

Data for Growth

Report prepared for North East Innovation Board's Digital Sub-Group

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Executive Summary

Data for Growth aims to establish a link between North East England's capabilities in the digital sector with needs and opportunities that exist in three other smart specialisation areas of:

- Life sciences and health;
- Low carbon passenger vehicles;
- Offshore, subsea and marine technologies.

This report reviews the interdependencies and shared opportunities that exist between these sectors.

It is informed by a comprehensive literature review, interviews with over 30 experts from 21 different organisations, and a series of four workshops in each of the smart specialisation areas.

The North East digital sector is characterised by industrial and research strengths in digital, software and technology services. This includes large digital enterprises, such as Sage, Accenture, Hewlett Packard, Red Hat, IBM and Worldpay. It also includes major organisations that are spearheading the digital transformation of the public sector, including the HM Revenue and Customs's Digital Delivery Centre and the NHS Business Services Authority. The region also has recognised strengths in its universities and is home to a number of high growth potential

companies, including: Leighton Group, Nomad Digital, Ontrac, Palringo, and Performance Horizon.

A comprehensive landscape of support is available in the North East to accelerate the growth of digital businesses. However, the interviews undertaken for this study revealed that this landscape was somewhat confusing. A profiling and mapping of a range of different business support assets is therefore presented in this report.

Examples of existing strengths in the digital sector are profiled and are grouped into the following areas: cloud computing, SaaS and web services; systems design and communications; gaming; ecommerce and marketplace.

Potential areas of opportunity for the North East digital sector are also identified, including: data analytics; cyber security; Fintech; Building Information Modelling; emerging technologies (including virtual reality); and digital transformation of the public sector.

Due to the pervasive nature of digital in almost every aspect of physical services, a more general consideration of the economic opportunities and challenges presented by digitalisation of the North East economy is also presented. This identifies that the direct and indirect benefits of increased digitalisation can lead to improvements in

healthcare, education, security, employment, as well as positive social and environmental impacts.

A further important point is that increased digitalisation, and the accompanying changes in business models, make continuous adaptation fundamental to remain competitive. Several key trends are identified that are likely to have both positive and negative impacts on the North East economy, namely: augmentation of human intelligence, automation, sharing economy, agility, servitization, openness, transparency, co-creation, cyber security and digital value propositions to differentiate products and services.

The interviews undertaken for this study revealed broad support for an overarching initiative to harness and develop the region's digital capabilities to address needs in the smart specialisation areas. The interviews, workshops and literature reviews supported the identification of specific opportunities in these sectors, which are summarised in Table 1.

Accessing domain expertise in the smart specialisation areas will help digital companies to identify opportunities and translate them into real needs. However, this expertise is not unique to the North East so on its own would not be a source of competitive advantage. In addition, the nature of digital solutions also means that geographical proximity to customers is not

necessarily an advantage, especially when targeting companies with a global footprint.

The National Institute for Smart Data Innovation (NISDI) is perhaps the only regional asset that could be considered to be a distinct source of competitive advantage for the North East. It is therefore recommended that consideration is given to how Data for Growth could be aligned with NISDI. This includes the suggestion that supported activities could focus on the exploration and use of data, rather than broader activities to support digital innovation.

The smart specialisation areas offer a logical focus that will assist in targeting businesses, maximising effective use of resources and potentially developing niche competencies that could be exportable outside the region. However, it is stressed that there may be significant opportunities outside of these three sectors and that consideration should be given to areas such as Building Information Modelling and digitalisation of public sector services.

Scalable solutions may also be better identified by targeting opportunities that cut across sectors, such as cyber security, condition monitoring, automation, personalisation, logistics and planning.

Several potential activities are identified that could be delivered under Data for Growth. This includes: challenge-based competitions focused

on business growth, embedded technologists, accelerator programmes and innovation portals. There are also opportunities to invest in infrastructure to make the region a test bed to develop and validate digital innovations.

The activities undertaken will ultimately dictate the way in which they should be delivered. However, in general terms, Data for Growth would benefit from a dedicated funded resource to develop a programme of activities, attract funding and secure the participation of companies from across the North East.

It is recommended that this resource is procured through an open competitive process and that, if

possible, existing governance structures in the region are used to oversee this activity.

It is likely that a core of public funding will be required to support Data for Growth. This could be supplemented by competitively won funding from the public and private sectors. However, care should be taken to ensure that the availability of funding does not dictate the activities undertaken and that competing for this funding does not disadvantage other businesses and organisations in the North East.

Life Sciences and Health	Low Carbon Passenger Vehicles	Subsea, Offshore & Marine
<ul style="list-style-type: none"> • Illness Prevention • Assisted Living • mHealth • Compliance and Dose Data • Analytics • System Efficiencies • Privacy • Pharmaceutical R&D • Trials • Formulations • Supply Chain Intelligence 	<ul style="list-style-type: none"> • Data-Driven Design • Operations Management • Monitoring Production Equipment • Product Variants • Supply Chain Intelligence • Connected Vehicles 	<ul style="list-style-type: none"> • Turbine Blades • Drive trains: Condition Monitoring • Electrical Infrastructure: Cable installation • Wind & Ocean Conditions: Environmental Data • Foundations & Substructures • Operations & Maintenance • Installation and Decommissioning

Table 1: Opportunities in the smart specialisation areas

1 Introduction

The North East Local Enterprise Partnership (NE LEP) has identified Digital, Software and Technology services as one of its smart specialisation opportunity areas. One of its key niches is around the exploration and use of data.

A Steering Group, convened under the auspices of the North East Innovation Board – part of the NE LEP – is working collaboratively to develop a strategy to support growth in this smart specialisation area. Within this work programme acceleration of data applications is a key focus under the working title “Data for Growth”.

Overview

Data for Growth aims to establish a link between North East England’s capabilities in the digital sector with needs and opportunities that exist in three other smart specialisation areas of:

- Life sciences and health;
- Low carbon passenger vehicles;
- Offshore, subsea and marine technologies.

This report reviews the interdependencies and shared opportunities that exist between these sectors, with three key outputs:

1. A profiling and mapping of the digital capabilities of the NE LEP area, considering strengths, opportunity areas and the roles and

capabilities of key support facilities including networks, hubs, skills providers and finance;

2. A review of the challenges facing the smart specialisation areas;
3. Recommendations to support the delivery of data for growth.

Research

This report is informed by a comprehensive desk study, interviews with over 30 experts from 21 organisations and four workshops in each of the North East’s smart specialisation areas (see Table 2).

Structure of the Report

[Chapter 2](#) introduces the North East digital sector, with [Chapter 3](#) describing the landscape of business support to digital companies in the region. [Chapter 4](#) profiles the region’s strengths and opportunity areas in digital.

The positive and economic impacts of increased digitalisation are considered in [Chapter 5](#), with the subsequent chapters considering relevant challenges in three smart specialisation areas of life sciences and health ([Chapter 6](#)), low carbon passenger vehicles ([Chapter 7](#)), and subsea offshore and marine technologies ([Chapter 8](#)).

The report concludes with [Chapter 9](#) outlining key considerations for delivering Data for Growth.

Table 2: List of organisations interviewed

Arjuna Technologies
Business Durham
Centre for Process Innovation
Datatrial
Digital Leaders North East
Durham County Council
Durham University
Dynamo
Geek Talent
Generator
Ignite
Innovation SuperNetwork
Newcastle University
North East and North Cumbria Connected Health Cities
North East Local Enterprise Partnership
SAP
Stellium
Secret Sauce
Sunderland Software City
TechNorth
Zero Carbon Futures



2 North East Digital Sector

North East England is a recognised digital hotspot, with both industrial and research strengths in digital, software and technology services.

Estimates of the size of the North East digital sector vary, but the region's software and technology market has been valued at nearly £2 billion, with the wider northern ICT worth £12 billion.¹

Table 3: Economic contribution of the NE Digital Sector²

Contribution to NE economy	£600 million
Companies	>1,500
Employees	>15,000

A Home to Large Digital Enterprises

The North East is home to the UK's only FTSE100 listed technology company, Sage plc, which is headquartered in Newcastle. Valued at \$8.9 billion, Sage is the world's third largest supplier of enterprise resource planning software.³

Both Accenture and Hewlett Packard Enterprises have major global delivery centres in the North East.

Red Hat, the world's leading provider of open source solutions, has an R&D centre in Newcastle.

IBM and Worldpay are also examples of big name technology companies that have chosen to establish a base in the North East.

Transforming the Public Sector

The North East is spearheading the digital transformation of the public sector.

Based in Newcastle, HM Revenue and Custom's Digital Delivery Centre brings together digital staff and suppliers to experiment with new technologies that create new ways of working and thinking.

The Department for Work and Pensions also has a major presence in the North East and is similarly embracing digital transformation.

Newcastle is home to the NHS Business Services Authority, which manages a range of key national services that support the front line of the NHS. These collectively represent almost 20% of the total national NHS budget, which in 2015/16 was around £116.4 billion.

North East local authorities are also embracing the potential of data and digital technologies to unlock new value and efficiencies.

Start-ups and High-Growth Companies

The North East has a proud track record of growing successful digital businesses.

Newcastle-headquartered Performance Horizon Group was ranked 16th in a 2015 list of the fastest growing technology companies in the UK.⁴ The company has reportedly raised \$28.5 million in funding over five rounds of investment.

Nomad Digital is reported to be the leading global supplier of connected passenger and fleet-management solutions to the rail industry. Based in Newcastle, Nomad's technology is deployed on 75% of all Wi-Fi connected trains in the world and is used by 1.7 billion passengers annually in more than 40 countries.⁵

Mobile gaming and instant messaging company, Palringo, which started in Northumberland, is reported to have over 23 million users around the world.⁶

Gateshead-based Ontrac was ranked 21st in the Sunday Times list of the fastest growing technology businesses in 2015, with sales growing to £7.1 million.

Sunderland's Leighton Group is one of the UK's leading Digital Agencies. Among its portfolio of companies is the WorkCast Corporation, which is Europe's largest provider of cloud-based webinar, webcasting and virtual event solutions serving over 150 global organisations.

Newcastle-based Leaf.fm is a musical discovery and promotions platform and is one of the fastest growing streaming services in Latin America.

Talented Graduates and World-Leading Universities

There are more than 100,000 students studying at the region's five universities, delivering 2,000 computing and creative design graduates every year².

Newcastle University's computer science department is the top ranked in the UK for research impact. It is also the only English university to host two EPSRC Doctoral Training Centres in computer science, namely: Cloud Computing and Big Data Analytics; and Digital Civics. These centres will train at least 115 doctoral students over the next five years.

Durham University hosts one of the largest global High Performance Computing Facilities and is a designated Intel Parallel Computing Centre⁷ and an NVIDIA CUDA Research Centre.

Northumbria University's School of Design was named one of Europe's top design schools by US Business Week magazine and has an international reputation for innovation and creativity. Notable alumni include Sir Jonathan Ive (Senior Vice-President, Apple) and Tim Brown (Chief Executive, IDEO).

Teesside University enjoys a long-standing reputation in the fields of animation and visual effects, being ranked as one of the top 20 places to study animation in the world by 3D World magazine.

The Digital Innovation Beacon at the University of Sunderland brings together researchers from throughout the digital economy to focus on the key themes of: big data, energy efficiency and safe vehicles, informatics for business and manufacturing and technology-enhanced living.

Urban Foresight analysis⁸ identified over 400 digital companies in the North East that could potentially engage with Data for Growth.

As shown in Figure 1, these companies are located across the NE LEP region. Newcastle is a key hotspot, accounting for 47% of the companies identified, followed by Sunderland, 12%; Gateshead, 10%; and County Durham, 8%.

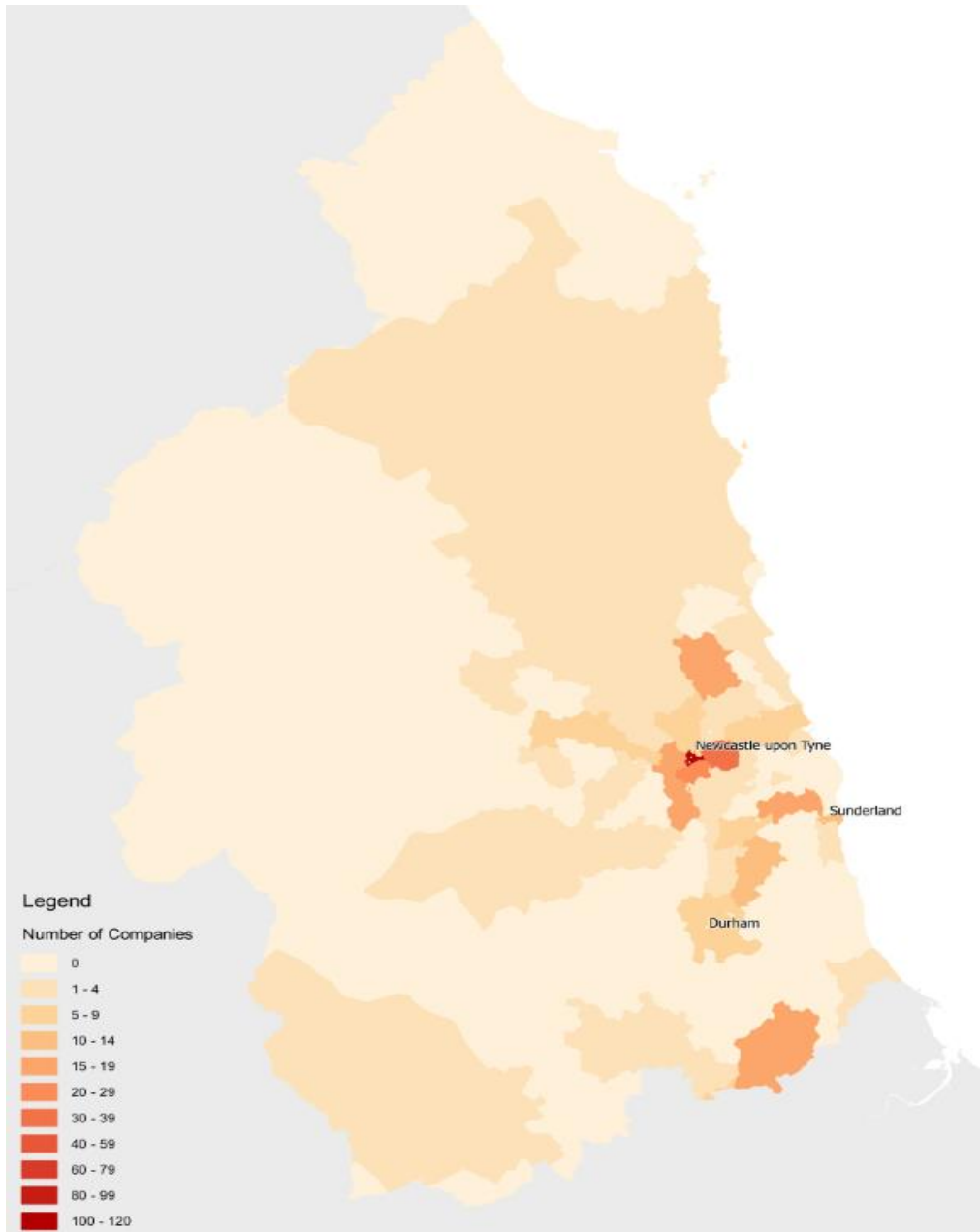


Figure 1: Distribution of digital companies within the NE LEP area

3 Digital Business Support Landscape

The North East can offer a comprehensive landscape of support to accelerate the growth of businesses of different sizes, operating across various markets and areas of technology.

Figure 1 illustrates that the support offered by these organisations corresponds to four broad areas:

- Innovation;
- Organisational development;
- Commercialisation; and
- Sector development.

3.1 Innovation

The North East possess a range of assets that enable businesses to access expertise and facilities to develop innovative products and services.

Knowledge-Base

The North East is home to five universities that offer deep technical and commercial expertise, as well as state of the art facilities for the development and testing of new products and services.



Figure 2: Business support framework

The expert knowledge-base in the North East is further strengthened by four regional Catapult centres. These are part of a network of world-leading centres designed to transform the UK's capability for innovation in specific areas and help drive future economic growth.

The North East and Tees Valley Digital Catapult Centre is hosted by Sunderland Software City, a publicly-backed agency that provides support for aspiring and established software businesses. The Catapult delivers business challenges, hacks,

open innovation competitions and incubation activities to help data owners from the private and public sector to exploit insights and value in their data.

Based in Durham, the North East Satellite Applications Catapult Centre of Excellence helps SMEs and large companies to solve problems and open opportunities using satellite data and technology, leading to more efficient use of resources, more market opportunities and a better quality of life.

The Centre for Process Innovation (CPI) runs the process arm of the High Value Manufacturing Catapult. This provides applied knowledge in science and engineering combined with state of the art facilities, including national technology centres in Printable Electronics, Industrial Biotechnology and Biologics.

The final Catapult Centre in the North East is the Offshore Renewable Energy Catapult, which is located in Blyth, Northumberland. The centre provides R&D, consultancy, test and demonstration facilities for the renewable and electrical power sectors.

A further important regional asset is the Cloud Innovation Centre, which is a joint venture between Newcastle City Council and Newcastle University's Digital Institute. The centre was established to equip regional businesses with the skills and tools necessary to exploit the benefits of cloud technologies and big data analytics.⁹

In 2016, the UK Government announced that Newcastle would host the National Institute for Smart Data Innovation (NISDI), which will bring together industry, the public sector and world-leading academics to develop the skills, ideas and resources needed to exploit the opportunities offered by the explosion in digital data.¹⁰

Knowledge Sharing

There is a vibrant programme of meetups and events in the North East.

Dynamo is the North East's largest industry-led digital network by membership and is focused on building the region's enterprise IT cluster. Dynamo hosts an annual conference and regular think tanks focused on several specialist workstreams including skills, data and cyber resilience.

TechNorth is part of TechCity UK and was established to provide tech communities in the north of England with information, networks, support and inspiration. TechNorth runs a programme of summits and socials.

Digital Leaders North East is one of 12 linked regional networks across the UK that run face-to-face conferences, salons, events and an online community promoting digital know-how, thought leadership and sharing best practice around digital transformation.

Design Network North's monthly Rise and Design events cover a wide range of topics, from the Internet of Things to Branding.

Campus North is a co-working and event space in Newcastle which has become a hub for local tech meetups, hosting between 30 to 40 events each month.

Other notable conferences in the North East include: Venturefest North East, an annual innovation summit; VRTGO which explores the future of virtual reality for both gaming and

serious applications; and the internationally renowned Thinking Digital, one of the UK's leading technology and ideas summits.

Knowledge sharing is further supported by the North East LEP backed Innovation SuperNetwork, which provides access to expertise and insights across the networks in specific sectors, membership organisations and disciplines to create new opportunities.

Market Intelligence

Sunderland Software City's Intelligence Service offers rapid market research to help businesses to better understand markets, customers and competitors.

The Business & IP Centre Newcastle offers North East entrepreneurs and SMEs free access to a wealth of databases, market research, company data, journals, directories and reports. The Centre is part of the British Library Business & IP Centre National Network and was the first to open outside of London.

3.2 Organisational Development

North East businesses can access a range of support to help them develop the necessary skills and resources to start-up and grow.

Mentoring and Coaching

The region's networks and associations play an important role in supporting the development of key skills and capabilities within organisations. 77% of companies in the region report that they are part of a digital cluster¹¹.

TechNorth's Founders' Network is a free six-month programme of educational workshop-led events for early to mid-stage tech start-up founders in the North of England.

The Entrepreneurs' Forum supports entrepreneurs based in the North East to develop and create new opportunities to grow their business. This includes a one-to-one mentoring programme and drop-in mentoring surgeries.

Digital Union is a network of digital businesses across the North East run by Generator, a Newcastle-based agency that represents the Commercial Creative Industry. Generator delivers a business coaching programme that provides access to experts in the fields of film, digital media and music who have all faced the challenges of setting up new businesses within a competitive sector.

Ignite, based in Newcastle, is one of Europe's most successful accelerator programmes for early-stage digital businesses. It helps entrepreneurs to shape their companies in an intensive 18-week programme, with access to business support and world-class mentoring.

Ignite also runs free pre-accelerator programmes which are designed to help new founders validate and progress their ideas using actionable methods and tools.

Investment and Funding

The North East Technology Fund, managed by IP Group plc, is a £28m Technology Fund investing in technology businesses which are based in, or are willing to relocate to North East England.

North East Finance manages the Finance for Business North East programme, a £142m investment fund established to provide debt and equity funding to SMEs based in the North East.

Northstar Ventures is a Newcastle and Darlington-based venture capital firm with over £95m under management across six funds.

Finance Durham is a £20 million investment fund administered by Durham County Council, which is planned to launch in 2017.

Based in Gateshead, Transmit Start-Ups is a national delivery partner for the Government-backed Start Up Loans programme. It has provided finance for over 1200 start-ups and early stage companies across England and Scotland, with a loan book of over £11 million.

Human Resource Development

Generator and Sunderland Software City deliver a range of free, funded and commercial training solutions.

Generator also run interim director scheme which places experienced directors into small to medium growing digital businesses for a period of time.

Sunderland Software City offer a service to help companies develop technical specifications to ensure they buy the technology they need at the right price.

Additional specialist professional development training is offered by a range of businesses and professional institutions, as well as the region's universities.

Managed Workspaces

There several hubs across the North East that enable digital businesses to co-locate and access related support services. This includes: Campus North, Design Centre North, Hoults Yard, i6 Charlotte Square, NETPark, Sunderland Software Centre, Evolve Centre, The Core, Toffee Factory, and VRTGO Labs.

Cobalt Business Park in North Tyneside is home to global brands such as Procter & Gamble, Accenture and Siemens and has the UK's largest purpose built data centre campus.

3.3 Commercialisation

Businesses in the North East also benefit from a range of support services to exploit intellectual property and win more contracts.

Operational Frameworks

Sunderland-based RTC North is a technology transfer company specialising in the commercialisation of new products and services.

The Business & IP Centre Newcastle runs a programme of free and low-cost one-to-one expert advice surgeries and workshops on a range of topics including business planning, marketing and intellectual property.

Generator has developed specific expertise in digital content licensing.

Business Development Services

The North East Purchasing Organisation (NEPO) Business Club helps businesses find tender opportunities and develop competitive bids. It also keeps businesses informed about current legislation and relevant procurement-related topics.

The Enterprise Europe Network is the world's largest business network, providing a platform to promote businesses, technology or ideas across Europe and beyond. The North East branch of the network is run by RTC North, which works to connect SMEs in the region to partners and

commercial deals, as well as sharing technology and new ideas.

Marketing and Promotion

TechNorth has a key focus on shining a light on the thriving tech scene in the north of England. This includes Northern Stars, a pitch competition to identify and showcase the best tech start-ups in the North of England.

Sunderland Software City also offers public relations and communications support to businesses.

3.4 Sector Development

A range of programmes and assets have been developed in the North East to improve the competitiveness of the digital sector and to ensure that firms can access the necessary support services to succeed and grow.

Business Infrastructure and Support Services

Local authorities across the North East have a key focus on providing the necessary broadband infrastructure to enable digital businesses to grow. The £34 million Digital Durham programme has facilitated the roll out of fibre-based broadband across Durham, Gateshead, Sunderland, South Tyneside, North Tyneside and the Tees Valley. The iNorthumberland programme aims to bring superfast broadband to 95% of the county by the end of 2017 and

GoDigital Newcastle is a project to make superfast broadband available to 97% of homes and businesses in the city.

Another key factor in supporting the growth of businesses is access to a strong professional services sector, including accountants, lawyers and consultants.

Events such as the monthly First Friday meetups in Newcastle, the quarterly Baltic Business Briefings in Gateshead and the regular Mussel Club networking sessions across the North East bring together companies from a range of different sectors, providing opportunities for digital businesses to engage with providers of professional services.

Access to this expertise is also supported by the Service Network, which brings together companies in the North East focused on delivering high value, business to business services.

Skills

Skills is a key workstream of the Dynamo network. Dynamo's focus is on creating and supporting the career pathways that ensure the region can continue to deliver a steady stream of skilled employees into the IT sector.

Sunderland Software City delivers teacher CPD sessions, two large-scale sector days per annum aimed at linking industry to students and a regular

GoReboot programme to help people understand employment in the sector

The region's universities and further education colleges are central to delivering this skilled workforce.

This will be further strengthened by the Northern Futures University Technical College (UTC), which is scheduled to open in 2017 and will focus on skills development for students aged 14-18 specialising in Information Technology (IT) and Healthcare Sciences.

The Tech Nation Visa Scheme makes it possible for tech talent from around the world to come and work in the UK's digital technology sector, and is part of Tech City UK's mission to ensure that the UK continues to maintain its position as a globally competitive digital economy.

International Engagement

UK Trade and Investment (UKTI) and the inward investment/ economic development agencies across the North East play a key role in promoting the region's strengths overseas and encouraging digital businesses to locate in the North East.

These organisations also help North East businesses to access partners and customers in new international markets.

Sunderland Software City and TechNorth also support international trade missions.

RTC North's Fast Track to China service is designed to help new and experienced exporters sell goods and services into one of the world's fastest growing economies.

Political Influence

Business associations such as the CBI and the Federation of Small Businesses work with members across the North East and with Government to shape regulatory standards and to underline the strategic importance of the digital sector to the UK economy.

Digital Leaders translates the content from its salons into blogs and whitepapers that are fed to local and national government.

Tech City's Future Fifty gives tailored support to 50 of the UK's fastest growing and most disruptive digital technology companies through a curated set of private partners, networking opportunities and direct links to the UK government. The current Future Fifty cohort includes two North East headquartered companies: Nomad Digital and Performance Horizon.

		Business associations	Catapults	Campus North	Digital Union/ Generator	Digital Leaders	Dynamo	Innovation SuperNetwork	Ignite	Incubators & workspaces	Inward investment agencies	NISDI/ Cloud Innov. Centre	North East Technology Fund	NorthStar Ventures	Professional associations	RTC North	Sunderland Software City	TechNorth	Thinking Digital	Universities	VRTGO Labs
Innovation	Market analysis																				
	Knowledge sharing																				
	Knowledge-base																				
Organisational development	Mentoring & coaching																				
	Investment and funding																				
	HR development																				
	Managed workspaces																				
Commercialisation	Operational frameworks																				
	Business development services																				
	Marketing/ promotion																				
Sector development	Business infra & support services																				
	Skills																				
	International engagement																				
	Political influence																				

Figure 3: Profiling of North East business support organisations



4 Digital Strengths and Opportunity Areas

Discussions with experts across the digital sector identified several areas of where the North East has established strengths and emerging opportunities to further grow the region's digital sector.

4.1 Digital Strengths

Cloud Computing, SaaS and Web Services

Newcastle University boasts world-leading research in cloud computing¹² and hosts the Cloud Innovation Centre (CIC).⁹

Red Hat's Newcastle research centre is focused on cloud computing, virtualisation and middleware technologies.

Cramlington-based SITS Group provides cloud services to organisations including the Premier League. In 2015 it was named as one of Britain's fastest growing technology companies in the Sunday Times's Tech 100.

Newcastle's Atlas Cloud delivers and manages virtual IT solutions that enable users to access applications from anywhere on any device.

Gateshead-based company PrismTech has developed an Intelligent Data Sharing Platform for

the Internet of Things, with applications in healthcare, transportation, smart cities, automation and energy.

Systems Design and Communications

Several North East companies offer expertise in linking together different computing systems and software applications physically and/or functionally to act as a coordinated unit.

Perfect Image is a full-service IT provider, delivering tailored solutions and services that improve its customers' businesses. The North Tyneside based company, which had a reported turnover of £7.5 million in 2016, provides managed infrastructure and cloud services.

Gateshead-based Aspire Technology Solutions specialises in managed IT support, datacentres and communications services. The company had a reported turnover of £7.3 million in 2015 and was ranked as one of Britain's fastest growing technology companies.

Gaming

The gaming sector is estimated to contribute £1.72 billion to the UK economy¹³.

The North East is home to world leading gaming firms including Ubisoft Reflections, Epic Games and CPP Games.

The region also boasts niche strengths in online gambling, including Sunderland-headquartered

Tombola, which is the world's largest online bingo company, and Newcastle's Bede Games which supplies an open online gambling platform that works with third party suppliers.

eCommerce and Marketplace

The North East has grown a number of notable ecommerce companies in recent years.

Online retailer Pink Boutique was founded in 2012 with a stock investment of just £90 and now generates an annual turnover of £7 million from its offices in Gateshead.

Newcastle-based online property auction company Iam-Sold was ranked at 23 of the Sunday Times' Fast Track 100 list of Britain's fastest growing businesses in 2015¹⁴.

Also based in Newcastle, END. Clothing was identified as one of the most impressive digital companies in the 2016 North East Tech 50 report¹⁵.

Stockton's Visualsoft, which also has an office in Newcastle, has been designing and building ecommerce websites for the likes of Gola, Canterbury and Mitre since 1998. In 2014 it reported sales of £6.7 million.

Newcastle's Moltin, raised \$2 million in seed funding at the start of 2016 for its eCommerce platform that helps developers to build customisable solutions.

SaleCycle, which is part of Sunderland's Leighton Group, specialises in helping online retailers to pinpoint the moment a browsing customer is lost or about to leave their site.

Gateshead's Verticly offers brands a SaaS platform that uses customer data to help personalise engagement. The technology provides real time insights to advertisers, enabling them to provide more relevant offers to customers and to personalise social retargeting, ultimately driving offline sales.

Newcastle headquartered Performance Horizon Group is a leading provider of SaaS solutions for digital partner marketing. Its performance marketing products and services are reported to drive over \$3 billion in advertiser top line revenues across 140,000 marketing partners in over 170 countries¹⁶.

Newcastle-based GoRaise is an online charity cashback platform that facilitates fundraising opportunities for both individuals and organisations.

4.2 Opportunity Areas

Data Analytics

According to TechUK¹⁷, £216 billion worth of economic growth and innovation can be created by Big Data in the UK, along with the creation of 58,000 new jobs in the sector¹⁸

The UK government announced in 2016 that the National Institute for Smart Data Innovation will be based in Newcastle and will focus on realising the potential of big data to address specific challenges in areas including health, automotive and manufacturing.¹⁰

The North East is also home to a number of companies that are ideally positioned to capitalise on this opportunity.

North Tyneside's Gavurin is a data analysis company that is focused on developing intuitive, user friendly and imaginative visuals.

Sunderland's Geek Talent is using data analytics to transform the jobs market. Its product set includes a recruitment platform for companies, a careers platform and a labour market intelligence platform.

With one of its key global offices in Sunderland, Saggezza, provides expertise in big data analytics, customer communications management, and user experience design.

Newcastle-based Arjuna has developed a framework that allows an organisation to unlock the value of data through its controlled consolidation, analysis and distribution.

Ontrac builds systems that help clients consolidate the disparate data throughout an

organisation in spreadsheets, databases and legacy systems.

Durham University has deep expertise in big data analytics.

Cyber Security

The UK is a global leader in cyber security, operating in an international market measured at \$75 billion last year and predicted to grow to \$170 billion by 2020.¹⁹

While much of this activity is focused on the Government Communications HQ (GCHQ) cluster around Malvern and Worcester, it is notable that GCHQ also has a site just outside the region in Scarborough.

North East expertise in cyber security is mainly focused on the region's universities.

Newcastle University hosts a GCHQ and Engineering and Physical Sciences Research Council certified Academic Centre of Excellence in Cyber Security Research.

Sunderland University is pioneering a radically different approach to teaching cyber security through problem based learning.

Northumbria University has a focus on developing fundamental algorithms and systems for biometric and digital media security problems.

Durham University is combining skills in machine learning, human behavioural analysis and statistical analysis to better characterise malicious and non-malicious users and to define the impact of their actions on technology.

XQ is a cyber security and resilience consultancy with an office in Newcastle. It provides technical testing services, secure architecture design, information assurance, incident response and crisis communications management.

Fintech

The UK is a world leader in Fintech, with the sector estimated to be worth \$20 billion in revenues.¹¹

Much of this activity is focused on London, with other notable clusters in Glasgow, Edinburgh, Manchester and Leicester. However, the North East's financial services sector employs over 45,000 people, and generates over £3.5 billion for the UK economy each year²⁰.

The opportunity for the North East could lie in the trend for 'challenger banks'²¹ to use technology to differentiate their offer by providing more personalised services and superior data analytics.

In April 2016, Durham-headquartered Atom Bank was the first UK bank to launch via a smartphone app. The technology-focused bank has no physical branches, but aims to offer a user experience that will be almost infinitely

customisable: from the way customers log in (biometrically or using a pin), are notified (email, text, phone, in-app messaging), through to the visual presentation of their account information.

Virgin Money employs around 1,800 people at its Newcastle headquarters and is reported to have been investing in new digital products as part of a series of investments to drive the growth of the business²².

Tesco Bank is another notable challenger bank with a significant presence in the North East. The Newcastle Building Society is also a significant employer in the region.

A related opportunity area is the application of Fintech to insurance and wider financial services.

For example, Newcastle-headquartered North Group is one of the world's biggest shipping insurance mutuals.

Also based in Newcastle, Positive Solutions, is reported to be one of the UK's largest financial adviser firms.

The North East can also cite real strengths in the development of innovative financial technologies and platforms.

Worldpay is a specialist in financial and payment technology. The company is responsible for over 8 billion global transactions per year and is one of the top five payments processors in the world²³.

Gateshead is home to one of Worldpay's larger offices and works on a wide variety of business areas, including: tech and business support, merchant records and financial control, chargeback claims and processing²⁴.

True Potential is one of the fastest growing Fintech firms in the UK, employing over 230 people in its head office in Newcastle, which has increased by 26% since January 2016²⁵. True Potential also appeared in the Deloitte Technology Fast 500 EMEA for three years running and UK Technology Fast 50 for the past two years.

Newcastle-headquartered Scott Logic provides bespoke software solutions to a number of sectors, including retail banks, asset managers, accountants, Independent Financial Advisers and insurance specialists.

Building Information Modelling

Building Information Modelling (BIM) uses digital technology to improve the sharing and analysis of data within both the construction and operation phases of projects. This brings together the geospatial and construction design and engineering world to create a powerful collaborative modelling environment.

The Global BIM market was estimated to be worth \$2.76 billion in 2014 and is expected to reach \$11.54 billion by 2022.²⁶

The North East is home to some of the main developers and users of BIM in the country.

Newcastle-based NBS is owned by the Royal Institute of British Architects (RIBA) and provides technical information to construction industry professionals. The NBS National BIM Library is the primary source of free-to-use Building Information Modelling content in the UK, containing thousands of generic and proprietary BIM objects authored to the trusted NBS standard, and integrated with the NBS specification software.

Based in Newcastle, 4Projects is SaaS web-based project collaboration tool used by many Contractors, Owners, Developers and all members of the supply chain. 4Projects is part of the global construction software company Viewpoint.

North Tyneside's Kycloud is a provider of built asset management and mobile building inspection software.

Newcastle-based Luminous Group specialises in 3D data capture and imaging, BIM and virtual reality to deliver digital surveys, digital architecture and visualisation services.

BIM Academy was co-founded by Northumbria University and Newcastle's Ryder Architecture in 2010 with the vision of creating an international centre of excellence for Building Information

Modelling (BIM), through the complementary activities of research, education and consultancy.

Newcastle University's Digital Institute and School of Architecture are also engaged in the development of innovative BIM products and services.

Emerging Technologies

The North East is home to VRTGO Laboratories, Europe's only virtual reality and augmented reality centre of excellence. This growing cluster comprises 26 companies including Facebook-owned Oculus, which has an office in Gateshead.

Digital Transformation of the Public Sector

Local government and the wider public sector in the North East has a long history of applying digital technology in innovative ways and of leading public service change. As a result, there is a great deal of practical experience and evidence of how public services can harness technology and digital tools to meet the enormous challenges they face.

Labour's 2015 Digital Government Review, which was led by Newcastle MP Chi Onwurah, reported that a digital transformation of Government Services could boost the North East's economy by £400 million a year and enable regional businesses to bid for up to £1 billion of government contracts due for renewal between 2015 and 2017.

5 Digitalisation and the Economy

The ability of “digital” to pervade almost every aspect of physical services led to a 2014 OECD report²⁷ to conclude that:

“There is no such thing as digital companies rather than digitization of the economy.”

The following sections explore the economic opportunities and expected consequences of digitalisation.

5.1 Economic Impacts

The direct and indirect benefits of increased digitalisation can be grouped into six categories which would positively impact the North East economy:

- Better healthcare
- Better education
- Increased security
- Positive social impact
- Positive impact on the environment
- Increased employment.

However, as almost every job and industry becomes increasingly technology-related, there will be winners and losers. Technological growth, and the accompanying changes in business

models, make continuous adaptation fundamental to remain competitive.

For policymakers, one way to formulate the challenge is to aim for policies that will help realise the productivity gains from digitalisation but with as few consequences on welfare as possible²⁸.

This can be considered through a number of key trends that are likely to have both positive and negative impacts on the North East economy.

Automation

Software has become sophisticated enough to replicate humans in a vast array of areas, including highly skilled ones. Increasing computer speed and processing power mean that many tasks previously reserved for humans, such as writing and research, can be executed faster and more accurately by computers. Increasingly, they can also write with style and it is no longer evident what is computer-generated or created from human hand.

Increasing automation will likely have a profound impact on the economy. For example, self-driving vehicles will mean that there will be less need for taxi drivers, truck drivers, driving schools, insurance companies, and service personnel in hotels and restaurants.

Researchers have claimed that almost half of the jobs in the US today may be automated within the

next two decades²⁹. Analysis for the UK by University of Oxford³⁰ identified that 35 per cent of all jobs have a high probability of being ‘computerised’ within the next 10 to 20 years.

The University of Oxford analysis also found that most jobs where automation is a low probability are likely to be in professional and vocational occupations where tasks were non-routine in nature. These occupations typically require higher-level cognitive or social skills, significant manual dexterity or some combination of both. In contrast, medium-probability jobs were dominated by caring and leisure occupations requiring a mix of routine and non-routine tasks. Occupations with a high probability of being automated were largely administrative in nature or involved routine manual activities, such as operating machinery.

Augmentation of Human Intelligence

A significant evolution of cognitive occupations over the last 15 years has been driven by humans and machines working together. This augmentation of human intelligence can deliver enhanced productivity because both humans and machines are matched to those tasks each performs best.

Medical, legal, financial and other knowledge-rich occupations are beginning to experience this shift, as technologies like natural language processing and other forms of cognitive analytics assist with knowledge recall and decision-making.

Sharing Economy

One of the more significant changes from digitalisation is the rise of the sharing economy. With digital platforms, even minor demand for goods and services can be matched to supply at low costs. This represents a major macroeconomic change that is expected will see more jobs in sharing economy with more flexibility but also more insecurity.

Agility

Jobs and organisations are becoming increasingly flexible in response to the shift towards a 24-hour society. 50 per cent of businesses say that flexible working (including flexible hours and offsite working) is now standard practice³¹.

Businesses are increasingly able to create and disband corporate divisions rapidly, as they shift tasks between slimmed-down pools of long-term core employees, international colleagues and outsourced external service providers. In 2013, 67 per cent of employees worldwide were working in more actively collaborative ways, while 57 per cent reported an increase in their number of co-workers who work from different geographical locations³².

Responding to the impact of new ways of working requires an agile workforce with the skills to adapt to fast-changing job requirements; flexible use of working space to accommodate rapidly-evolving work practices; and infrastructure that uses

technology to support increasing numbers of people at home, work or play³⁰.

Servitization

Servitization describes the transformation of firms (often in manufacturing) developing the capabilities they need to provide services and solutions that supplement their traditional product offerings.

This represents a considerable change for many traditional manufacturers. It characterises a product as a platform to deliver a service and requires a focus on building solutions that deliver the outcomes that are wanted and valued by customers. This combination of products and services recognises that customers only realise value when they receive the service.

The benefits of servitization are many and varied. By using the approach to get closer to customers, businesses drive up loyalty levels; develop more valuable supplier-customer relationships and ultimately generate recurring and incremental revenue streams.

With product information readily available online, customers are more knowledgeable than ever and matching their exact requirements is more straightforward.

As a result, customisation and pay per use are concepts that are now familiar. Customers expect

their suppliers to be flexible, responsive and to provide a quality service.

Openness

Technology companies are increasingly adopting more open approach to platforms. This includes collaboration with third-party providers to provide customers with access to “best in class” products and services and at the same time generate additional revenue for themselves.

Transparency

Transparency is changing the way companies interact with customers. This includes inviting customers to create communities among themselves, transparency on fees and rates and even informing customers when they would be better off with competitors.

Co-creation

Co-creation is a form of collaborative creativity, that’s initiated by firms to enable innovation *with*, rather than simply *for* their customers³³.

Consumer knowledge, derived from experience, is increasingly being viewed as a key competitive asset. Companies are designing and marketing products in ways that appeal more to the emotional side of consumers.

Aided by information technology, which makes interaction spaces like online user communities

possible, co-creation allows for a continuous process in which products are tuned or recast.

Cyber Security

A report for the Government's Cabinet Office estimated the cost of cybercrime to the UK to be £27bn per annum. A significant proportion of this cost comes from the theft of IP from UK businesses, which was estimated at £9.2bn per annum. Businesses bearing the brunt of cybercrime are providers of software and computer services, financial services, the pharmaceutical and biotech industry, and electronic and electrical equipment suppliers.

Digital Value Propositions

Digital technologies are increasingly providing a means to differentiate products and services.

Central to this is mass personalisation and the aim to create a highly personalised service to attract, motivate and provide an experience dividend to users.

Increasing the rate of self-employment in the digital economy in line with the rest of the UK would result in over 9,700 more tech founders.³⁴

5.2 Digitalisation of the Smart Specialisation Areas

Increased digitalisation is widely expected to have a significant impact at all levels and in all sectors.

The pervasiveness of digital, the rapid rate of technological progress and the transformative impacts (both positive and negative) underline the importance of the North East adopting a proactive approach to shaping its digital future.

Central to this are four 'smart specialisation' areas identified in the North East LEP's Strategic Economic Plan (SEP). These represent areas of the economy that provide opportunities for developing long term competitive advantage and productive growth through innovation, business clustering and investment.

This includes the digital sector, and three other areas

- Subsea offshore & marine;
- Low carbon passenger vehicles;
- Life sciences & health.

The following chapters consider how these three areas could be enhanced by digital and data expertise.



6 Life Sciences and Health

The life sciences and health sector comprises pharmaceutical, biotechnology, and medical technology segments.

Table 4: Economic contribution of the North East life sciences and health sector

Contribution to NE economy	£683 million
Companies	144
Employees	5,644

6.1 Market Potential

The UK life science sector is an important contributor to the UK's employment footprint and GVA with the sector generating £50bn of revenues and £5bn in R&D investments.¹

After the US, the UK is the world's second leading location life sciences foreign direct investment.

Since 2011, £6bn of inward investment has been secured, leading to 17,000 jobs.³⁵ The UK also attracted 36% of foreign investors into Western Europe in the first eight months of 2015.¹

The global digital health sector was worth £23bn in 2014 and is forecasted to almost double to £43bn by 2018.³⁶

The UK market size is £2bn and is expected to grow to £2.9bn by 2018, driven predominantly by

high growth in markets such as mHealth apps and health analytics.³⁶

Cisco estimates the value of the overall healthcare related Internet of Everything (IoE) opportunity in the UK to be £48.5bn by 2025.³⁷

6.2 Challenges

Illness Prevention

With more individualised care, healthcare providers can make sure that at-risk patients are identified and helped before they have to enter the hospital.

The challenge can be summarised as knowing what patients are doing, and equipping them and their providers with better tools and algorithms to make more informed and better decisions.

Assisted Living

Advances in technology and healthcare mean that people are living longer. However, the number of people who will have long-term conditions, and as they grow old become frail, is also set to increase. At the same time, the number of economically active people who can finance health and social care is falling. As a result, there are concerns that today's care models are unsustainable. Accordingly, a key focus for health and social care professionals is to develop technologies and services that will enable individuals to receive support at home.³⁸

Assisted Living includes the use of sensor and information and communication technologies to facilitate the remote delivery of health, care and support to people to allow them to live as independently as possible in the lowest intensity care setting consistent with their needs and wishes.

This includes: telecare and telehealth products and services; home automation and environmental control solutions; communication aids including videoconferencing and services for people with dementia, learning difficulty and sensory loss; and devices and services to support care workers delivering assisted living services in the community.

mHealth

mHealth refers to mobile phone applications relating to health and/or wellbeing and connected wearable devices. These technologies enable people to track, manage, and improve their health, achieve wellness goals, and interact with their health system.

The use of mobile phones for accessing information about health almost doubled between 2010 and 2013.³⁹ Today there are around 103,000 mHealth apps on the major app stores.⁴⁰

Currently, mHealth is being used more commonly by consumers to make decisions about wellness, but the potential lies in supporting higher-impact

clinical decision-making and developing the interaction between clinicians and patients³⁶.

While the potential of mHealth is enormous, integration into the IT clinical infrastructures with the successful resolution of privacy and security issues will be an ongoing challenge. Regulatory frameworks and evidence for the actual impact on clinical care and quantifiable improvement of health outcomes as a result of mHealth are also limited.³⁹

Compliance and Dose Data

Remote-monitoring devices are being developed to increase patients' adherence to their prescriptions. This includes smart pills that can release drugs and relay patient data, as well as smart bottles that help track usage. Technology and mobile providers are offering services such as data feeds, tracking, and analysis to complement medical devices.⁴¹

Gamification approaches could have a major impact on changing behaviour and improving compliance with a treatment plan, especially with children. Currently, 28% of mHealth app publishers include gamification approaches into their apps.⁴⁰

Social monitoring, e.g. sharing blood pressure results on Facebook or other social networks, is another potentially useful device.

Dose data is a major challenge, particularly for those who are self-medicating by injections. There is significant potential help providers, particularly in type 2 diabetes where data is often lacking on what patients are doing.

Analytics

Recent achievements in mobile technology and sensor/wearable devices have created real-time geo-located big data streams, facilitating context-aware social media communication and participatory systems that are radically changing the way we monitor populations with unprecedented opportunities for disease surveillance, early-warning, preparedness, and rapid response.

Health analytics is an emergent and fast growing digital health sector. The market is currently still relatively immature but expected to grow rapidly, c. 24% up to 2018.³⁶

There is great potential for health analytics in the UK; however, challenges around data access need to be overcome in order to maximise the benefits and grow the industry.³⁶

The UK has a unique environment to develop the health analytics industry, combining the large volume of data being generated by the NHS, digital health solutions and investments in genomics.

System Efficiencies

The UK's National Health Service (NHS) is the world's largest healthcare system and is facing a budget deficit of £20bn to £30bn in the coming years.⁴² Innovation will be needed to improve the quality of treatments and promote cost effectiveness.

A key gap is the lack of integration across care services, namely: hospital, community and home, clinical and social care, formal and informal settings.⁴³ This encompasses electronic health records and e-prescribing, with a total current market size of £1.3 billion.³⁶

The systems need to be able to move healthcare data securely across organisational boundaries, store highly confidential data safely, link datasets together and deliver consistent analytical methodologies that support clinical decision making. These actions are fundamental to improve the quality and efficiency of health care while maintaining patient confidentiality.³⁶

Another key focus is removing any process that is not a core function of a healthcare professional. Digital solutions can allow more time be dedicated to better care and provide opportunities for better scale so that practitioners and caregivers can see far more people in a far shorter time.

Research by McKinsey found that implementing technologies such as patient self-services, using digital channels rather than direct physician

interaction, or patient self-management solutions can produce net economic benefits of 7 to 11 percent of total healthcare spending.⁴⁴

Privacy

The security of patient records is necessarily a top priority. IT platforms must have strong data-protection measures in place to minimise the risk of a data breach and allow individuals to determine who can see their records.

Many patients are concerned about the confidentiality of their medical records, and some may not want application developers to have access to those records. However, the popularity of online communities suggests that some patients are willing to share data if they believe it provides a near-term benefit.

Pharmaceutical R&D

Pharmaceutical R&D suffers from declining success rates and a stagnant pipeline. Sophisticated modelling, the wealth of new data available and improved analytical techniques will enhance future innovation and feed the drug-development pipeline.

One such example is connecting patient genotypes to clinical-trial results to identify opportunities for improving the identification of responsive patients. Such developments would make personalised medicine and diagnostics an integral part of the drug-development process

rather than an afterthought and would lead to new discovery technologies and analytical techniques.

Trials

Smarter devices and improved data exchange will enable improvements in clinical-trial design and outcomes as well as greater efficiency. Clinical trials will become increasingly adaptable to react to drug-safety signals seen only in small but identifiable subpopulations of patients.

Panels such as VOICENorth, established by Newcastle University, will become increasingly valuable sources of data and could help attract further research and investment to the region.

Formulations

Complex formulated products are ubiquitous in everyday life. The design and manufacture of formulated products is a highly significant value-adding step.

Formulations are traditionally empirically-derived and highly reliant on the knowledge of individual formulators. These capabilities and this incremental approach to development is widely believed to be approaching its limits. A shift to a more data-driven approach provides an opportunity to exploit growing global demand for differentiated products with novel effects, delivered quickly and sustainably.⁴⁵

There is an appetite amongst companies from different formulating industries, which do not compete, to collaborate to tackle common technical challenges and opportunities. Despite the diversity in end-use applications, the level of cross-over potential in formulation is particularly high as seemingly unrelated products often share very complex microstructures. However, achieving this requires the sharing of proprietary and commercial sensitive information in a highly secure way.

A further opportunity is to harness IoT technologies to gain data on how products are used and perform in the real world and to optimise formulations to better meet these applications.

Supply Chain Intelligence

The distribution of pharmaceutical products presents several challenges and opportunities.

At the most basic level this includes securing greater intelligence on demand, inventory and usage patterns.

A further challenge is security, authentication and anti-counterfeiting measures.

Low cost sensors also provide opportunities to monitor environmental exposures that could damage the product such as extremes in temperature, humidity, stress and impacts.



7 Low Carbon Passenger Vehicles

Low carbon passenger vehicle manufacture encompasses the manufacturing of conventional, electric, hydrogen and hybrid cars and vans, and rail transport, leisure vehicles, off road vehicles and their associated components/products.

Table 5: Economic contribution of the North East life sciences and health sector⁴⁶

Contribution to NE economy	£35.4 billion
Companies	21
Employees	13,700

7.1 Market Potential

The potential for Internet of Everything (IoE) companies to solve transport issues, such as predicting public transport problems, reducing traffic in urban areas and locating trains in more accurate ways presents a market opportunity worth £10.4 billion for the UK in the next decade.³⁷ Opportunities from the aggregation of user data for example, provides a wide range of opportunities for IoE start-ups, from congestion management applications to retailer-focused analytics that provide better information about flow of potential customers through stations.³⁷

According to KPMG, connected and autonomous vehicles will provide huge social, industrial and economic benefits to the UK. By the year 2030,

autonomous vehicle technology could be worth over £50bn a year and could create an additional 320,000 jobs in the UK by 2030, 25,000 of which would be in automotive manufacturing. By the same year, these vehicles have the potential to save over 2,500 lives and prevent more than 25,000 serious accidents in the UK.⁴⁷

7.2 Challenges

Data-Driven Design

Data-driven design has become a standard practice in the digital sector. Manufacturers stand to benefit if they apply it more comprehensively to their own products.

Vehicle manufacturers have taken a simulation-based approach. For example, McLaren conducted performance analysis on its designs before creating a physical prototype, and Volvo used customer data to forecast whether designs and features would appeal to customers.

Another related challenge is the use of simulation for testing components. For example, it is impossible to test welded parts in production without production.

Operations Management

Data and analytics can be used by manufacturers to improve operations on the factory floor. The explosion of low-cost sensor technologies has made nearly every manufacturing process and

component a potential data source. Innovative manufacturers can use the resulting data sets to gain insights about the physical fabrication process, improving efficiency, increasing yields, and reducing product defects.

Monitoring Production Equipment

Plant and operations managers can use streaming data from connected tools and robotics to monitor production equipment. This helps identify potential problems before a failure occurs. More detailed and accurate information about asset performance can enable planned maintenance and adjustment of equipment schedules to ensure production line availability and adhere to delivery schedules.

Product Variants

IoT solutions with product line engineering can help manage the complexities of product variants as automakers look to offer greater personalisation in their vehicles.

Supply Chain Intelligence

Automotive supply chains consist of hundreds of companies making thousands of parts and components that ultimately are funnelled into a single plant that performs the final assembly. The correct, high quality parts and components must arrive at the right time, in the right quantity, and in a coordinated manner so the assembly can be done quickly and efficiently.⁴⁸

The interconnected nature of industrial supply chains makes them hotbeds for risk, and more information can mean the difference between a recall and a successful shipment.⁴⁹

Supply chain data platforms can be used to manage and monitor materials, equipment, and services in real-time. This addresses the high cost of downtime and supply chain optimisation.

Automotive supply chains are increasingly required to provide information flows to provide traceability and transparency in both the order-generating and order fulfilment channels.

Suppliers are also increasingly using camera-based monitoring systems to maintain tolerances within specifications.

Real time intelligence from manufacturing and assembly lines would enable local suppliers, that deliver on a just-in-time sequencing basis, to make small adjustments in the dimensions of components to allow for factors such as tool ware and to enable better/ easier fitting. This offers an opportunity to speed up production, increase the productivity of assembly plants and ensure that suppliers maintain tolerances within agreed (and possibly dynamic) specifications.

The bottom line for all original equipment manufacturers and suppliers is to reduce the delivered unit cost of products. Intelligent use of data and technology to realise cost efficiencies will therefore be central to the future competitiveness of automotive companies.

Connected Vehicles

The cloud computing model is not applicable to environments where operations are time-critical or internet connectivity is poor. This is especially true for vehicle to vehicle communications, where the prevention of collisions and accidents cannot afford the latency caused by the roundtrip to the cloud server.⁵⁰

“Fog computing” refers to the need for bringing the advantages and power of cloud computing closer to where the data is being generated and acted upon. Fog computing reduces the amount of data transferred to the cloud for processing and analysis, while also improving security.

IoT nodes are closer to the action, but for the moment, they do not have the computing and storage resources to perform analytics and machine learning tasks. Cloud servers, on the other hand, have the horsepower, but are too far away to process data and respond in time.

An example application of this technology is helping semi-autonomous cars to assist drivers in avoiding distraction and veering off the road by providing real-time analytics and decisions on driving patterns.⁵¹ Intelligent communication between vehicles and traffic signals is another such application.



8 Subsea, Offshore & Marine

Subsea, offshore and marine technology is used to conduct processes and operations both beneath the surface of the sea and in the interface between the sea and connected (offshore) activities above.⁵²

The sector encompasses oil and gas (offshore oil and gas fields), offshore renewable energies (such as tidal, wave and offshore wind) and associated works of these sectors. It also includes ports, shipping, the use of remotely operated vehicles, underwater cabling and research facilities/institutions.

Table 6: Economic contribution of the North East subsea, offshore and marine sector⁵³

Contribution to NE economy	£1.5 billion
Companies	50
Employees	15,000

8.1 Market Potential

The UK subsea, offshore & marine sector is worth £8.9 billion, with the UK enjoying 45% of the £20 billion global market. The industry supports 66,000 jobs nationally, 16,000 of those posts having been created in just the past five years.⁵³

There is strong export performance of UK subsea companies to Europe (especially Norway), Africa (especially West Africa), North America and Asia.

Further export growth is expected to come from South America as well.⁵²

The offshore wind industry is expected to reach a capex of €15 billion per annum globally over the next decade.⁵⁴ This growth is expected to play a significant role in the quadrupling in size of the global subsea sector, expected to reach £85 billion by 2020.⁵²

With this market potential in sight, the industry is believed to have the economic power to help the region hit its goal of creating 100,000 new jobs in the North East economy over the next decade.⁵³

The growing wave and tidal renewables sectors, are set to employ 20,000 people by 2035.⁵²

Liquefied Natural Gas (LNG) is an important growth space for the oil and gas sector. Global demand is rising and stretching into new markets. As such the volume of LNG traded globally is expected to double by 2035.⁵⁵

8.2 Challenges

The Offshore Renewable Energy Catapult has identified a number of key areas where it is keen to collaborate with organisations to develop innovative technologies and solutions in wind, wave and tidal technologies.

Turbine Blades

- Innovative solutions to improve the durability of wind and tidal turbine blades and improve the repair of damaged and eroded blades.
- Innovative solutions to improve the capability, and reduce the costs, of monitoring the condition of offshore wind turbine blades.
- Innovative solutions to improve the capability and reduce the costs of monitoring blade conditions, and to ensure the quality of blades and subcomponents through the manufacture and installation process.

Drive trains: Condition Monitoring

Innovative solutions to improve the capability and reduce the cost of acquiring, and intelligently analysing, operational data to determine current and predict future drive train health.

Electrical Infrastructure: Cable installation

Innovative solutions to reduce the costs of cable installation and operation. This includes solutions that:

- Increase the safe range of working conditions for cable installation and trenching.
- Improve the effectiveness and reduce the cost of cable protection.
- Increase the reliability of transmission cabling e.g. methods to support cables running to and from floating wave devices that account for device movement and wave loading.

Wind & Ocean Conditions: Environmental Data

Innovative solutions to improve the capability and reduce the cost of:

- Extracting additional value from existing meteorological data sources to support offshore wind farm, tidal and wave array design, installation and operation.
- Acquiring environmental data such as wind speed, atmospheric temperature, wave height, and turbidity.

Foundations & Substructures

Solutions to improve the capability and reduce the costs of foundation installation, such as:

- Installing large diameter monopile foundations.
- Managing installation pollution (piling noise, spoil, failures leading to unintended spill, etc.).
- Accelerating piling timescales in difficult sub strata (drill/drive, screw piles).

Solutions to improve the capability, and reduce the costs, of monitoring the condition of offshore wind foundations. Specific areas of interest are:

- Corrosion, loadings, the structural integrity of steel and concrete foundations.
- Monopile/Transition piece-grouted connection integrity monitoring.

Operations & Maintenance

- Improve the speed of installation and reduce the costs of foundation installation

- Improve the range of working conditions and reduce the costs of providing safe crew access to offshore infrastructure for maintenance activities.
- Improve the capability and reduce the costs of acquiring and intelligently analysing operational turbine data to improve wind farm design, operation and management.
- Support the collection of data on mammal interactions with wave devices, monitor the build-up of biofoul and its effect on device performance, and sub-systems that enable the integration of multiple sensors, Ethernet transmission and the rapid analysis of data at onshore base stations.

Installation and Decommissioning

- Installation and retrieval of tidal turbines, reaction systems, subsea hubs, using mechanical aids, ROVs, and on site sensors (cameras, positioning sensors etc.).
- Device connection/disconnection mechanisms
- Solutions to reduce operations and maintenance costs of wave energy devices, enabling fast, reliable connection and disconnection of wave devices in arrays.
- Optimised mooring/anchoring systems.
- Structure subsystem foundation solutions for seabed ancillary items.

9 Delivering Data for Growth

This section summarises key considerations that will shape how Data for Growth could be delivered in North East England.

9.1 Regional Perspectives

The interviews undertaken for this study revealed broad support for an overarching initiative to harness and develop the region's digital capabilities to address needs in the smart specialisation areas.

Interviewees cited several examples of where data was successfully being commercially exploited in the North East in each of the smart specialisation areas.

The interviews and workshops also confirmed that intelligent use of data and digital capabilities were expected to be central to the future growth in each of the smart specialisation areas.

A key point of discussion in the interviews was whether 'data' was different to 'digital'. As a broad generalisation, interviewees from the digital sector tended to support the idea that the two concepts could be used interchangeably, whereas individuals in the smart specialisation areas tended to see data and digital as being linked but different. A number of the interviewees that held the latter perspective asserted that digital was

often perceived in 'industry' (i.e. outside the digital sector) as being the responsibility of ICT managers, whereas focusing on data would facilitate easier engagement with individuals across a range of application domains.

Focusing on data was also seen to be beneficial in securing funding and in engaging with businesses. This was largely based on the assertion that a more general 'digital' programme would be less distinct from previous activities and those offered elsewhere in the UK.

A further key motivation for focusing on data was the opportunity to connect Data for Growth to National Institute for Smart Data Innovation, which is seen to offer a great 'shop window' for the region. There was also strong support for establishing links with the two other national centres to be hosted by Newcastle University: National Centre for Ageing Science and Innovation; and the National Centre for Energy Systems Integration.

However, several interviewees raised the perception that NISDI (and other national centres) will necessarily be more research-led than focused on business support. These individuals all agreed that Data for Growth could be a way to give NISDI a sharper focus on business growth, but stressed that Newcastle University could not do this alone.

Several interviewees also stressed the importance of connecting Data for Growth with the regional Catapult centres.

In considering the wider enabling environment to support this activity, a key issue identified was that the business support landscape for the digital sector in the North East was somewhat confusing. It was stressed that Data for Growth should not add to this complexity and would ideally contribute to making things more straightforward.

9.2 Ambition

In formalising the design of Data for Growth it is suggested that an important starting point would be to clearly articulate the ambition for the initiative and consider what success would look like.

Given the links to the North East Local Enterprise Partnership, the overarching ambition to create "More and Better Jobs" is likely to feature prominently. However, it is also recommended that the potential for wider economic benefits are also considered including:

- Better healthcare
- Better education
- Increased security
- Positive social impact
- Positive impact on the environment.

9.3 Scope




In defining an appropriate scope for activities related to Data for Growth, there are three broad options, which are summarised in Table 7.

These options were discussed with stakeholders in the Digital Sub-Group of the NE LEP innovation board, who collectively agreed that an initial focus on areas of smart specialisation was important to give Data for Growth a distinct identity and to maximise the impact of the resources deployed. A broad focus on the digital transformation of the North East economy was seen to offer a less distinct value proposition and would likely compromise opportunities to access funding and to engage with companies.

The Digital Sub-Group acknowledged that further consideration may need to be given to whether the proposed areas of smart specialisation were the correct focus for Data for Growth. This issue is being addressed, to a degree, by the refresh of the regional strategic economic plan.

The Digital Sub-Group also agreed that it is likely that Data for Growth would probably be extended beyond the initial three areas of smart specialisation, confirming that the third option identified in Table 7 was likely to be the most suitable approach.

Table 7: Options for the scope of activities under Data for Growth

Focus	Description
 Smart specialisation areas	Link capabilities in the digital sector with needs in: <ul style="list-style-type: none"> <input type="checkbox"/> Life Sciences and Health <input type="checkbox"/> Low Carbon Passenger Vehicles <input type="checkbox"/> Offshore, subsea and marine technologies
 Digital Transformation of NE Economy	<ul style="list-style-type: none"> <input type="checkbox"/> Opportunities supported on individual merit irrespective of sector <input type="checkbox"/> Engage with other emerging smart specialisation areas <input type="checkbox"/> Support additional sector that are major contributors to NE economy (e.g. public sector, engineering & construction, financial services)
 Digital Transformation of NE economy with initial focus on smart specialisation areas	<ul style="list-style-type: none"> <input type="checkbox"/> Phase 1: focused on smart specialisation areas <input type="checkbox"/> Phase 2: opened to any sector/solution

The scope of activities related to data for growth could be further delineated by concentrating on cross-cutting opportunities that offer potential to add value to each of the smart specialisation areas. Such an approach would increase opportunities for cross-sectoral innovation (i.e. transposing a solution from industrial area to another) and support the scale-up and strengthening of niche areas of expertise. Examples identified in the research undertaken for this study include:

- Augmentation of human intelligence
- Automation

- Co-creation
- Condition monitoring
- Cyber Security
- Data-driven design
- Logistics & supply chain management
- Mass personalisation
- Openness and transparency
- Servitization

9.4 What is the North East's Competitive Advantage?

While the North East has some excellent digital capabilities in both industry and research, many other regions across the UK and globally would be able to present a similar portfolio.

Accessing domain expertise in the smart specialisation areas will help digital companies to identify opportunities and translate them into real needs. However, this expertise is not unique to the North East so on its own would not be a source of competitive advantage.

The nature of digital solutions also means that geographical proximity to customers is not necessarily an advantage, especially when targeting companies with a global footprint.

A key differentiator reported in interviews undertaken for this study was the vibrancy of the digital sector in the North East, as indicated by the number of events and meet-ups.

However, the National Institute for Smart Data Innovation is perhaps the only regional asset that would pass a formal test of competitive advantage⁵⁶.

9.5 Approach

Table 8 shows a number of potential activities that could be delivered under Data for Growth.

Table 8: Types of activities that could be supported by Data for Growth

Option	Description	Example(s)
Challenge-Based Competition	Grant funding awarded through a competition to support growth, diversification and capacity building of established North East businesses.	Small Business Research Initiative (SBRI) is a process to connect public sector challenges with innovative ideas from industry, supporting companies to generate economic growth and enabling improvement in achieving government objectives.
Embedded Technologists	Funding to place digital experts inside companies in the smart specialisation areas to co-create solutions, supporting their implementation and enabling necessary culture change.	NESTA's Open Data Scotland encouraged collaboration between local authorities and digital media developers to provide innovative, digital services to solve real issues.
Accelerator Programme	Fixed-term, cohort-based programmes that offer investment and include mentorship and educational components	Rockstart : Amsterdam-based accelerator programme consisting of three verticals: Web and Mobile, Smart Energy and Digital Health. Port Innovation Lab : Joint initiative of YES!Delft and the Port of Rotterdam Authority to attract and accelerate new and relevant port ideas into successful start-ups. Entrepreneur First : London-based startup accelerator which assists promising tech graduates and those already working in technology firms to design and run their own startups. Corporate accelerator programmes .
Innovation Portal	Online platform to facilitate technology scouting, partnerships, knowledge brokering, idea contests and crowdsourcing.	Kaggle challenges data scientists to compete with each other to solve complex data science problems, using the latest and varied applications of machine learning.
Living Lab	Invest in infrastructure to make the region a test bed to develop and validate innovation. Not just focusing on growth/ venturing but also creating infrastructure for co-creation with end-users.	Existing data assets in the North East include VOICENorth, Urban Observatory, Co-operative ITS

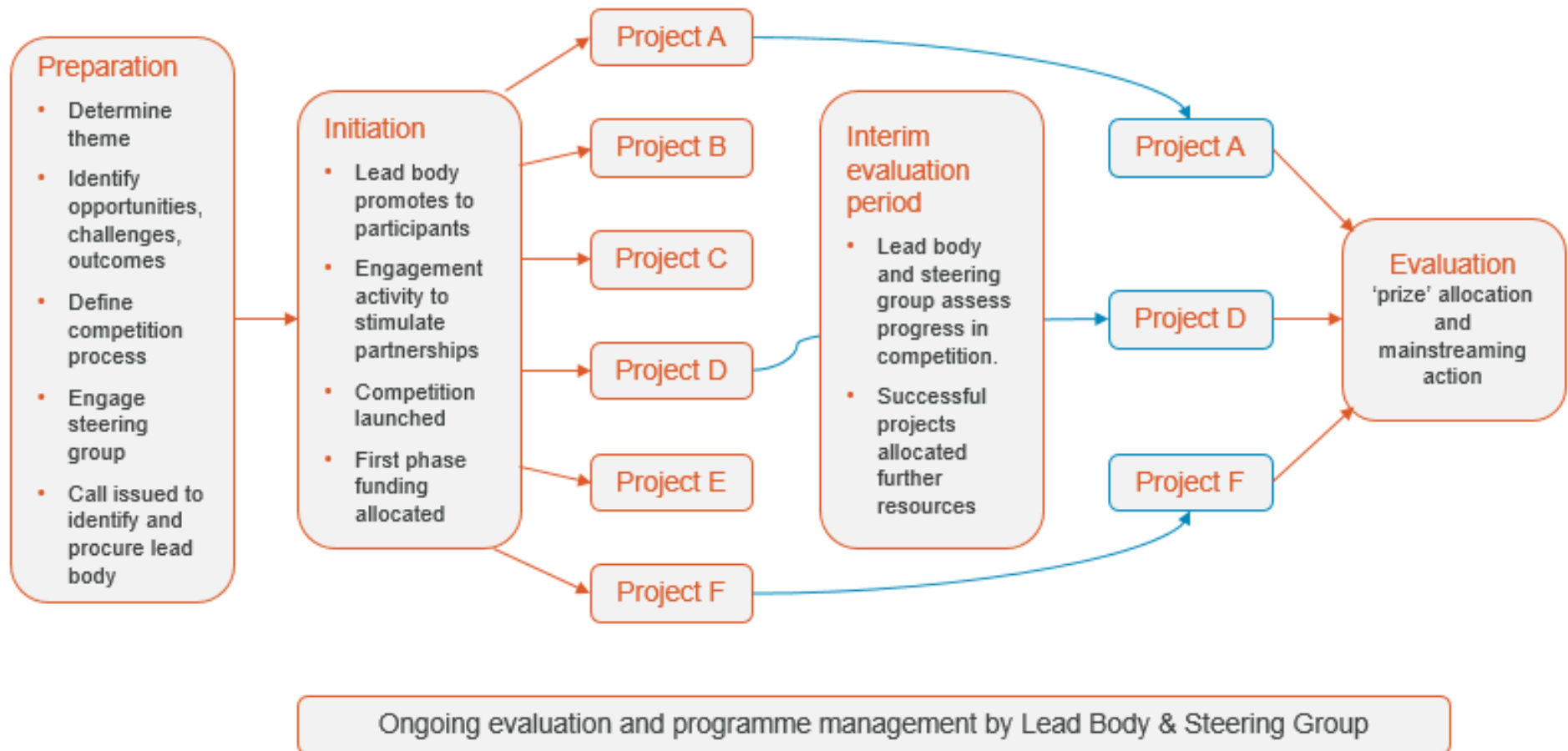



Figure 4: Challenged-based Competition concept and schematic developed by the NE LEP


9.6 Delivery Structures

The nature of the activity will strongly influence the delivery approach taken.


There several options could be considered for delivery of Data for Growth:




Distributed Responsibility: Responsibility for managing and sourcing funding for projects is distributed among stakeholders.



Task Force: A voluntary task force is formed to facilitate improved coordination among projects.



Task force + Champion: The task force is supported by a funded 'Champion' which provides a dedicated resource to advance the development and delivery of Data for Growth.



Dedicated Agency: A dedicated team of experts responsible for developing and implementing Data for Growth.

It is also possible to adopt a phased approach whereby the delivery structures evolve over time.

9.7 Governance

The governance required for Data for Growth will also ultimately depend on the activities delivered.

A general recommendation would be to avoid establishing standalone governance structures

solely for Data for Growth. The following are examples of existing or planned groups that could potentially perform this role:

- Use the North East Innovation Board
- Formalise the North East Innovation Board Digital Sub-Group
- Work with Newcastle University to establish an industry board to oversee NISDI and Data for Growth
- Use the Board of the Innovation SuperNetwork

9.8 Funding

Data for Growth is likely to require core public funding for long-term investment in the necessary infrastructure, expertise and skills development to deliver the activities considered.

This core funding could be supplemented by work to secure competitively won collaborative R&D projects that are funded jointly by the public and private sectors. To maximise the impact and benefit of Data for Growth, it is important that funding is sought to implement activities that are set by an overarching strategy, rather than a more opportunistic approach where the funding available defines the activities that are undertaken.

Once the relevant capabilities and infrastructure are established in the North East, it is possible that revenue may also be generated by business funded consultancy and R&D contracts. However,

should this approach be adopted, care should be taken to ensure that this does not create a publicly-sponsored competitor to existing businesses and support agencies.

9.9 Summary of Recommendations and Key Findings

Scope

- Focusing on the exploration and use of data provides a focus that is both innovative and offers potential to add significant value to the smart specialisation areas. Appendix A presents further information to support the conception and design of data-oriented activities.
- Focusing on the smart specialisation areas provides an effective means to target businesses and to develop niche capabilities that could attract investment and be exported outside the region. However, some of the highest growth opportunities may lie outside the smart specialisation areas and merit further consideration (e.g. Building Information Modelling, public sector solutions).
- Scalable solutions may also be better identified by targeting opportunities that cut across different sectors (e.g. cyber security, condition monitoring, automation, personalisation, logistics and planning).

Ambition

- Data for Growth offers an opportunity to create jobs and to deliver wider economic benefits.

North East's competitive advantage

- The North East's digital strengths and smart specialisation opportunities are not unique or unmatched.
- NISDI gives the North East a strong anchor for a unique offer to the world.

Potential activities

- In addition to challenge-based competitions focused on business growth, there are also wider activities that could be supported under Data for Growth, including: embedded technologists, accelerator programmes and innovation portals.
- There are also opportunities to invest in infrastructure to make the region a test bed to develop and validate innovations.

Delivery structures

- Data for Growth would benefit from a dedicated funded resource to develop a programme of activities, attract funding and secure the participation of companies from across the North East.
- This should be procured through an open and competitive process.

Governance

- It is recommended not to set-up a standalone board solely for Data for Growth.
- A Board for Data for Growth should ideally be linked to NISDI, the Catapults and wider work of the NE LEP.
- Needs to be industry-led and focused.

Funding

- Data for Growth will likely require a core of public funding to develop the necessary resources to deliver the activities considered.
- This could be supplemented by competitively won funding from the public and private sectors.
- Care should be taken to ensure that the availability of funding does not dictate the activities undertaken and that competing for this funding does not disadvantage other businesses and organisations in the North East.

Appendix A: Data

The modern world is full of billions of connected devices serving many different applications including environmental monitoring, industrial applications, business and human-centric pervasive applications. These developments have brought us to the era of Internet of Things (IoT).

This data offers tremendous potential for efficiency gains, new business models and related opportunities. By 2017, it is projected that the annual amount of data traversing global networks will exceed total accumulated data from 1984 to 2012⁵⁷.

Organisations that effectively use data to drive decisions have been shown to outperform their competitors by a margin of 5% to 6%⁵⁸. However, assembling the physical infrastructure and skill base necessary to exploit big data represents a considerable challenge⁵⁹.

i. Data Value Chain

Figure 5 summarises the key activities in managing and coordinating data from generators to information consumers.

Data Discovery

There are many sources of data that help solve business problems. Data can be internal and external to organisations and needs to be located and evaluated for cost, coverage, and quality.

Discovery also includes inventorying, preparing and organising data assets, as well as establishing access to the data sources by copying them into a shared system and setting up security and privacy restrictions for data use.

Data Integration

Much of the value in data can be found from combining a variety of data sources to find new insights. Integration can be either virtual, such as through a federated model, or physical, such as through a data warehouse.

Data Exploitation

Once the data has been gathered and integrated, an organisation is ready to exploit it to make informed decisions.

Visualisation involves presenting analytic results to decision makers as a static report or an interactive application that supports the exploration and refinement of results.

Once data has been translated into meaningful information that can readily be consumed to make critical decisions, the final activity is to determine what action is necessary. This is supported by analytics including predictive or behaviour analysis, algorithm-driven suggestions and augmented services.

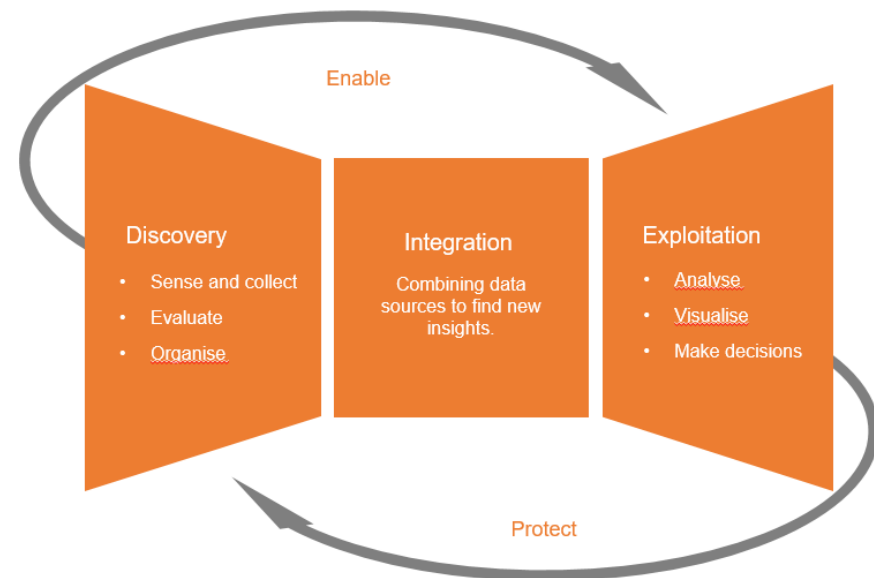


Figure 5: The Data Value Chain

Table 9: Roles within the Data Ecosystem⁶⁰

Data Provider: introduces new data or information feeds into the ecosystem.

Big Data Application Provider: executes a life cycle (collection, processing, dissemination) controlled by the system orchestrator to implement specific vertical applications requirements and meet security and privacy requirements.

Big Data Framework Provider: establishes a computing fabric (computation and storage resources, platforms, and processing frameworks) in which to execute certain transformation applications while protecting the privacy and integrity of data.

Data Consumer: includes end users or other systems who utilise the results of the Big Data Application Provider.

System Orchestrator: defines and integrates the required data application activities into an operational vertical system.

Security and Privacy: the role of managing and auditing access to and control of the system and the underlying data including management and tracking of data provenance.

Management: the overarching control of the execution of a system, the deployment of the system, and its operational maintenance.

ii. Roles Within a Data Ecosystem

The data economy supports an entire ecosystem of businesses and other stakeholder organisations. These are often dependent upon each other's products and services so the vitality of the sector as a whole is crucial.

The various roles within this ecosystem are defined in Table 9. However, a simpler conception is to differentiate between the following three broad business models:

- **Data users** are organisations that use data internally—either for business intelligence activities such as forecasting demand, or as an input into other products and services such as credit scores or targeted advertising.
- **Data suppliers** are organisations that supply data as a product for others to use
- **Data facilitators** are organisations that help others to exploit data.

iii. Types of Data

Big Data

The term Big Data encompasses all large digital datasets (Internet, RFID, mobile) which can no longer be treated with conventional database management tools. This massive data is much less structured than traditional data. Thus, raw data directly derived from the activity or the opinion of a user provides information to better understand his/her behaviour.

It is the role of data scientists to interpret the data, combine it, put it into perspective and suggest clear interpretation to policymakers.

Social Data

With businesses experiencing a 40-60% increase in the data available to them, they are faced with both a significant opportunity and a real challenge in how to leverage information from social and digital platforms that customers use daily, and expect to be integrated within any relationship building strategy⁶¹.

Providing a leading service and strengthening customer relationships is increasingly seen as a predictor of business success. Research indicates that sales CRM solutions that do just that are set to reach over \$36 billion dollars by 2017.⁶¹

Personal Data

Data from which a person can be identified is personal data. If data can be combined with other information to identify a person, that data will still be personal data.

Smart Data

The flood of data faced by citizens and the business community will lead to the development of new services and the creation of new values. Thus, these data sets, originally of little use and relevance, will be treated and recycled to become Smart Data and finally be useful for decision making. They will enable the design and implementation of digital marketing strategies and more efficient and effective customer relations.

Closed Data

Some data should not be shared for security reasons or because it is personal information. This data can only be accessed by its subject, owner or holder.

Shared Data

Data may be 'shared' without being entirely open. This includes different levels of access:

- Named access – “data that is shared only with named people or organisations”
- Attribute-based access – “data that available to *specific groups* who meet certain criteria”
- Public access – “data that is available to *anyone* under terms and conditions that are not 'open'”.⁶²

Open Data

Open Data is the term for the free sharing of data put online in open formats, allowing the reuse and free access by anyone. This is a set of digital data of public or private origin. It can be produced by a particular community, a public service or a company. The opening of this data represents a movement, an information-access philosophy and a practice of publication of freely accessible and usable data.

iv. Practical Challenges

A study by the University of Oxford⁵⁹ identifies several key practical and political obstacles to the wider use of data:

- An important practical obstacle is the quality of data sets. Some experts say analysts spend as much as 90% of their time cleaning data. Data, especially government data, is often provided in non-machine readable or non-standardised formats requiring manual re- entry.
- Past experience highlights the importance of being forward-looking in anticipating future uses (and users) of data. Legacy datasets that were not stored with appropriate human-readable metadata are now essentially useless because nobody knows what the data mean. A similar point holds for the format and physical infrastructure in which data is stored.
- Although technology has revolutionised data availability, there are still problems in providing access to data to those in an organisation who are best placed to exploit it. Tools to facilitate the use of data by non-specialists are an exciting prospect, but are still not mature enough to solve the problem.
- A key political barrier to data use is the extent to which people are protective of 'their' data. This often applies to a reluctance to share data within an organisation as much as to an unwillingness to share data between organisations, and speaks to the need for an

organisation-wide policy and strategy for data use.

- There is widespread appreciation of the importance of privacy, but a lack of standards and clear policy guidance in this area.

v. Making the Most of Data

The same University of Oxford study⁵⁹ also identifies a series of recommendations for businesses to make the most out available data assets:

- Data should be central to the business. The biggest success stories have either essentially reinvented their entire business around the use of data or are 'born' data users.
- A clear profit model is essential. Experts warn that optimistically collecting data in the hope that it will somehow prove profitable is naive. Managers and data scientists should be clear on the plan for generating value or efficiency from data before the data strategy is implemented.

The most successful firms understand the limitations of the technology behind their big data operation and recognise the importance of combining analysis with a sound understanding of the context, a good intuition for the industry, and a critical attitude towards insights derived from data.

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