7 Conclusions

3. *Strengthen the capability (supply) sector:* The emergence of the Innovation Centres in Scotland will do much to advance the digital economy in Scotland and we should explore the potential for a Big Data Innovation Centre to help realise opportunities in this area.

4. *Strengthen our professional ICT skills base:* We should agree, publish and implement a skills investment plan in conjunction with key industry partners and stakeholders. As part of this process, Education Scotland and Skills Development Scotland (SDS) should work in collaboration to make recommendations to enhance awareness of, and help our current and future workforce make the most of career opportunities within the digital economy.

5. *Strengthen our digital literacy skills:* User skills and digital leadership skills are important across the workforce in all sectors of the economy and a broader digital literacy plan would help organisations to realise the potential benefits that can come from digitisation. A Digital Leadership Programme should be developed to target Managing Directors (MDs) and senior staff within our SME base, whilst Education Scotland, in collaboration with SDS, should examine how digital literacy skills are promoted in our schools, benchmark international practice and make recommendations on how to take this agenda forward. The Digital Participation Charter can play a significant role in ensuring partnership working around this agenda.

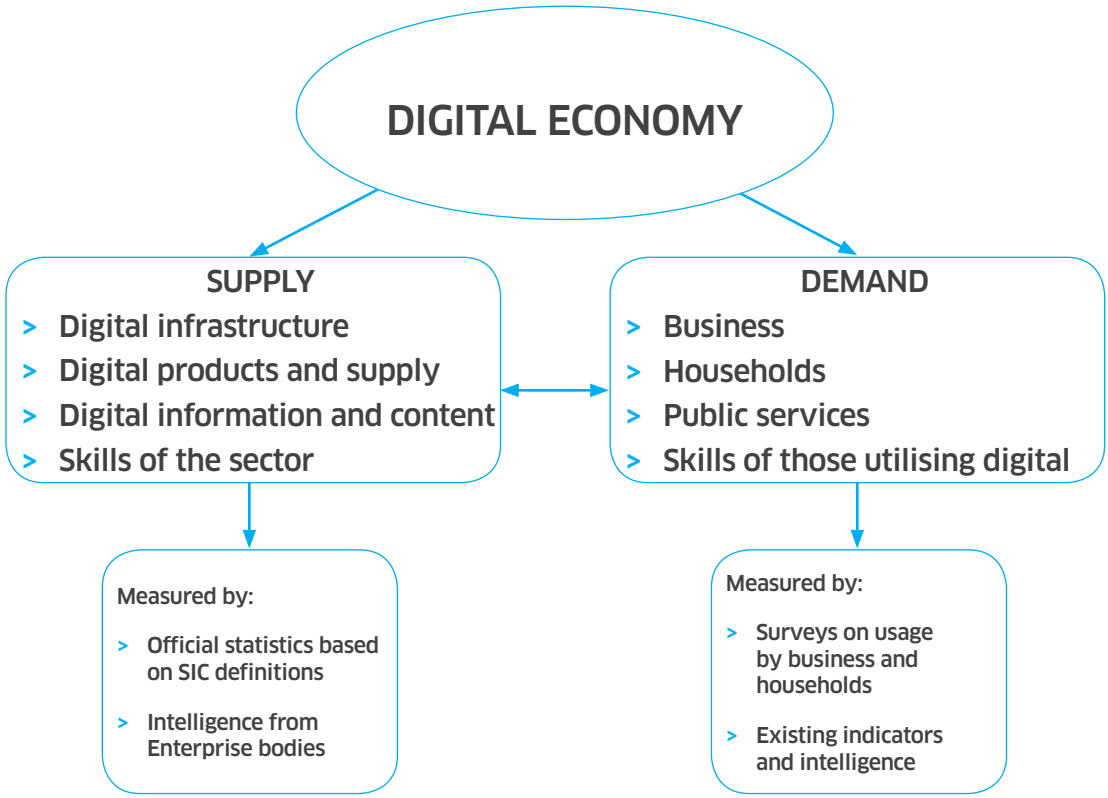
6. *Strengthen knowledge exchange opportunities:* Partners should work together to explore the potential for Digital Excellence & Demonstration Centres. These would be a shared resource between industry partners and the public and academic sectors and would demonstrate the practical application of existing and innovative digital technologies.

7. *Strengthen ways of working in the public sector to promote commercial opportunities:* The Scottish public sector should build upon its existing commitment to open public data, e procurement and the delivery of digital public services and take these agendas forward in a way that will maximize their positive impact on the digital economy. Specific opportunities could come from opening up government system APIs (Application Programme Interfaces), the development of an agile procurement framework for digital projects and using the public procurement platform to build the capability of Scottish suppliers to interact electronically.

ANNEX A

Measurement Framework

Figure 1: Scotland's Digital Economy Measurement Framework



Supply

The supply side of the measurement framework will define and measure the digital economy and track Scotland's progress in relation to other countries and nations.

Demand

The demand side of the measurement framework will track the adoption, usage and exploitation of digital infrastructure and technology and assist policymakers in prioritising areas of support. It will cover both business and individuals. However, the focus of this paper is on developing business-related indicators.

The demand side of the framework will measure progress in five key areas:

- Headline economic indicators
- Adoption
- Usage
- Exploitation
- Skills

Annex A

The table below provides an overview of the rationale for tracking progress in each of these areas and the broad areas we will seek to collect data on.

Theme	Rationale	Potential indicators
Headline economic indicators	The digital economy is a key driver in increasing productivity and stimulating business investment and growth. These indicators are important for establishing a baseline position to allow us to track future progress.	Potential indicators include: > GVA per head > Enterprises per 1000 working age population > Business births as proportion of total stock > Employment in Knowledge Intensive Sectors > Employment rate > % premises with NGA broadband coverage
Adoption	Given the levels of public sector intervention in delivering digital infrastructure and technology, tracking progress on adoption and usage by businesses will be important for monitoring progress against Scottish Government's Digital Strategy and understanding the extent to which superfast broadband is a differentiator.	Potential indicators include: > % of businesses with broadband access > Speed of broadband connection > Businesses with access to basic, NGA and superfast broadband > Business uptake of basic, NGA and superfast broadband. > Reasons for not having the best available broadband

Annex A

Theme	Rationale	Potential indicators
Usage	These indicators will provide evidence on how businesses are using the digital infrastructure and technology available to them.	Potential indicators include: > % of businesses with website > % businesses who sell/ purchase online > % businesses who sell internationally online > % of businesses interacting with public authorities online > % of businesses using public authorities' electronic procurement
Exploitation/ Sophistication (e-intensity)	These indicators relate to how digital infrastructure and technology has been exploited by businesses with a focus on understanding the level of exploitation/ sophistication (e-intensity) of the company and the extent to which: > new approaches have been adopted and > the impact of these on productivity and growth.	Potential indicators include: > % of businesses adapting business strategy due to digital technologies > % of businesses identifying the adoption of new processes and systems as a result of internet based technologies > % of businesses reporting a business benefit as a result of using internet based technologies. > % of businesses trading in new markets > % of businesses experiencing growth as result of investment

Annex A

Theme	Rationale	Potential indicators
Skills	These indicators provide an overview of the digital skills used and demanded by businesses with the aim of identifying gaps in provision and to assist government bodies with targeting support in this area.	Potential indicators include: > Digital Leadership skills > Professional ICT skills > Skills gaps and shortages

With the exception of the headline economic indicators, many of the proposed indicators are not currently available either on a consistent basis or for Scotland. This suggests that additional survey work in Scotland may be needed to gather this information.

ANNEX B

Capability Sector Analysis

The following outlines the main attributes of the ICT/Data/Informatics sector in Scotland.

Dimension	Attributes
Strengths	> Good co-ordination of software sector in Scotland through trade body ScotlandIS. > Good co-ordination of academic assets through research pool Scottish Informatics and Computer Science Alliance (SICSA). > Good intelligence around market opportunities through SE and HIE. > Good industry links into policy through TAG members. > ICT sector is not parochial; much of its market is outside Scotland. > Scotland has multiple high capacity connectivity to the main hub locations in London and on the continent for onward connectivity. Capacity on these routes is not an issue and technology developments means more and more capacity can be delivered over the fibre routes which already connect Scotland.
Weaknesses	> The ICT industry in Scotland is characterised as 'broad but with no depth'; there are no complete supply-chains in Scotland. There is a widely reported shortage of software engineers in Scotland per annum. For instance, e-skills UK reports[17] that, through to 2015 there is a need for 9,600 new entrants a year into IT and Telecoms professional job roles in Scotland – the majority of which (4,100/43%) are forecast to come from people working in occupations other than IT or Telecoms with 1,800 (19%) coming from education. > Scotland currently relies on two main routes south for UK and international connectivity and there are areas where routes converge to 'pinch points'. For a few organisations with the very highest resilience demands, an additional third route is often required and in these circumstances, Scotland could be at a disadvantage. > Scotland does not have a strong, wide or large capability in the communications field.

17 Technology Insights 2012, http://www.e-skills.com/Documents/Research/Insights-2012/TechnologyInsights_2012_Scotland.pdf

Annex B

Dimension	Attributes
Opportunities	> Reported high demand for every undergraduate software place in Scotland; so skills shortage weakness could be solvable with resources (although time lags would still operate between intervention and full solution). Near-term solutions could include re-skilling, especially targeted at re-entry of those who have left the sector. > SFC/SE/HIE Innovation Centres initiative seems to be providing focus for community and possible hosting of various associated support and exploitation mechanisms in specific areas such as Data Analytics, Digital Health, Sensors and Imaging. > Niche market opportunities have been identified for action; these opportunities are of the 'inevitable' type, being susceptible for positive influence by public investment and information campaigns rather than relying on consumer confidence.
Threats	> Rapid and massive investment in digital infrastructure and training by other countries. > Skills scarcity raises cost-base and dilutes international propositions which rely on a readily available pool of talent.

ANNEX C

Summary of Key Sector Capabilities and Supporting Initiatives

Opportunity	Sectors	Initiatives	Support focus	Maturity
Digital Health and Care *Description:* Using ICT and informatics to support and exploiting reform of service delivery in health and care. Includes initiatives in remote monitoring, call-centre technology and interfacing, medical devices. *Context/Drivers:* Demographics: global economic imperative to treat more patients in the community rather than in hospital. Internal efficiencies for global health services.	Capability Sectors: ICT/ Informatics Market Sectors: Life Sciences, Financial Services	**Digital Health Institute** Collaboration between NHS Scotland, University of Edinburgh (UOE) and Glasgow School of Art to provide a platform to support service delivery reform and for exploration, experience-testing and realisation for products and services.	Innovation Collaboration Cluster development Foreign Direct Investment (FDI) Exports	Awarded
		Dallas in Scotland Small Business Research Initiative (SBRI)-based initiative to provide digital solutions. Seven companies, NHS24, SE and HIE.	Innovation Collaboration	In progress
		Digital Health and Care (DHC) Network Integrator SME networking and intelligence gathering resource	Cluster Development	Just started in field
		DHealth A HIE initiative for a business networking and opportunity matching organisation	Cluster Development	Just started in field

Annex C

Opportunity	Sectors	Initiatives	Support focus	Maturity
Big Data *Description:* Requirements for increased velocity, volume, veracity and variability of data. Includes data analytics, data industrialisation, cyber-security and data personalisation. *Context/ Drivers:* Supporting and exploiting opportunities arising from paradigm shift which considers 'data' to be the primary asset, not the software.	Capability Sectors: ICT/ Informatics Market Sectors: All, especially Digital Health, Financial Services	**SuperComputing Scotland** The aim of Supercomputing Scotland is to enhance the competitiveness and productivity of Scottish Companies through the use of advanced Modelling and Simulation, by supporting collaboration between Scottish Companies and EPCC: Edinburgh University's world-class supercomputing centre.	Innovation Productivity	In progress
		Data Science & Engineering Innovation Centre Proposed Scottish centre for innovation and collaboration around data analytics etc.	Innovation Collaboration Cluster Development	Concept stage. Consortium assembled. Bid in development.

Annex C

Opportunity	Sectors	Initiatives	Support focus	Maturity
		CDE Catapult (TSB/UK) The Connected Digital Economy Catapult will help businesses and researchers to collaborate and to address some of the large and complex challenges facing the UK. It will provide access to testing facilities and demonstrators, and it will co-ordinate and link expertise across the country.	Innovation Collaboration	Opening in London Spring 2013 (potential connections through UOE Informatics)

Annex C

Opportunity	Sectors	Initiatives	Support focus	Maturity
Smart Mobility *Description:* Using digital capabilities to support and exploit opportunities arising at the junction of ICT, transport and energy. *Context/Drivers:* delivering an efficient and sustainable transport system as part of the transition to a low carbon economy.	<u>Capability Sectors:</u> ICT and Engineering <u>Market Sectors:</u> Transport, Energy and ICT	**Future Cities Demonstrator, Glasgow** TSB funded initiative to provide a flagship project to develop and showcase 'smart city' capabilities	Innovation Collaboration Cluster Development FDI	Awarded
		Grand Challenge To stimulate a new flow of large-scale smart mobility demonstrator projects to meet societal challenges and accelerate relevant innovation by industry	Funded call for innovation (50-50 public private)	In development for launch mid 2013
		Transport Systems Catapult (TSB/UK) West Midlands hub with Scotland's Smart Mobility programme as a virtual spoke. Strong likelihood that Scottish demonstrator projects become a Living Lab for Catapult-led innovations.	Innovation Collaboration Cluster Development	Awarded

Annex C

Opportunity	Sectors	Initiatives	Support focus	Maturity
		Smart Cities Inter-operation Standards Scotland has the opportunity to define and demonstrate a unique digital platform (as a public good) which can unlock export markets through increased global usability	Collaboration Exports	Idea stage
		Future Cities Catapult (TSB/UK) Hub expected in London, looking to Glasgow as a exemplar project.	Innovation Collaboration	Approved in concept by TSB. Now consortium building.

Annex C

Opportunity	Sectors	Initiatives	Support focus	Maturity
Sensors and Imaging Systems *Description:* Using ICT capabilities to convert analogue data such as temperature, movement and electromagnetic radiation into forms useful for the digital economy. *Context /Drivers:* Excellent Scottish capability with good penetration into global markets.	Capability Sectors: ICT and Engineering Market Sectors: All Oil and Gas and Offshore Renewable Energy (Subsea)	**Sensors and Imaging Innovation Centre** Collaboration between Scottish Universities and companies to support innovation around Scottish strengths and global market needs	Innovation Collaboration Cluster development FDI Exports	Awarded
		Subsea Engineering Programme Possible programme to exploit global requirements based on Scottish supply-side strengths in rugged engineering and sensors and imaging	Cluster Development Exports	Idea stage
Smart Built Environment *Description:* Includes the use of digital capabilities to better control energy use in our existing and new building stock. *Context/Drivers:* Support better living and the transition to a low carbon economy.	Capability Sectors: Sensors, Informatics/ ICT Market Sectors: Construction	**Built Environment Innovation Park** The project provides a Scottish innovation pathway via a clearly articulated support system from concept through to market demonstration within Scotland.	Innovation	In Progress

Annex C

Opportunity	Sectors	Initiatives	Support focus	Maturity
		Built Environment Supply Chain Innovation Support Aims to increase the level of innovation within the construction industry by connecting market opportunities with the relevant company-base and to encourage, stimulate and support innovative products which are aligned with real and current market needs	Innovation	Ending this year
		Construction Scotland Innovation Centre Proposed Scottish initiative to create a dynamic innovation support body to facilitate new construction products and processes from inception through to market delivery to benefit Scotland PLC	Innovation Collaboration Cluster development Exports	In development

ANNEX D

Digital Technologies and Industry Sectors

The following table outlines (by market sector) the main sector challenges around the digital economy.

Sector	Strengths/Opportunities	Weaknesses/Threats
Chemical Sciences	Asset management and control (e.g. industrial plant) increasingly based on machine-to-machine techniques.	Absorptive capacity for maximising opportunity compromised by lack of highly-skilled workforce pipeline.
Construction	Productivity increases for architects and consulting engineers. Opportunities in infrastructure deployment.	Challenges for training of general workforce.
Creative Industries	Significantly increase revenue by exploiting content globally and enriching content across multiple devices (e.g. smart-phone, tablet, connected TV, etc.).	Retention of Intellectual Property (IP) in Scotland, as companies seek funding for growth from overseas investors and to locate core functions in target markets.
Energy – Oil and Gas and CCS	Asset management (e.g. oil rigs, subsea and field plant) increasingly based on machine-to-machine techniques.	Absorptive capacity for maximising opportunity compromised by lack of highly-skilled workforce pipeline.
Energy – Renewable Energy	Extreme environments (e.g. offshore) provide opportunities to deploy asset management, condition monitoring and other capabilities. Ability to utilize machine to machine applications within a smart grid, enabling full energy resource maximization and utilization of renewable sources.	Lack of available grid infrastructure and connection with digital infrastructure. Need to develop new products.
Financial and Business Services	Greater digital inclusion and better data analysis open up new models. Services in Tele-Healthcare, Cyber Security & Digital Risk Management.	Mass customer base requires full digital inclusion.

Annex D

Sector	Strengths/Opportunities	Weaknesses/Threats
Food and Drink	Productivity increases for marginal processing and distribution. Protection of provenance through digital tracking of supplies.	
Life Sciences and Health	Productivity increases through use of remote contact and digital data records and medical technology. Increasingly personalised medical approaches.	Citizen privacy and security concerns are high profile issues.
Textiles	Premium protection through Digital Provenance.	
Timber	Productivity increases through better analysis of crops.	
Tourism	> Wider marketing reach. > Increasing use of location based services and augmented reality. > Acceptance that wi-fi should be considered a 'hygiene factor'. > Increasing use of mobiles and tablets by visitors. > Encourage user-generated content to increase awareness. > Increased scope for cross selling of products and services. > Improved commercialisation through improved use of e-business ie CRM to booking and payment systems.	> Significant variance in understanding and adoption of technology across the sector. > Bandwidth limitations. > Lack of network coverage. > Provision of appropriate content to the market place. > Improved understanding of the customer journey and 'touch points' required. > Tourism businesses need to build and maintain their online offering. > More collaboration required linking attractions, destination activity and providing rich content. > Prohibitive cost of mobile roaming for international visitors.

Annex D

Sector	Strengths/Opportunities	Weaknesses/Threats
Universities and Colleges (as an international market sector)	Online training elements easier to deploy into various student bases, including industry. Ability to maintain presence abroad.	Increasing globalised market. Increasing domestic costs compared with arts and humanities. Challenge to maintain quality and personalised service remotely.
Engineering (as a market sector)	Additional opportunities from demand for services and civil infrastructure deployment and maintenance. Productivity increases as lean manufacture becomes more easily supportable. High-value manufacturing involving machine-to-machine techniques.	Absorptive capacity for maximising opportunity compromised by lack of highly-skilled workforce pipeline.
Technology (as a market sector)	Additional opportunities from demand for digital services, follows through to demand for innovation in technologies.	Specialised workforce in short supply, skills costs rising as chargeable prices are falling due to increased general expectation.

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