CURDS Newcastle University

North East Local Economic Partnership
Smart Specialisation Report

December 2013

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RR2015/02

North East Local Enterprise Partnership

Newcastle Science City
TRANSFORMING TOMORROW

NORTH EAST LOCAL ECONOMIC PARTNERSHIP
SMART SPECIALISATION REPORT

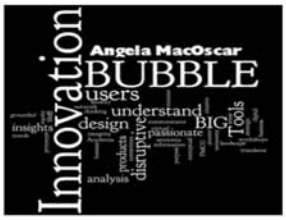
December 2013

In partnership with:

Newcastle University Business School

Centre for Urban & Regional Development Studies

CURDS



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1. EXECUTIVE SUMMARY

1. Introduction and Purpose

The North East Local Enterprise Partnership (North East LEP) has a major opportunity to use ongoing exercises to formulate a strategic economic plan (SEP) and EU structural and investment funds strategy (EUSIF 2014-20) to progress the recommendation of the North East Independent Economic Review[1] to be known as an 'international exemplar in smart specialisation, open innovation systems and culture'. This was one of five key defining features – 'built on smart specialisation centres of excellence, outstanding university research, and an eco-system which leads on taking ideas to market'. It gives a strong sense of the character of North East LEP's 'making, trading and innovating' thematic priorities[2].

In this context, 'smart specialisation' has been described[3] as "*a process of developing a vision, identifying competitive advantage, setting strategic priorities and making use of smart policies to maximise the knowledge-based development potential of any region, strong or weak, high-tech or low-tech*". This report seeks to assist the North East LEP and its partners to define a starting point for developing a smart specialisation process and build on this foundation through 'smart' intervention strategies to bring the 'international exemplar' ambitions to a credible fruition.

The smart specialisation research project has been part-financed by Technical Assistance through the North East of England European Regional Development Fund Programme 2007-2013. This is part of a Technical Assistance project supporting the North East LEP to prepare for the 2014-2020 programme of European Funding.

2. Project Outline and Process

Smart specialisation is a systematic approach to prioritisation and intervention management that is most widely applied in an iterative and mutually reinforcing six stage process outlined in the European Union's (EU) RIS3 guidance and illustrated in Figure 1.1.[4]

[1] North East Independent Economic Review, April 2013
[2] Most recently set out formally in the NELEP EUSIF 2014-20 draft submission, October 2013
[3] http://s3platform.jrc.ec.europa.eu/home EU Commission smart specialisation platform web site
[4] Guide to Research & Innovation Strategies for Smart Specialisation (RIS 3)', European Commission, May 2012

Figure 1.1: The RIS3 Framework

The smart specialisation project team (the 'S3 project team') was led by Newcastle Science City (NSC), in association with the Centre for Urban and Regional Development Studies (CURDS) at Newcastle University, Newcastle University Business School and Innovation Bubble. The focus and contribution of the S3 project team was on providing the analysis (stage one) to support North East LEP's visioning, prioritisation and policy mix processes – and to feed into the emerging governance arrangements of developing a place-based, innovation strategy. The analysis involved both desk-based research, a range of bilateral consultations, focus groups, and an online business survey. Regular deliberations and feedback from a North East LEP steering group, and iteration with the concurrent strategic innovation framework exercise led by the Chair of the North East LEP Innovation Board also provided valuable reality-testing to and triangulation with the emerging findings.

The S3 project team's intention, following submission of this final report, would be to facilitate a deliberative session on the process with the emerging North East LEP 'innovation leadership team' – as part of passing ownership of findings from the project team to North East LEP and their partners. We also consider our findings can contribute to stage six – the establishment of monitoring, performance management and evaluation arrangements, where the North East LEP may have an opportunity to position themselves nationally in any S3 'support platform' established by UK Government in their response to the Witty Review[5].

3. Background: A Starting Point for the North East of England

The region has faced huge challenges in making the transition(s) through the global financial crisis (GFC), and the national government's new approaches to local growth. This is, in many

[5] Encouraging a British Industrial Revolution: Sir Andrew Witty's Review of Universities & Growth, October 2013

ways, exemplified by the establishment of North East LEP as part of the difficult birth and infancy of LEPs.

The North East is a relatively small region. In some ways this is a strength but overall the region possesses limited private sector investment in and demand for innovation, and remains distant from the UK's political and economic powerhouses (and decision makers). The pre-GFC growth model(s), with a high dependence on public sector and public investment- led growth, is no longer tenable in an era of relative public austerity. And the region runs the risk of being increasingly squeezed between Scotland and a resurgent trans-Pennine corridor further to the south.

In this context, adopting a smart specialisation approach has considerable strategic merit as it:

- Plays to the EU 'growth model' and to the region's positioning as England's 'trading' region in global markets, as a counter to UK constraints
- It builds on considerable public investment in university and R&D infrastructure and services. This gives the region assets and capabilities of international quality and significance
- It recognises the more 'entrepreneurial' and nuanced approaches to local economic growth that the region needs to deploy in realising business growth dividends from tackling major societal challenges - like energy generation and storage, ageing and wellbeing etc. These are areas where the region has major capabilities that would be submerged in more traditional 'priority sector' approaches

The North East LEP has made a strong start in building agreement on how to make this transition and anticipated the government's SEP and EUSIF expectations of LEPs. The North East Independent Economic Review; the decision to establish a Combined Authority (to give public commitment to a shared approach to growth alongside LEP private sector leadership); gaining government agreement to City Deal(s) and to Catapult designations (notably at CPI with Tees Valley); and the Chair of the North East LEP Innovation Board on a strategic innovation framework; all provide powerful precursors to a smart specialisation approach. This report now reviews the evidence to help inform how that approach might be put into action.

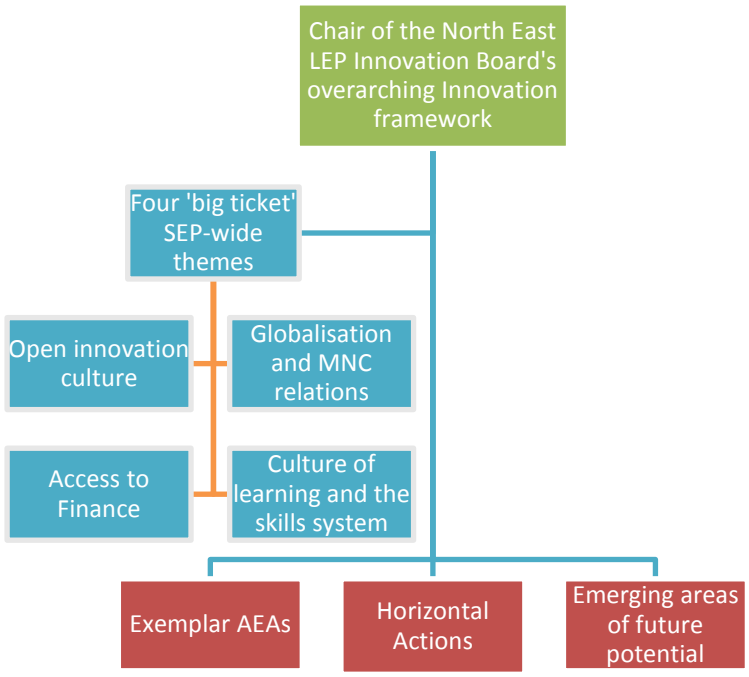
4. Towards Realising the North East LEP Areas Smart Specialisation Opportunities

This report provides an approach to smart specialisation underpinned by the overall North East LEP strategic Innovation framework perspective – with three distinctive 'legs':

- a portfolio of high potential areas of economic activity (AEAs), where the North East LEP area has established assets, capabilities, and realisable opportunity to deliver innovation-led growth
- a series of horizontal activities that draw AEAs together, linking with other sectors and technologies, and with neighbouring and potential partner LEPs
- a suite of measures to support emerging AEAs of high future potential

This relationship is illustrated below in fig 1.2:

Figure 1.2: Towards an Illustrative Smart Specialisation framework



The Chair of the North East LEP Innovation Board's overarching Innovation framework puts innovation at the heart of the (business elements of) North East LEP SEP with strong traction on enterprise, skills, finance and internationalisation strategies. This report elaborates the potential focus of innovation intervention through four exemplar AEAs, a series of cross-cutting initiatives, and a broader support to encourage the emerging AEA niches of the future.

5. Exemplar Areas of Economic Activity

Four areas of economic activity (AEA) where the North East LEP area has existing strengths have been explored as exemplars to realising smart specialisation opportunity in differing economic and business contexts. Importantly, the AEAs under investigation have not been analysed or viewed as sectors, but are industry-led clusters of innovation and economic activity, with dynamic networks that animate and support the 'entrepreneurial discovery' process to identify and exploit niches of business growth opportunity.

The overall intervention strategy rationale and approach is shown in Table 1.3. In summary, the key features of exemplar AEAs are:

- Passenger vehicle manufacture is an exemplar of major foreign inward investment of strategic national importance which can stimulate supply chain business growth

- Subsea and Offshore Technology is an exemplar of indigenous business growth building on national and local innovation assets/capabilities, and attracting new enterprise to the area
- Life Sciences and Health is an exemplar of an AEA with a very large GVA and employment footprint, major manufacturing and local R&D capabilities, often national public service clients – where most LEPs will have considerable business growth ambitions
- Creative, Digital, Software and Technology Based Services is an exemplar of a mixed AEA which shares technology and skills bases to reinforce the overall footprint in creative industries and position North East LEP area (and region) as a UK 'delivery centre' of the AEA, and provide a key enabling technology capability to other business growth industries

Each AEA will stimulate its own distinctive growth strategies and potential suites of interventions for each AEA. However, in broad terms, the North East LEP can grow an AEA through deploying at least some of the following:

- A major 'translational' centre – bringing together university, R&D, and industry – to commercialise and develop innovation. An example of this might be the Centre for Process Innovation in both advanced engineering and health and life sciences.
- A proactive business-led network to animate the AEA, deliberate and articulate priorities, identify synergies between and across businesses, and promote the AEA in wider markets. An example of this might be DYNAMO or Subsea North East
- Strong internationalisation components both to make it easy to access new markets (for trade and export), and to attract and retain inward investment
- A legible accessible 'access to finance' platform – appropriate for the scale and maturity of the AEA
- A series of 'innovation challenges' (both technology and social) to incentivise development of new technologies and business processes
- Support for the 'skills funnel' ensuing employers have access to the skills they need
- Where necessary, investment in physical infrastructure e.g. grow-on accommodation for life sciences firms
- Clear promotion of the North East LEP area (and region) as a location with international quality strengths and a dynamic eco-system for the AEA
- The North East LEP can also support the AEA exemplars by encouraging relatedness and connectedness between them, with other industries, and relationships to initiatives in other LEP areas

6. Horizontal and Emerging Priorities

The AEA exemplars represent priorities for innovation and economic growth, but they are not the whole of a smart specialisation approach. Cross-cutting interventions should be considered on skills (including STEM skills in schools), apprentices, exporting, and on building capacity to successfully access wider EU and national innovation support across the business community. The S3 project team also raise the possibility of further 'grand challenges' and supply chain developments with large global corporates, regardless of AEA.

The North East LEP can support developments in new markets and technology areas that may become smart specialisation AEA strengths in due course. Candidates for this include surface science, public sector innovation, ageing and 'future cities' initiatives. These emerging areas are at differing stages of potential, and, like exemplar AEAs, will benefit from bespoke, tailored support.

The North East LEP role should include enabling and facilitating pan-LEP collaboration, notably in terms of smart specialisation with Tees Valley Unlimited (TVU) in the first instance, but with other LEPs that possess complementary synergies.

7. Leadership, Governance and Delivery Management

The S3 project team did not investigate stage two of the RIS3 process formally. We had understood that part of the Chair of the North East LEP Innovation Board's brief would be the establishment of an Innovation Board responsible for formulating and delivery managing any innovation strategy. Suffice to say, any smart specialisation approach and innovation framework will need to be owned by the North East LEP Board; welcomed by and with a mandate from the Combined Authority; and supported by a breadth of 'quadruple helix' role players (industry, government, academia and end-users) throughout the North East LEP area.

The arrangements put in place will need relations and traction with skills, internationalisation, finance, enterprise and infrastructure arrangements for economic growth and development; and also be rooted in local eco-systems across the cities and communities of the North East LEP geography.

The North East LEP area possesses a number of powerful delivery managers for innovation interventions. Whilst this will vary across interventions and AEAs, the need for robust commissioning, delivery and performance management processes will be acute. This feeds into stage six of the RIS3 smart specialisation guidance, where there is a case, at the least, for North East LEP to engage with the What Works Centre and any 'platform for support' established by government in their response to the Witty Review.

8. Conclusions and Recommendations

The S3 project team largely endorse the propositions arising from the North East Independent Economic Review and the first draft of the EUSIF 2014-20 that the region can become 'an international exemplar in smart specialisation'. The report and appendices present considerable evidence that support this conclusion. The process of moving towards an international exemplar will be assisted by adoption of the following recommendations. The North East LEP should:

1. Commit to developing integrated industry-led bespoke business growth programmes for the four AEAs analysed in this report
2. Consider the range of cross-cutting horizontal actions and support for potential emerging AEAs

3. Establish and launch a broadly based and legitimate innovation leadership team, reporting to the North East LEP Board and endorsed by the Combined Authority, who can deliberate on this report and put agreed recommendations into practice.
4. Adopt an innovation strategic framework based on the Chair of the North East LEP Innovation Board's 'principles' of open innovation, international relationship management, a culture of learning, and access to finance to underpin the smart specialisation approach
5. Build the analysis of this report into the final SEP and EUSIF2014-20 submissions to government in early 2014

As stated repeatedly throughout this report, smart specialisation as an approach is a process with no final destination. We do hope, and consider, though, that the work to date can contribute positively in moving the North East LEP area (and region) towards becoming the smart specialisation international exemplar that it has chosen to wish to be.

Table 1.3 Smart Specialisation Rationales and Intervention Summary

Area of Economic Activity (AEA)	Characteristics/ Exemplar Qualities/Embeddedness*	Prioritisation Logic	Policy Intervention Strategy	Relatedness**/Connectedness*** Considerations
Passenger Vehicle Manufacturing	• AEA anchored by global multinationals (Nissan, Hitachi etc) of national significance • Significant supply chain cluster	• Importance of AEA (Nissan) and supply chain to employment and exports • First mover advantage in emerging low carbon vehicle industry	• Supply chain development and diversification • R&D to deepen and broaden innovation capacity/capability • Inward investment (electric vehicle, fuel cell electric vehicle, Hitachi supply chain)	• Lithium-ion battery technologies • Low Carbon Vehicles (hydrogen and fuel cell vehicles) • Energy supply and infrastructure • High value manufacturing • E-mobility - (Big) data, software and communications (intelligent transport systems) • Regional hydrogen infrastructure network (locally sourced)
Subsea and Offshore Technology	• AEA possesses significant industrial base supported by national innovation assets e.g. NAREC, Neptune Centre	• Strong and innovative industrial base of international quality • High GVA contributor	• Development of local supply chain • Export support to new and emerging markets • Inward Investment e.g. from Aberdeen	• Marine renewable energy activities - offshore wind • Other energy activities - carbon transportation and storage; unconventional gas; and mining and harvesting of seabed minerals
Creative, Digital, Software and Technology Based	• AEA with indigenous entrepreneurial small and micros needing local scaling up and	• AEA has very high rates of start-ups and strong cohort of young dynamic	• Building innovation eco-system and networks • Access to major	• Professional and business services – especially knowledge intensive business services • Key enabling AEA for all other

Area of Economic Activity (AEA)	Characteristics/ Exemplar Qualities/Embeddedness*	Prioritisation Logic	Policy Intervention Strategy	Relatedness**/Connectedness*** Considerations
Services	widening markets • AEA based on region as UK 'delivery centre' with comparative cost and skills advantages	SMEs • Need to support cohort to grow locally rather than relocate • AEA has global players (eg. Accenture) already chosen to locate in region • Relatively high productivity, large employment sector with good linkages to other prof & bus services where NE is comparatively weak • Need to anchor these and build cluster	players and metropolitan markets • Skills and financing support • Deliver strong skills 'funnel' to increase employment capacity • High quality office campus and connectivity • Strengthen industry led cluster networks (DYNAMO) • Promotion of region as UK 'delivery centre' for knowledge intensive business services, and location for 're-onshoring' inward investment	industries and technologies • Professional and business services • Creative, digital and software • Public sector reform
Life Sciences and Healthcare	• AEA anchored by a number of big pharmaceutical manufacturing firms and	• Presence Significant GDP/ export contributor • National Industrial	• Strengthen SME base (access to finance, export, infrastructure) • Support for big	• Biologics (R&D and manufacturing) • Synthetic biology • Ageing, telemedicine and

Area of Economic Activity (AEA)	Characteristics/ Exemplar Qualities/Embeddedness*	Prioritisation Logic	Policy Intervention Strategy	Relatedness**/Connectedness*** Considerations
	diverse supply chain	priority sector • Large employer and high GVA contributor	pharma via skills supply and increasing exports • Promotion of North East LEP and region as leading bioprocessing and pharmaceutical manufacturing centre • Embed and support emerging national life science innovation assets and initiatives e.g CPI National Biologics Centre, Academic Health Science Network	assisted technology • Health service innovation/health economics – personalised medicine • Clinical trials – linked to big data

*'Embeddedness' refers to the need to identify industries that are in tune with the relevant socio-economic conditions and can rely on a trained local labour force and a history of cooperative relations with other regional actors

**'Relatedness' describes the potential diversification of firms into related areas based on new innovative techniques or processes

***'Connectivity' refers to a 'joined-up approach to regional innovation-both internal and external to the region e.g links to supply chains, R&D activity, international clusters etc.

CONTENTS

2. PROJECT BRIEF

The North East Local Economic Partnership (North East LEP) commissioned Newcastle Science City and partners (to be referred to as the 'S3 project team') to undertake research and analysis to support the development of a 'smart specialisation strategy (S3)', place-based innovation strategy for the North East LEP area.

Smart specialisation is considered a key element in achieving 'smart growth' as set out in the European Commission's (EC) Europe 2020 Strategy (2010)[6]. As an ex-ante conditionality of receiving European Structural Funds in the next programme period (2014-2020), the S3 project team was tasked with identifying areas of smart specialisation for inclusion into the North East LEP's European Union Structural and Investment Funds 2014-2020 strategy (EU SIF).

The invitation to tender (ITT) posed two principle aims of the research exercise:

1. The study will provide the North East LEP and partners with an understanding of what niche opportunities are present in the North East LEP area based on the current strengths and innovation ecosystem. This will build on the work of the North East Independent Economic Review[7] and analyse previous investments in innovation and supporting ecosystems;
2. The project will consider which themes or sub-sectors may be of common interest with other areas, both neighbouring and further afield.

The ITT also identified a number of other aims and objectives which would identify areas of specialist potential, including:

- Identifying clusters and groupings of companies with common interests in innovations and research and development (R&D) including at a sub-sector and specialist level;
- Identifying key niche areas of closely linked specialist skills;
- Identifying areas of strength in general purpose and key enabling technologies and related skills;
- Short, medium and long-term analysis of the research base;
- Consideration of access to finance programmes;
- An analysis of the distribution of national R&D funds in the North East LEP area e.g Technology Strategy Board;
- An analysis of investments made in research and innovation from the 2007-2013 ERDF programme in the North East;
- An analysis of the present position of the innovation connectors, programmes and infrastructure within the North East LEP area;

[6] Europe 2020: A European Strategy for Smart, Sustainable and Inclusive Growth 2010, European Commission

[7] North East Independent Economic Review Report, April 2013

- A review of spin-out and start-up activity from the higher education sector.

Following a project inception meeting in August 2013 to refine the brief of the research exercise between the North East LEP and the S3 project team, the following aims and objectives were universally agreed and endorsed by the North East LEP:

1. To provide an evidence-based assessment of the North East's current research and development (R&D), industrial and innovation capabilities (both supply and demand) based on the place-based assets, actors and institutions within the North East LEP economy;
2. To identify and highlight future niche technology and industrial opportunities that present economic development potential to the region;
3. To provide the North East LEP with evidence, analysis and initial recommendations associated with the governance, priorities and policy mix of developing a smart specialisation strategy for inclusion into the EU SIF, North East LEP Strategic Economic Plan (SEP) and underpin the parallel work of the North East LEP Innovation 'framework' led the Chair of the North East LEP Innovation Board

3. WHAT IS SMART SPECIALISATION?

Smart specialisation has been described[8] as "*a process of developing a vision, identifying competitive advantage, setting strategic priorities and making use of smart policies to maximise the knowledge-based development potential of any region, strong or weak, high-tech or low-tech*".

Smart specialisation has arisen out of recognition of the central role of innovation in sub-national growth and EU cohesion policy. Innovation has accounted for increasing proportions of cohesion spend, rising to 25% in the current 2007-13 period. However, the European Commission (EC) has been criticised in the past for cohesion-funded innovation interventions for being too linear, poorly-aligned with wider EU and national programmes, too supply-side focused and divorced from market demand – which has led to 'copycat strategies' often on an implicit 'closed region' model.

In response to such criticisms the EC has promoted smart specialisation as a key underlying principle for EUSIF – including the need to focus on fewer priorities and better coordination of place-based policies across the EC. As a result, the EC has established an 'S3 platform' based in Seville to support regions and member states to develop smart specialisation strategies. This has facilitated the transition of smart specialisation from a wholly sectoral concept to one that is applicable to regional policy with local and regional smart specialisation strategy entailing:

- A process of 'entrepreneurial discovery' to discover regional strengths with potential for experimentation, innovation and growth;
- The seeding of intellectual capital ;
- Strengthening of local innovation 'ecosystem(s)' and building local capabilities to enable and support this process ;
- Stimulating local supply chains to invest and collaborate ;
- Catalysing and leveraging the differing opportunities of social innovation ;
- Positioning and branding places as credible centres of smart specialisation opportunities to target private and public sector audiences.

Smart specialisation proposes a new and more active involvement of different actors in the entrepreneurial search process and a move away from 'top-down' processes. Principles of embeddedness and relatedness are highly significant. 'Embeddedness' refers to the need to identify industries that are in tune with the relevant socio-economic conditions and can rely on a trained local labour force and a history of cooperative relations with other regional actors, whereas 'relatedness' describes the potential diversification of firms into related areas based on new innovative techniques or processes. Smart Specialisation should link emerging knowledge based industries to other actors within and outside the region, but within the region Interaction can sometimes be most beneficial between different sectors and communities and connections to outside the region are only beneficial when ideas are internalised to the benefit of local firms.

[8] http://s3platform.jrc.ec.europa.eu/home EU Commission smart specialisation platform web site

Fundamentally, smart specialisation calls for evidence-based identification of competitive advantages around which inputs of regional stakeholders and resources can be concentrated. On top of this, it asks for measures to strengthen regional innovation systems in order to maximise knowledge flows and spread the benefits of innovation throughout the entire regional economy.

Overall a six step process is identified[9] for the creation of a smart specialisation strategy as demonstrated in Figure 3.1. These processes can be considered sequentially as in Table 3.2, although, in practice, as nowhere is starting with a 'blank sheet of paper', they will tend towards iterative adaption in practice.

Figure 3.1: Key Steps for Delivering a Smart Specialisation Strategy

[9] Guide to Research & Innovation Strategies for Smart Specialisation (RIS 3)', European Commission, May 2012

Table 3.2: Required Outcomes from Smart Specialisation Process

Smart Specialisation Process		Outcome sought
Stage 1	**Analysis**	• Robust economic intelligence system, able to produce and analyse evidence of economic performance and innovation potential to enable informed S3 choices and specialisations to be made
Stage 2	**Governance**	• Clear innovation leadership team(s) and supporting constructs, with coherent links/ relationships to broader structures
Stage3	**Vision**	• A shared view of the area's economic ambitions, and the major innovation challenges in delivering those ambitions
Stage 4	**Priorities**	• Agreement on and justification of broad areas for investment, and of 'smart' focuses within these
Stage 5	**Policy Mix**	• A coherent mix of policies, roadmaps and action plans for progressing the priorities
Stage 6	**Monitoring & Evaluation**	• Establishment and capacity building of a strong performance management, evaluation and review framework for S3

4. METHODOLOGY

This project largely contributes to Stage 1 of the process of developing a smart specialisation strategy, but can also assist in supporting the North East LEP's creation of a vision for the region, providing justification for broad areas of investment and suggesting potential policy interventions.

The initial phase of the project drew on the project team's extensive background knowledge of the region and a review of a substantial amount of prior research to identify and clarify areas of economic activity (AEAs) where the North East LEP area has opportunities for economic growth and improved innovation performance based on current business strengths and innovation ecosystem (see Appendix 1).

Many 'sectors' and 'clusters' have been identified as actual or potential strengths in the region over the past decade and a filtering process was applied to an initial long list (drawn from the North East Independent Economic Review and the publicly available plans of the LA7) to identify which areas of economic activity had a good fit with a) European[i10] and national industrial[11]and innovation priorities[12]; b) The North East LEP's initial views on economic development and innovation activity and c) where there was clear evidence of private and public investment.

On the basis of the preliminary findings of the initial phase, four key AEAs were identified by the S3 project team for more extensive research. The four AEAs identified were: passenger vehicle manufacture; subsea and offshore technology; life sciences and healthcare; and creative, digital and software. These formed the basis of the initial report to the North East LEP, the findings of which formed part of the North East LEP's draft EUSIF submission in October 2013. Subsequent to the initial smart specialisation report it became apparent that the creative, digital and software AEA had been too narrowly defined as strengths in technology based service delivery in the North East LEP area were becoming apparent .

The final report benefits from a more detailed analysis of innovation spend in the region and extensive desk-based research on the selected AEAs. To supplement this secondary data and because a smart specialisation strategy will only be successful if firms and other institutions engage in direct discussion, the S3 project team conducted 10 semi-structured interviews and consultations with key regional-based innovation and economic development actors. Workshops were held with stakeholders from the creative, digital and software industries with the remaining AEAs subject to further investigation by project team members attending a variety of pre-arranged conferences, networking events and meetings (see Appendix 2.1, 2.2 and 2.3). The Subsea and Offshore Technology firms were not invited to a separate meeting as they were already meeting to discuss the Neptune Centre in mid-December and the findings of this meeting will be reported under separate cover.

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[10] Europe 2020 Strategy, European Commission, State of the Innovation Union 2012, European Commission

[11] Industrial Strategy: Sector Analysis, BIS 2012

[12] Eight Great Technologies, Policy Exchange 2012

To ensure feedback from the business community, an online business survey was produced and disseminated to firms via regional business intermediary organisations (see Appendix 2.4). In total, the survey yielded 186 responses of which 116 were generated from the private sector.

In addition, individual input was sought from the four universities in the North East LEP area to feed into the smart specialisation research exercise with Durham University and Newcastle University providing formal responses (see Appendix 2.5 and 2.6). In the case of Durham University, feedback from the institution was received too late to inform this report but should be considered by the North East LEP in relation to ongoing innovation activity by the LEP. Informal feedback was also obtained from the universities. Feedback was also requested from the eleven colleges in the NE LEP geography via the North East LEP.

This primary research was also to ensure that the configuration of the AEAs was 'sense-checked' and potential policy interventions identified. The S3 project team believe it is important that these dialogues continue and now hold a database of individuals who have agreed to be contacted further in respect of the formation of a smart specialisation strategy for the North East LEP area.

Returning to the six stage process this methodology has enabled the project to contribute to the broader smart specialisation strategy formulation as detailed in Table 4.1. The next chapter of the report goes on to outline the policy context for smart specialisation and the S3 project team's assessment of a roadmap for the North East LEP to deliver a smart specialisation strategy.

Table 4.1: S3 Project Team Contribution to Smart Specialisation Strategy

Smart Specialisation Process	**S3 Project Team Contribution**
Analysis	Production of a high level SWOT analysis of innovation in the North East LEP area Detailed summaries and SWOTs of four key economic activity areas to enable selection of potential S3 portfolios of activity Online business survey to enrich desk-based research Series of entrepreneurial discovery workshops, interviews and focus groups to triangulate and gain buy-in to SWOT analyses
Governance	Bilateral interviews and discussions with key stakeholders as NSC team firm up S3 propositions
Vision	Provision of evidence and analysis to support a visioning process by North East LEP
Priorities	Provision of evidence and analysis to justify the selection of a potential portfolio of AEAs to be the initial focus for investment
Policy Mix	Initial recommendations for potential policy interventions based on review of national industrial strategies and stakeholder input
Monitoring & Evaluation	n/a

5. SMART SPECIALISATION: POLICY CONTEXT

5.1 Background

Since the onset of the global financial crisis and the establishment of the national coalition government in 2010, the North East has been subject to profound changes to its political, economic and institutional fabric. Models of economic growth driven by significant public investment, often mediated through a strong regional public policy and delivery architecture, have been replaced with new approaches that are still emergent and evolving.

National government continues to give primacy to deficit reduction[13], but with an increasing focus on supporting growth. Many of the levers for this focus have been effectively renationalised e.g. instruments like the 'National Infrastructure Plan' for physical investment, enterprise and innovation through national programmes (e.g. MAS, Growth Accelerator) and organisations (e.g. Technology Strategy Board (TSB)).

However, this reconfiguration is 'balanced' by a range of new institutions and mechanisms to support and enable growth sub-nationally. Thirty nine local enterprise partnerships (LEPs) have been established and provide public-private strategic economic leadership. Since the 2012 Heseltine Review[14] LEPs have been assuming increasing responsibilities and resources for putting that leadership into practice. Twenty eight 'city deals', to focus on bespoke city economic challenges and opportunities through decentralising specific freedoms and flexibilities, have or are being negotiated with 'city regions'. Reforms of planning and financing 'systems' e.g. tax increment financing, business rates retention, new homes bonus etc, designation of enterprise zones, and new funding programmes (e.g. Regional Growth Fund provide considerable levers and incentives to local leadership teams. The local governance and accountability of this new 'system' may be enhanced through promulgation of statutory 'combined authorities' (of Local Authority-led economic prosperity boards and integrated transport authorities) in metropolitan areas[15].

5.2 North East England in the Context of National Policy

The North East LEP covers the local authority (LA) areas of County Durham, Gateshead, Newcastle, North Tyneside, Northumberland, South Tyneside and Sunderland. The North East LEP geography has a population of almost 2 million, a workforce over 850,000, and an economy with over 40,000 businesses contributing £30bn of gross valued added to the national economy.

The North East LEP was approved as a local enterprise partnership (LEP) in January 2011. In July 2012, Newcastle secured a city deal with national government in wave one, with Sunderland in final stages of negotiating a settlement in the wave two programme. In

[13] see headlines, 'Spending Round 2013: What it means for the North East', HMG, 12 July 2013
[14] 'No stone unturned in pursuit of growth', Heseltine, October 2012
[15] Greater Manchester Combined Authority was established in 2011 and further CAs are in the process of being established in Leeds, Sheffield, Liverpool city regions and the North East

addition, the seven LAs have endorsed the establishment of a combined authority (CA) which is likely to come into effect from 1st April 2014.

An understanding of the economic landscape, and subsequent strategy, on the North East LEP geography, was developed for the new national context in an Independent Economic Review exercise chaired by Lord Adonis. This reported in April 2013[16]. The report outlined economic strengths founded on 'making, trading, exporting', but recognised a number of structural weaknesses "*summarised as: too few private sector jobs and enterprises, and too few jobs in key parts of the service sector economy, notably business and financial services; and lower levels of productivity, impacting on earning levels for a number of groups in the labour force*".

The review made recommendations for 14 actions - four by North East LEP, and five each by government and 'North East LEP and partners'- highlighting six key challenges for reinforcing the North East as:

- An international exemplar in smart specialisation, offering world-class open innovation systems and culture;
- A place to invest in business growth with public and private finance targeting SMEs, taking risks and attracting footloose capital;
- An international leader in trade in a global economy;
- A high skilled economy which invests in its young people;
- A leading location for trade, (re-investment) and stickiness;
- A special place to live and work.

These challenges have been progressed by North East LEP in their formulation of growth strategy focused on delivering 'more and better jobs', through building on the strengths of 'making, trading and innovating', and addressing the 'enabling factors' of 'connectivity skills and community'.

The first major tranche of investment resources for operationalising this approach is the EU SIF 2014-20 notional allocation of €539.6m. In October 2013, NE LEP submitted a draft investment prospectus[17] for this allocation to government with an accompanying consultation process for the draft European strategy to run through November and December 2013.

5.3 North East Local Economic Partnership Priorities

The draft EU SIF is just one component of a number of key programmes to be executed by North East LEP. Over the period to mid-2014, North East LEP has an agenda to:

- Prepare a 'strategic economic plan' and 'growth deal' for North East LEP including part-competitive bids for (at least) £2bn.p.a. Local Growth Fund (LGF) from April 2015;

[16] North East Independent Economic Review Report, April 2013
[17] European Structural and Investment Funds Strategy 2014-20, NELEP 7 October 2013

- Finalise the investment strategy for EU SIF against the 'notional allocation' (€539.6m) received from government in July 2013; with potential for further EU SIF, European Agricultural Fund for Development and European Maritime and Fisheries Fund;
- Ensure effective deployment of North East LEP RGF, Growing Places Fund (GPF) allocations, core funding, and any other specific roles and responsibilities devolved by government;
- Delivery manage the North East Enterprise Zones;
- Make a significant contribution to Newcastle and Sunderland City Deals, and the establishment of the Combined Authority;
- Contribute to Local Transport Board (LTB) prioritisation, establishment of Local Nature Partnerships (LNPs), skills pilot etc.

5.4 Smart Specialisation and National Policy

The UK Government's approach to smart specialisation is founded on a credible assertion that relevant national strategies and programmes are already 'smart' and therefore smart specialisation compliant. This position is backed by a relatively well-evidenced belief that the UK's innovation performance is broadly strong and often of global quality and competitiveness.

In terms of the current national content of UKs implicit smart specialisation approach, the key national strategies are identified as the industrial strategy and the innovation and research strategy.

The industrial strategy is prioritising strategic partnering for industrial growth in eleven key sectors (automotive, aerospace, life sciences, agri-tech, professional business services, information economy, construction, education, nuclear, oil and gas, and offshore wind) and 'eight great technologies' (big data, space, robotics and autonomous systems, synthetic biology, regenerative medicine, agri-science, advanced materials and energy). The industrial strategies supports the provision of access to finance to SMEs through the newly established Business Bank, encouraging business-led skills initiatives, and promoting public procurement as a catalyst for innovation e.g. through the TSB-run Small Business Research Initiative.

The UK Government's innovation and research strategy has focused on university-business interaction. Indeed, it supports business innovation, particularly SMEs, through the tax system, SMART grants, innovation vouchers, and seeks to promote and leverage UK R&D excellence in global markets. The strategy is being progressed, inter alia, through the outcomes of the 2012 Wilson Review of business-university collaboration, and the recent publication of the Witty Review of Universities and growth[18].

National responsibilities for delivery of the industrial and innovation strategies rests most frequently, but not exclusively, with the Department for Business, Innovation and Skills (BIS) and its delivery agencies, including: TSB; Research Councils; Higher Education Funding Council for England (HEFCE); Skills Funding Agency (SFA); and UK Trade and Investment (UKTI). However, the devolved administrations lead in Scotland, Wales and Northern Ireland; other departments e.g. Department of Energy and Climate Change (DECC), agencies e.g. NHS

[18] 'Encouraging a British Invention Revolution', Sir Andrew Witty, BIS, October 2013

Academic Health Science Networks (AHSNs), and other bodies e.g. National Endowment for Science, Technology and Arts (NESTA) have important roles to play in England.

The government response to the Witty Review is expected to include measures to bring together national and sub-national role players, including LEPs, to more systematically support and enable smart specialisation 'good practice'. In advance of this, a number of LEPs have begun a process of smart specialisation strategy formulation, and have also joined the EU S3 platform as members in their own right.

5.5 Smart Specialisation in the North East

The North East Independent Economic Review proposed that the north east should be known as an 'international exemplar in smart specialisation, open innovation systems and culture' as one of five key defining features – 'built on smart specialisation centres of excellence, outstanding university research, and an eco-system which leads on taking ideas to market'.

The Review recognised that the starting point for the area is one of relatively low R&D intensity, compared to larger and more advanced regions, but has benefited from recent investment in supply-side infrastructure and from strengths in the four universities.

The Review went on to recommend production of a regional innovation strategy and business plan focusing on the three 'open innovation and growth centres' of Bionow, The Institute of Automotive and Manufacturing Advanced Practice (AMAP) and the Neptune National Centre for Subsea and Offshore Engineering. The approach was also to include the four universities, the Northern Design Centre, Newcastle Science City and a network of innovation scholarships. A culture of employer and employee-led open innovation was proposed to be nurtured enabled by a North East LEP Innovation Board.

In response to recommendations proposed in the North East Independent Economic Review, North East LEP commissioned a Chair for the North East LEP Innovation Board to animate and provide a 'strategic framework' for the North East's approach to innovation. His work is exploring a number of overarching innovation activities, including: open innovation hubs and infrastructure, engaging with major multinational corporations (MNCs) with an open innovation approach to addressing specific issues/challenges; training and learning (cultural) environment, and access to finance.

In the draft EUSIF submitted to BIS in October 2013, the North East LEP accepted and endorsed the recommendations of the North East LEP Independent Economic Review as one of five core objectives of the EU SIF programme. The submission identified four areas of economic activity in which the region had particular strengths: automotive; advanced manufacturing; pharmaceuticals and health; 'new economy'; and a number of potential EU SIF funded activities. There was also recognition of the relevance of smart specialisation to other European core objectives and thematic priorities e.g. skills, finance, low carbon etc.

Table 5.1 provides a potential roadmap for the development of a smart specialisation strategy for the North East LEP area, building on the contribution of this project.

Table 5.1: Potential Roadmap for the Development of an S3 Strategy for the North East LEP Area

S3 process	North East LEP Process/Milestones	Smart Specialisation Project Contribution
Analysis	• Commissioning of evidence and analysis required for EUSIF 2014-20 investment strategy formulation and related strategic planning purposes • Mobilising and securing buy-in to this process from local intelligence capabilities (e.g. LA7, HEIs etc) • Capacity and capability-building of intelligence system(s) in the LEP geography to secure evidence-based decision-making and review	• Production of a high level SWOT analysis of innovation in the North East LEP area • Detailed summaries and SWOTs of four key economic activity areas to enable selection of potential S3 portfolios of activity • Online business survey to enrich desk-based research • Series of entrepreneurial discovery workshops, interviews and focus groups to triangulate and gain buy-in to SWOT analyses
Governance	• Establishment of a Chair of the North East LEP Innovation Board with commissioning and performance management arrangements for prioritised prospectus/intervention strategies (e.g. open innovation hubs, financial instruments, global networks etc) • Clarity of relationships between LEP innovation board processes, LA7 combined authority, HEI and other governance and leadership arrangements	• Bilateral interviews and discussions with key stakeholders as NSC team firm up S3 propositions
Vision	• Flesh out Adonis report into clear overarching regional economic strategy, with strong buy-in and distinctive innovation 'chapters' • Embody this in strategic economic plan, ESI2014-20 prospectus; and test/validate	• Provision of evidence and analysis to support a visioning process by North East LEP
Priorities	• Produce and get sign off for strategic economic plan, LEP growth deal , ESI proposals and other relevant intervention strategies/bids	• Provision of evidence and analysis to justify the selection of a potential portfolio of AEAs to be the initial focus for investment

S3 process	North East LEP Process/Milestones	Smart Specialisation Project Contribution
Policy Mix	• Pull together intervention strategies in ongoing economic planning exercises into a deliverable integrated investment programme • Commission and performance manage LEP programme activity • Enable alignment and synergies of LEP programmes with mainstream national and local public policy and private investment intentions	• Initial recommendations for potential policy interventions based on review of national industrial strategies and stakeholder input
Monitoring & Evaluation	• Assure clear performance management, evaluation and review processes are in place and feedback into regional intelligence system	• n/a

6. INNOVATION IN THE NORTH EAST OF ENGLAND

6.1 Introduction

Relative to the rest of the UK, the region[19] continues to perform below average on many of the accepted indicators for measuring 'innovation' in the economy. However, the region has a number of assets in terms of its universities, companies and specialist facilities that align well with expected opportunities for growth in the future. These have already been well described in the Innovation Strategy Discussion Paper presented to the North East LEP Board in November 2013.

In an era of globalisation and significant societal challenges e.g. ageing, climate change, declining natural resources etc., it is unlikely that any one geographic place or defined business sector can be innovative in isolation. Current and future growth areas increasingly transcend traditional boundaries; for example, the software and communications systems of vehicles have become an ever escalating component of their value. Strategies and policies that can successfully drive and support innovation going forward will have to be highly sophisticated, nuanced and able to embrace these complexities.

6.2 Investment in Research and Development

The region invested just over £500m in public and private R&D in 2011 (Source: ONS), the least of any UK region or devolved administration. This accounted for 1.87% of the UK total, showing a disproportionately small level of investment relative to the size of the economy - about 3% of UK GDP. What is also concerning is the lower proportion of the total that is made up of private sector investment in R%D - 50% in the region compared to 64% nationally. R&D performed in the region's universities made up a far higher proportion than other regions (45% vs. 26%). However, this is mainly due to the relatively low levels of private sector activity. The total investment in university R&D is just over 3%, which reflects the size of the economy.

Of the investments that are made by the private sector, these are more likely than the national average to be in manufacturing (77% vs 72% of the total), particularly chemicals, mechanical engineering and 'other' manufacturing. However the proportion of investment in R&D accounted for by transport equipment manufacturing is far lower than the national average - less than 4% compared with more than 10% nationally.

6.3 A Broader Definition of Innovation

Investment in R&D is an important indicator of innovation performance, but there are other sources of data that can be drawn up which paint a less stark picture of the region relative to the rest of the UK. The BIS UK Innovation Survey 2011 found that companies in the region were overall no less involved in 'innovative activities' than in the UK as a whole - and in some cases the region was significantly above the national average. Companies in the region

[19] Due to the limitations of the data behind this section, 'north east' refers to the 'old' Government Office region which includes the Tees Valley

described as 'broad innovators' were more optimistic than their counterparts nationally about barriers to innovation, but considerably less likely to report taking steps to protect their innovations e.g. patenting, copyrighting, non-disclosure agreements etc.

In terms of skills, innovating companies were as likely - or in the case of science and engineering disciplines - more likely to have employees with degree or higher level skills as companies in the rest of the UK. However, non innovating companies were considerably less likely to have highly skilled employees than those in the rest of the country.

6.4 The Role of Universities in the Innovation Ecosystem

The region's five universities are important sources of both research and human capital for the regional innovation system. Each of them has teaching and research expertise and specialisms that can potentially be aligned with emerging areas of opportunity nationally and internationally, and in some cases this is embodied in physical facilities which could become key hubs for coordinating future activities and investments. For example, the Centre for Ageing and Vitality at Newcastle; the Innovation and Growth Centre at Durham; the Northern Design Centre with Northumbria as a leading partner; the Automotive and Manufacturing Advanced Practice Institute at Sunderland and Digital City at Teesside.

It is also important to note that the research strengths in our universities are well aligned with areas that have been identified as being important sources of future innovation and growth. Of the 17 growth areas identified in the recent BIS commissioned Witty Review, our universities featured in the top 20 for research nationally in over half.

The region's universities 'punch above their weight' when it comes to attracting external funding for research and collaborative activities e.g. from UK funding councils, EU etc., with over 4% of the total share of research funds.[20] Universities in the region are more engaged in contract research with non-academic partners than the average. However most of these contracts were with organisations (SMEs, non-SMEs and other non-commercial organisations) outside of the region, which is a potential indicator of a lack of absorptive capacity among the region's business base. It is possible that businesses are working with universities in other regions - though this is unlikely as analysis of KTP data showed 88% of these were with universities in the region (implying businesses do tend to look to their local universities for support). Furthermore the HEBCIS data relating to consultancy work, equipment and facilities related services, and provision of continuing professional development and continuing education was below the average in the region on most measures.

6.5 European Regional Development Funding

European Regional Development Funding (ERDF) has been a significant investor in the infrastructure for innovation in the region during the current funding programme. According to the record of project approvals just over half of the £300M spent or committed between November 2007 and June 2013 was for 'Priority 1', which is "Enhancing and Exploiting Innovation". Bearing in mind the match funding minimum requirement of 50%

[20] Higher Education Business and Community Interaction Survey (HEBCIS) 2009-2010

this means well in excess of £600M in total has been invested in Priority 1. Projects supported have ranged from funding instruments such as 'Jeremie' to capital developments such as the Northern Design Centre. There have also been a number of 'soft' interventions supported such as Narec's renewable energy accelerator and RTC North's Design for Growth programme. The list of investments shows some strong emphases in areas such as design, digital, software, creative, healthcare, renewable energy, low carbon, process and healthcare.

6.6 Other Public Investments

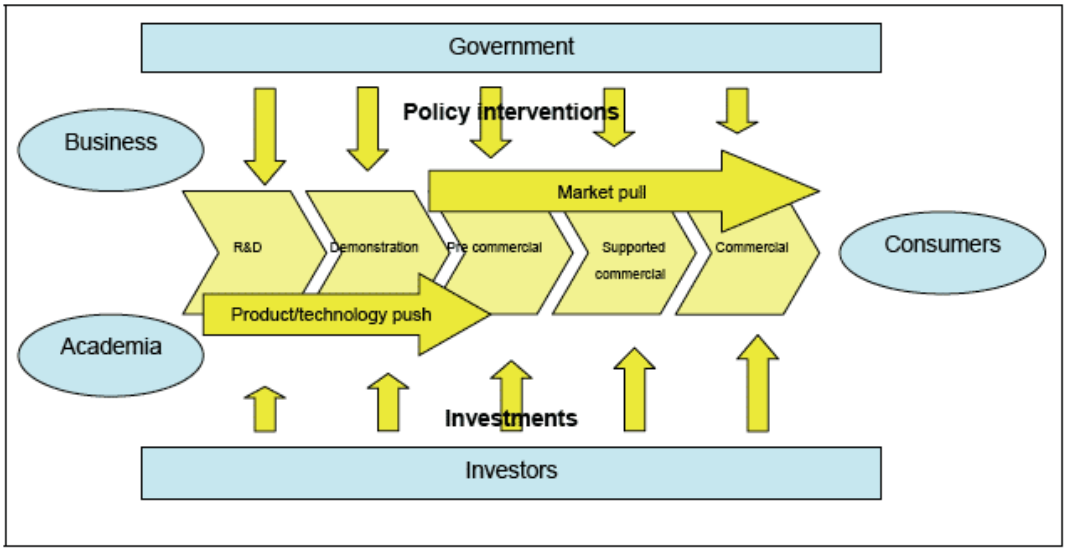
The region has been in significant recipient of TSB funding over the last few years. Since 2011 this has amounted to over £170M, which is just under 20% of the national total. While this level of funding is to be of course welcomed, the nature of the investments warrants further analysis. Looking at the figures in more depth it is notable that almost 90% of the TSB investments in the region were in Catapult Centres (and therefore primarily capital) while the funds that might indicate private sector demand for innovation (such as innovation vouchers, funding for collaborative research with non SMEs etc.) were highly underrepresented. It has been suggested that this may be due to companies with headquarters outside the region showing up on the returns for other places. It has not been possible to categorically resolve this issue, but as several companies who do appear in the regional dataset have headquarters elsewhere, it seems unlikely that this would make a significant difference to the overall picture of one of weak demand.

In terms of Knowledge Transfer Partnerships (KTPs), the region performs well, again underpinning the importance of universities for regional innovation. There have been almost 300 KTPs in the region since 1987 with an average value of £75,153. This compares with an average project value of £60,000 for KTPs nationally. The region has typically had a 5% share of total UK KTPs. In 2011/12 this rose slightly to 6%. However, the number of KTPs has fallen from 1,200 to around 800, so in real terms the number of regional KTPs fell from 60 to 48.

6.7 Linkages to the Outside World

Innovation cannot happen in isolation, and this is increasingly the case in a globalised and connected world, with complex and overlapping supply chains (see Table 6.1)

6.1 Global Innovation Ecosystem Paradigm



Source: Adapted from International Energy Agency, G8 (Siracusa, Italy)

The region is not a closed system, but is affected, often profoundly, by decisions made outside its boundaries and often beyond its control. The national framework conditions in terms of macroeconomic stability, education and skills, business climate, legal processes etc. are critical. Likewise, a supportive national policy environment - in terms of tax incentives, subsidies, and regulations etc., is also important. Changes in policies can have 'make or break' impacts on certain industries. For example, the Coalition Government elected in 2010 has been less supportive than their predecessors of the on and offshore wind industry and there is currently some uncertainty around the future of green subsidies and taxes. This appears to have led to a lack of confidence in the supply chain which may have impacted on investments moving to places with more 'enabling' environments e.g. Scotland.

Based on the evidence collected by the S3 project team, Figure 6.2 summarises the relative strengths, weaknesses, opportunities and threats of the regional innovation system.

Figure 6.2 Summary SWOT Analyses

Strengths	**Weaknesses**
• Universities and other key assets that have been developed over the past number of years • Significant investments in terms of TSB and ERDF in infrastructure, finance and business support for innovation • In terms of innovation more broadly defined, the region's companies are competing with the rest of the country, and are particularly strong in terms of manufacturing	• Lack of absorptive capacity and demand from the private sector, especially SMEs as evidenced by low levels of investment, low take-up of public funds to support business-led R&D and low levels of collaboration with universities • Much of the investments in the regional innovation system to date have been at the supply side of the chain and research generation • Skills in the workforce, particularly in companies that don't currently define themselves as 'innovative'
Opportunities	**Threats**
• Many of the assets the region possesses in terms of research and other activities are well aligned with areas being targeted as sources of future growth e.g. energy generation and storage, transport, robotics, advanced materials, medical technologies, advanced manufacturing and the overlaps with 'enabling technologies' such as design, digital etc. • But the innovation actors in the region will need to understand and embrace the complexities of these overlapping areas and where they fit within the relevant part of what may be an international supply chain	• If the region does not build its demand side for research and innovation the danger is that the potential benefits of investments (especially to non-private organisations) will leak out of the region to other places with higher levels of absorptive capacity • A possible referendum on EU membership could create uncertainty in the run up for potential investors and could be more damaging to the region than other places due to high levels of exports • Globalisation and competition from other (and new and emerging) markets

7. SMART SPECIALISATION IN THE NORTH EAST LEP AREA: IDENTIFYING AND JUSTIFYING EXEMPLAR AREAS OF ECONOMIC ACTIVITY

Building on the North East Independent Economic Review, the high-level SWOT in chapter five and embracing the methodology detailed in chapter three, the smart specialisation research project set out to identify exemplar 'areas of economic activity' (AEA). Discovered through 'an entrepreneurial process of discovery', working with firms and institutions, these AEAs would be ones where the region had both a demonstrable competitive advantage and substantial business base around which potential smart interventions could be identified that would maximise the knowledge-based development of the North East LEP area. These AEAs would be a starting point for the LEP to explore the key features of a smart specialisation strategy, which are:

- Encouraging knowledge producers and users to discover what best to do by working together;
- Mobilising distinctive local resources/assets (firms, people, geography, institutions (especially universities));
- Promoting the generation of local ideas and maximising intra and inter regional knowledge spillovers (e.g. by upgrading supply chains, enhancing higher level skills).

Phase one of the smart specialisation research project initially identified four AEAs and phase two has enabled these to be more closely defined as:

- Passenger Vehicle Manufacture;
- Subsea and Offshore Technology;
- Life Sciences and Healthcare;
- Creative, Digital, Software, and Technology Based Services.

As will be demonstrated in chapter seven, these exemplars can be shown to use, and have potential to further exploit, the North East's:

- knowledge base (in terms of universities, research institutes and catapults);
- physical infrastructure (in terms of incubators, business parks, science and technology parks, innovation centres);
- Connectivity both physical (ports and quays; airport, rail and road links) and virtual;
- human capital and skills base;
- engineering and manufacturing supply chain;
- business networks and support infrastructure.

There is real potential in these exemplars for excellence built on the capability of the companies and the capacity of the regional knowledge base. The four exemplars all have identified growth potential in national and international markets. Further upgrading the supply chain in the region would give suppliers across multiple tiers opportunities to grow regionally, nationally and internationally.

The exemplars also fit with some of the challenges the North East LEP area faces. This will be elaborated further in chapter seven, but the exemplars have varying potential to address EU

SIF thematic issues including innovation, ICT, SMEs, low carbon, sustainable transport, employment, social inclusion and skills.

The exemplars have also been assessed in light of their strategic ‘fit’ with the national industrial strategy, the national innovation and research strategy, the economic development priorities of the seven local authority (LA7), and Horizon 2020: The EU’s Framework Programme for Research and Innovation.

The S3 project team maintain that a vision for the North East LEP area of delivering ‘more better jobs’, through building on the strengths of 'making, trading and innovating', and addressing the 'enabling factors' of 'connectivity, skills and community’ can start to be developed around these four exemplars, although as will be evident from the conclusions to this report other areas of economic activity have the potential to be explored in similar ways.

8. AREAS OF ECONOMIC ACTIVITY: PROFILE AND POTENTIAL POLICY INTERVENTION

8.1 Passenger Vehicle Manufacturing

The North East LEP area has a demonstrable competitive advantage and substantial business base within passenger vehicle manufacturing (PVM). PVM is largely anchored on Japanese inward investment and its supply chain, while also being home to an innovative and niche low carbon vehicle (LCV) sector.

The North East LEP area is home to Nissan, the UK's largest ever car manufacturer and is welcoming the return of train production with the arrival of Hitachi into the region, which it is hoped can become embedded into the region in a similar fashion to Nissan. The designation as PVM does not preclude links to commercial 'yellow' vehicle production which is also represented in the region with the presence of Caterpillar and Komatsu.

Nissan's Sunderland plant, directly employing around 6,500 people, is widely heralded as one of the most productive car manufacturing plants in Europe and is the largest car producer in the UK, with the vast majority of vehicles produced for the export market. It should be noted however that none of Nissan's R&D is done in the North East and its manufacturing innovation is primarily driven by internal benchmarking (closed rather than open innovation).

The presence of Nissan, supported by proactive local and central government actions, has seen Tier 1 and 2 suppliers locate in the North East LEP area and the neighbouring Tees Valley Unlimited (TVU) area. These include companies co-located with Nissan (Unipres, Calsonic Kansei, Johnson Controls and Lear Corporation) and those further afield including Faltec Europe (formerly Hashimoto) in South Tyneside, NSK Bearings in Peterlee, Gestamp-Tallent in Newton Aycliffe, and Nifco in Stockton.

The presence of Nissan in the region is of national significance and is already leveraged to attract national government attention and highlight that the North East LEP area is an excellent base for manufacturing. Nissan directly provide significant numbers of relatively well paid jobs and, of particular importance in an area with relatively low level skills, they provide training opportunities, including to young people not in employment, education or training with few formal qualifications[21]. There is anecdotal evidence that the managerial capacity in smaller manufacturing firms in the region is helped by labour mobility from firms such as Nissan and other major multinationals such as P&G.

Nissan supports significant numbers of jobs in their Tier 1 and 2 supply chain, and that supply chain may have further opportunity to supply into the rest of the UK automotive industry[22]. There are existing SMEs in the region's engineering base who supply to Nissan and could also increase their sales outside of the region to the UK automotive sector.

[21] http://careersatnissan.co.uk/nmuk-sunderland/apprentices-training-schemes/youth-evolution-scheme/

[22] The Government estimate that on average only a third of the parts that go into vehicles manufactured here are sourced from the UK

Claimed to be linked to Nissan's success[23], Hitachi is currently developing a production facility, at Newton Aycliffe in County Durham, its first in Europe, to supply carriages for the UK Government's Intercity Express Programme. It is initially forecast to create 730 jobs producing for the UK market, but may open the way for exports. Established companies in the North East LEP area are already set to benefit from Hitatchi's intercity contract including Romag supplying glass, Petards supplying security and safety systems and Nomad supplying on board servers. It is hoped that, as with Nissan, further supply chain opportunities will be forthcoming for regional firms who may then be able to supply into the rail industry nationally and internationally.

A particularly interesting niche is the regions' expertise in low carbon vehicles where North East LEP's area can be considered to be in the forefront of technology within the UK. The shift to low carbon vehicles (LCVs) is a trend that presents significant further opportunities for the region. Partnership working between businesses, universities and government agencies has resulted in the region having a national reputation for developing LCV technology, particularly vehicle electrification, manufacturing capabilities and broader e-mobility infrastructure e.g intelligent transport systems, energy infrastructure etc. Notable infrastructural initiatives that have taken place, in development and/or currently operating include the delivery of a Plugged in Places project ('Charge your Car') and the construction of a National Centre for Low Carbon Vehicle Technologies in Sunderland.

Nissan remains at the centre of these innovative activities and produces the Leaf Electric Vehicle (EV) at its Sunderland plant. The Sunderland location is also home to the company's European Centre of Excellence for battery manufacture. However, the North East LEP area also plays host to US based Smith's Electric Vehicles, the largest manufacturer of electric commercial vehicles in the world, who purchased Tanfield Group and are developing a centre of excellence in Washington that will support manufacturing around the world; Cramlington based Avid Group who produce a range of low emission products, including electric all-terrain vehicles; Sevcon a global manufacturer of electric vehicle motor controllers headquartered on the Team Valley; and Hyperdrive an engineering company, also based in Cramlington, who develop low carbon vehicle technology.

For a complete analysis and review of the PVM AEA, see Appendix 3.1 for summary sheet and 4.1 for SWOT analysis.

Potential Policy Interventions

The region should do all it can do to maintain and build the success of those major companies already here and ideally learn from them and disseminate that learning to improve the effectiveness of other organisations in the region. Opportunities for policy intervention include:

1. Work with Nissan and other major car manufacturers to establish their interest in hydrogen based fuel systems. Discuss how the learning the region has and is developing in moving to EV could be reapplied to a hydrogen based power and explore whether this would prove sufficiently interesting to them to lead them to

[23] www.hitachirailproject.co.uk/index.php/hitachi-rail-project-news/item/nissan-s-role-in-trains-move

invest in the region. The risks and costs in such a venture are such that we should only invest Government money if there is private sector matched funding coupled with inward investment. There is potential overlap with hydrogen storage and distribution capabilities in the Tees Valley.

2. As highlighted above, the North East does not have a heavy research presence associated with PVM. Nonetheless, North East LEP could challenge what it would take to leverage CPI and University expertise to create a significant position in battery development in the region. This technology is clearly critical to EV success and therefore any effective developments will have a ready market. This is a case of finding promising approaches and 'spending a little, to learn a lot'. For example, one appropriate approach would be to focus on a specific approach/technology in which the region already has an interest e.g. the potential graphene technology offers to Li ion battery performance
3. Consider a sector based 'grand challenge' that brings together Nissan, house builders, mortgage suppliers and PV manufacturers to explore a means to stimulate electric vehicle demand that provides an impetus to Nissan sales of the Leaf and establishes the region's credentials as a leading location for sustainable, community supported business via a model that can hopefully be exported nationally and internationally. An organisation such as Zero Carbon Futures would appear to be well placed to orchestrate such an endeavour
4. Explore mechanisms within the UK Government's 'Driving Success' industrial strategy for the automotive sector to enable points 1-3 above
5. Unlike other industries in the North East LEP area, the PVM industry is noticeable for lacking a regional network. The importance of networks such as Energi Coast, NOF Energy and many others is important for intra-regional connectivity, learning and developing collaborative projects, but also for external engagement and lobbying. NE LEP should consider supporting PVM and in particular, the emerging LCV industry, with support towards this endeavour
6. To date, Business Durham has principally led on the inward investment and associated supply chain opportunities of Hitachi. The North East LEP should take a more proactive approach to connect Hitachi, via business intermediaries, with potential local and regional supply chain partners

8.2 Subsea & Offshore Technology

The North East LEP area has a demonstrable competitive advantage and substantial business base, second only to Aberdeen within the UK, within subsea and offshore technology. Subsea and offshore technology is used to conducted process and operations both beneath the surface of the sea and in the interface between the sea and connected (offshore) activities above. Products and services within in the subsea and offshore technology 'sector' can be broadly broken down into the following five groupings:

- Products and components to operate subsea and offshore;
- Vehicles and machinery used subsea ;
- Equipment for vessels used to install products and deploy and recover vehicles/machinery ;
- Subsea and offshore installation, seabed intervention, inspection, maintenance and repair (IMR), and decommissioning activities;
- Engineering Design and Knowledge Intensive Business Services.

The North East of England has a critical mass of successful and in many cases world leading firms in all those five groupings spread across both the NE LEP and Tees Valley Unlimited (TVU) geographies. It is estimated that more than 50 companies in the wider region are involved in the subsea sector, with over 15,000 employees and £1.5bn turnover. There is a good mix of ownership (inward investment, privately owned, private equity, foreign owned subsidiaries) and a long history of entrepreneurial activity in the sector.

There are multiple applications for the technologies which are currently predominantly used to recover oil and gas reserves. While the UK will continue to supply oil and gas well beyond 2055 and export markets will be available long after that, there are opportunities for diversification into related areas. There are opportunities in offshore wind and more speculatively in other marine renewable energy activities; carbon transportation and storage; unconventional gas; and mining and harvesting of seabed minerals.

The UK subsea and offshore sector is widely acknowledged as a world leader in experience, technology and innovation. There is strong export performance with key export markets for UK subsea companies being Europe (especially Norway), Africa (especially West Africa), North America and Asia. Future export growth is anticipated to come primarily from South America, Asia and North America.

The subsea and offshore technology sector has a high GVA, noted as a weakness for the North East LEP area in the SQW Review of Current Performance for the North East Independent Economic Review. This partly reflects the relatively high paid roles in the sector and a strong regional supply chain.

For a complete analysis and review of the subsea and offshore technology AEA, see Appendix 3.2 for summary sheet and 4.2 for SWOT analysis.

Potential Policy Interventions

1. Develop the Neptune Centre to achieve the same level of success as that achieved by the Norwegian model of industry/academia collaboration;
2. North East LEP and partners should continue to seek to attract firms who are unable to achieve their growth plans in an over-heating Aberdeen market;
3. Continue to explore and promote opportunities within the UK Continental Shelf (UKCS);
4. Support the development of the local supply chain. NOF Energy and Subsea NE are already working on this with showcase and meet the buyer events;
5. Support for exporters (novice and experienced). Work with UKTI on exports. The majority of exports relating to oil and gas have been in services to USA, Canada, Angola, Norway and Australia and there a number of other international high value opportunities, where there is the best fit with UK capability and appetite to engage with the UK supply chain, such as in Brazil, Iraq, Kazakhstan, Mexico, Libya and Saudi Arabia;
6. Consider a regional Subsea Academy – with sponsored places on engineering courses at regional colleges and universities with guaranteed work experience from regional companies;
7. Lobby for government led technology development programme akin to Demo 2000 (Norway) or DeepStar (USA);
8. Look at emerging opportunities from the national Oil and Gas Strategy e.g.
    a. Seek to engage at North East LEP level with the new Oil and Gas Industry Council;
    b. Look at possibility of a regional technology 'Share Fair' event, akin to the one held in Aberdeen, to improve technology uptake by linking industrial demands with technology suppliers. Look at experience of the 'Driving Innovation' event and learn lessons accordingly;
    c. Explore access to finance and keep a watching brief on activities relating to performance bonds;
    d. Keep watching brief on the proposed focussed technology strategy.
9. At a strategic level, explore partnership working with TVU, Humber LEP, New Anglia LEP and South East LEP to connect and develop new supply chain, trade and inward investment opportunities for offshore wind;
10. Continue to work with schools to promote opportunities in the sector including Energise Your Future zone at the Skills NE event;
11. Promote Year in Industry scheme building on positive experience of individual firms.

8.3 Life Sciences & Healthcare

The North East LEP area possesses significant competitive advantage in the life sciences and healthcare industry. The strength of the AEA lies in its diversity of its business base across the innovation and supply chain where it is estimated that approximately 260 life science and healthcare companies employ in excess of 38,000 people, and generate a combined turnover of £10.5bn to the regional economy. Including public health and social care, the AEA is the largest employer in the region by some considerable margin.

The above statement withstanding, a significant proportion of the pharmaceutical industry in the North East is concentrated in formulation, manufacturing, packaging and distribution activities. Some of the world's leading pharmaceutical companies are located in the North East LEP area, including: GlaxoSmithKline; MSD; Piramal Pharma Solutions; and Aesica Pharmaceuticals. Together, they represent a significant employer in the region and substantial contributor to gross value added (GVA)[24]. Including pharmaceutical companies based in the TVU sub-region, the North East is still considered to produce 33% of the UK's GDP in pharmaceutical manufacturing with 95% of finished product exported to global markets.

Alongside pharmaceutical formulation and manufacturing businesses, the North East LEP area has a diverse business base operating across the innovation and supply chain with a broad range of biopharmaceutical companies, custom synthesis and supply firms, medical technology businesses, and specialist bioprocessing and technical support firms undertaking R&D into drug discovery, supplying research tools, producing speciality chemicals, manufacturing medical diagnostic devices etc. Unlike the predominantly overseas owned big pharmaceutical manufacturing sites, there is a good mix of ownership (privately owned, private equity, inward investment) with a history of indigenous entrepreneurial activity in the AEA.

At the early stage of the innovation chain, Newcastle University's Faculty of Medical Sciences is one of the top six medical schools in the UK. Through its partnership with Newcastle upon Tyne Hospitals NHS Foundation Trust - collectively known as 'Newcastle Biomedicine' - the North East LEP area possesses one of the UK's leading bioscience centres for translational medicine. This has been evidenced by securing a number of high-profile research and infrastructure investments by UK Government over the past five years. In addition to Newcastle Biomedicine, the North East LEP area is also home to significant research expertise at Durham University's Biophysical Sciences Institute, Northumbria University's expertise in sports science, exercise and nutrition, and Sunderland University's Pharmacy School.

The AEA is well supported by a number of regional multipliers and initiatives including Bionow, First For Pharma, NEPIC, North East and North Cumbria Academic Health Science Network (AHSN) and NHS Innovations North.

For a complete analysis and review of the life sciences and healthcare AEA, see Appendix 3.3 for summary sheet and 4.3 for SWOT analysis.

[24] Sunderland University Submission –Key Manufacturing Sectors for the North East Economic Review,

Potential Policy Interventions

Whilst the potential policy interventions for the life sciences and healthcare industry seek to broadly support the industry, the focus for North LEP and public sector intervention should concentrate disproportionately on supporting the SME base to become more innovative, produce more products/services, and increase export activity. There is also the potential to provide better and more targeted support to the existing pharmaceutical industry.

1. Skills – Establish a regional training centre for pharmaceutical manufacturing offering vocational and professional development training to support graduates and skilled workers to enter, or retrain for, the pharmaceutical manufacturing industry. This could be delivered by an existing college or private training provider with course content primarily driven and delivered by industry
2. Support for exporters (novice and experienced). The majority of biotechnology, medical technology and pharmaceutical exports are directed at established markets in the U.S and the EU. However, more life science and healthcare companies, particularly SMEs, are exporting to new and emerging markets in Africa, Asia Pacific (China) the Middle-East and Russia. North East LEP should review existing export support activity delivered by UKTI and organisations including NEPIC to explore areas for additional export support.
3. Explore academic and industrial opportunities to engage and support R&D and manufacturing into biologics. In particular, linkages should be strengthened between Newcastle University, Durham University, Sunderland University and industry to embed the Centre for Process Innovation's (CPI) National Biologics Centre within the region.
4. Linked to point 3, the North East LEP should keep a watching brief over national policy, industry and market developments related to synthetic biology. North East LEP to potentially support the proposed development of Newcastle University's Synthetic Biology Centre as a significant opportunity to engage with the region's process industries supply chain to develop new industrial applications of synthetic biology and attract extra-regional funding, industrial collaborations and longer-term inward investment to the region
5. Infrastructure – Unlike Teesside (Wilton), Durham (NetPark) and Sunderland (NE BIC), Newcastle has a significant bottleneck in the provision of grow-on bio-incubator space for life science and healthcare companies. Locations, funding and business models should be explored to alleviate this gap in Newcastle's competitive offering
6. Explore access to finance – A number of dedicated life science investment funds have been established throughout the UK e.g. North West Fund for Biomedical, Mobius Life Sciences Fund etc, leveraging new and existing funding sources to support predominantly life science and healthcare SMEs. North East LEP to explore options relating to 'Jeremie 2' and North East Access to Finance legacy funds
7. Build resource (financial) capacity in the North East and North Cumbria Academic Health Science Network (AHSN) as a UK Government priority initiative and one in

which the innovation, industry and wealth creation platform via 'innovation in' and 'innovation out' activities are key delivery work-streams of the network

8. A significant amount of skills support to the pharma industry is presently delivered via NEPIC, the National Skills Academy Process Industries Academy and initiatives such as SEMTA's North East Skills Alliance for Advanced Manufacturing. Capacity should be built using these institutions and initiatives to deliver further support to encouraging the uptake of apprenticeship schemes (particularly technician level 3 onwards).
9. More can be done in developing KTP opportunities linked to process and business operations rather than science-based R&D projects. For SMEs, the four universities in the North East LEP geography should consider offering a programme similar to Teesside University's knowledge exchange internship and industrial sandwich placements as part of undergraduate degree programmes
10. Explore collaborative opportunities with other 'tier 2' bioscience cities and hubs to provide a more compelling and competitive life science offering. In addition, North East LEP should also explore more joined-up activity with Scotland.
11. North East LEP to explore options for attracting and retaining experienced life science entrepreneurs and senior management in the region
12. Innovative healthcare delivery – The North East LEP area has a number of businesses delivering innovative health and social care delivery programmes. The North East LEP should learn from examples such as the KEIRO Group to explore how the private sector can support the public sector with the delivery of health services and solutions
13. Develop, award and deliver a societal challenge programme - linked to health, demographic change and well-being - encompassing projects which might include new service commissioning e.g. more than medicine, co-design of new patient pathways, adoption of digitally-enabled technologies etc

8.4 Creative, Digital, Software and Technology Based Services

The S3 project team believe this area of economic activity offers major future opportunity within the North East LEP area. While this AEA is really difficult to characterise and quantify it is united by the combination of creative talent with enabling digital technology. The AEA stretches from large well established companies in both products (Sage) and services (Accenture) sectors through to fast growing medium sized companies (Eutechnyx) to many, many small to micro companies ranging from design companies, music, film, games and software typically characterised by low financial barriers to entry and the reliance on digital technology to the creation of wealth. It also could encompasses some of Accenture's neighbours on the Cobalt Business Park, where Procter & Gamble and Hewlett Packard deliver back office services through digital technology; BT who are reportedly the largest employer of software engineers in the region; Convergys a US based firm based at Quorum Business Park; and home grown businesses such as TSG, Leighton Group and Utilitywise.

The AEA is well served by a number of well respected intermediaries who are key connectors within their subsectors, not only within the region, but also to national talent and resources e.g. Generator (Music), Northern Film & Media and Sunderland Software City. Sunderland Software City already makes links and grows networks through its activities that reach beyond the AEA, e.g. workshops run in conjunction with Sage Plc aim to improve business' product development skills using the widely adopted Scrum methodology.

These are very different types of business but advocacy body Dynamo, (akin to a Subsea NE for the IT and digital technology in the North East), believe that connectedness across the businesses will be mutually beneficial. There is a dynamic, entrepreneurial start up community in the region in creative, digital and software which are relatively 'foot loose' and should be supported to remain in the region and who need access (remotely) to markets, and assistance with getting through potentially multiple rounds of funding to get to be sustainable SMEs. Then there are large multinationals and home grown larger businesses that are embedded in the region due to relatively low (in the UK context) costs and the availability of a workforce with relatively low turnover. Both have a relatively young workforce and offer opportunities both for graduates coming out of the region's universities with degrees in this area, and in the case of the larger companies provide opportunities for those with fewer formal qualifications to receive training and skills.

For a complete analysis and review of the creative, digital, software and technology based services, see Appendix 3.4 for summary sheet and 4.4 for SWOT analysis.

Potential Policy Interventions

1. Ignite 100 (a start-up competition) clearly demonstrates what can be done in a relatively short time to establish the region as a hotspot of digital activity. The fact that 50% of participants remain in the region following completion of the program illustrates the locality and its amenities are a powerful anchor to those fortunate enough to have experienced them. North East LEP could explore how to amplify this

initiative and consider opportunities to reapply competitions with significant funding prizes as a stimulus for creativity and new business formation

2. Accenture has a flourishing and innovative apprenticeship scheme and this could be replicated and expanded to other large employers
3. Early stage businesses in creative, digital and software typically don't require significant funding on capital projects but would benefit enormously from office rental relief particularly if it enabled significant numbers from across the AEA to work in close proximity, ideally with business support services – both to get their businesses off the ground and to incubate completely new ideas as a result of the creative ferment that will occur in these spaces. Any such relief should be made repayable were the business to move outside the region within 3 years of receipt of the subsidies
4. The already partially funded Newcastle University 'Cloud Innovation Centre' has a stated aim to facilitate the uptake of distributed computing opportunities within local industry. How exactly this is to be achieved is yet to be fully decided. However, funding could be made available to again drive 'best in class' structure, governance and behaviours that maximise the chances of productive wealth creating collaborations
5. Northern Film and Media make the case that the region should create a fund (similar to many other regions of the UK) to attract major film productions to the region. The diversity of the regional landscape, small size of the region and excellent transport links are considered important differentiators vs. competing regions. In addition to the inward investment and publicity that results it would provide a focus for local talent and skills development resulting in further interesting career paths for talented young people
6. TSB will be funding programmes worth £26m up to the end of the 2014 financial year, designed to boost innovation and growth for the UK's creative and digital businesses. North East LEP should ensure this is sufficiently publicised and bidders supported by those with experience of TSB funding
7. Tailored support for exporting could be useful and smaller companies need back up, e.g. software engineers, admin support, if they are to leave the business to chase opportunities abroad
8. The Combined Authority must ensure the very best connectivity across the region and that there is strong coordination of the various elements of digital service delivery
9. Work to raise the profile of the region as an exemplar of music industry development and source of creative and business talent. Attract, grow and retain creative business talent

Given all sizes of business in the sector are concerned about the pipeline of skilled people to support the growing industry we should:

10. Organise and fund a Grand Challenge to the AEA (music, film, digital, software) to work together to develop digital content for use in local schools that provides high quality, place based career information and motivation relevant to the digital sectors
11. For those young people attracted to the AEA there is a need to provide training that combines business and technical knowledge

12. North East LEP should consider sponsoring bursaries that enable students to gain industry experience as part of their courses. Again the terms of those bursaries should be such that money has to be repaid if students leave the area within a few years of completion of their courses

7.5 Potential Horizontal Policy Proposals

In addition to suggested policy proposals put forward in each of the individual AEAs, the S3 project team also recognise the importance of underpinning horizontal policy proposals that cut across those stipulated AEAs. As a result, the North East LEP should also consider the following recommendations to be factored into ongoing programmes of activity led by the North East LEP, the Combined Authority and its partners:

1. Through NEPIC's BASME programme, the region has direct experience of helping to link locally-based small companies in the chemical industry to large regional players in the process industries in an effort to increase small business turnover. The North East LEP should consider how to reapply the learning and process to other AEAs and niches by focusing on connecting small regionally based companies with large companies and/or large public sector organisations e.g. NHS, outside the region (UK and international)
2. The North East LEP appears to have an outstanding example of academia (Gateshead College) and business collaboration (Nissan) in the delivery of apprenticeship programmes. The North East LEP should use this experience to find fit for purpose analogies for other companies to help create an apprenticeship culture of the sort that used to exist in the region
3. Evidence has pointed to a greater need for technical and business support to the region's engineering and advanced manufacturing industries. The North East LEP should explore an upgrade or 'add on' service to the nationally delivered Manufacturing Advisory Service (MAS). Establishing a regional industry-led advisory group aligned with North East LEP (and TVU) priorities should be considered
4. As highlighted in individual AEA policy recommendations, North East LEP should consider additional programmes and projects to increase export activity over and above the current offering delivered by UKTI. Regional initiatives such as the Go Global project delivered by NEPIC, RTC North and NECC should continue to be supported and scaled-up where possible
5. The Combined Authority has already established an inward investment director for the North East LEP area. The focus of inward investment targets should fit in accordance with the areas of economic activity stipulated in this report e.g. Hitachi supply chain; electric vehicle manufacturers; medium-sized pharmaceutical firms; expanding subsea firms etc. In addition, and in partnership with the Chair of the North East LEP Innovation Board, the North East LEP and its partners should consider providing a central coordination point and support for significant International and national innovation initiatives, investments and projects e.g. Catapult bids, UKTI High Value Opportunities (HVO)
6. For the advanced manufacturing industries, North East LEP should consider developing a Technology Commercialisation Centre. In similar model to the Energy Technology Institute (ETI), the Centre should be a public-private partnership between North East LEP and key regional-based multinational companies' e.g. Siemens, Nissan, GSK, P&G etc. Unlike the ETI which concentrates solely on future energy challenges, the purpose of the Centre would be to support the development and delivery of key thematic projects (societal challenges), funded by North East LEP, but generated from industry and academia

7. Promote science, technology, engineering and mathematics (STEM) subjects within North East LEP schools to create expertise within the local area which is currently missing. Through this create strongly industrial links with local schools (local community value creation). Primary Engineer is a good example of a programme which could be scaled-up across the region
8. Evidence from this project confirms the assertion in the draft EUSIF submission that the current provision of careers education, information advice and guidance is insufficiently linked to an understanding of the employment opportunities within the region. Mechanisms to remedy this should be investigated and implemented
9. The North East LEP and TVU should jointly explore the establishment of a central resource to identify, coordinate and support North East-based businesses seeking to access emerging European and national R&D and innovation funding programmes e.g. Horizon 2020, TSB etc. To do this, the North East LEP can learn from organisations such as Hyperdrive and OJ-Bio on how to use TSB and European R&D programmes to successfully drive their business through research grants. Reapply the learning to other companies and lead the funding efforts via intermediary involvement
10. There is a strong case for developing better connections, linkages and opportunities between the AEAs. With this in mind, North East LEP should consider developing, funding and coordinating a series of 'innovative projects' e.g. feasibility studies, collaborative projects etc, between AEAs, clusters and multipliers. Universities in the North East LEP area represents a key source of projects and initiatives and should be considered by North East LEP where there is a demonstrable business case for local economic development.

9. ESTABLISHED OR EMERGING NICHE AREAS OF 'SMART' FUTURE POTENTIAL

Within the remit and timescale of this commission the S3 project team was only able to conduct a detailed exploration of four exemplar AEAs. However, based on a combination of primary and secondary data gathered both prior to and throughout this research exercise, the S3 project team identified other niche areas with significant potential for growth and innovation, and recommend that the following opportunities should be considered by the North East LEP for further exploration :

1. Surface Science – The North East LEP area possesses significant academic and industrial technology and innovation capabilities, competencies and skills in surface science. Two of the largest corporate R&D hubs in the North East LEP region – P&G (detergents) and AkzoNobel (surface coatings) have committed significant resources to this emerging field. This is supported by a critical mass of regional businesses operating - in the sense of conducting R&D, supplying products/solutions and/or possessing core industrial competencies, in this area, including: Applied Graphene Materials; DuPont Teijin Films; Parker Hannifin; Johnson Matthey; Lucite International; FujiFilm Diosynth Biotechnologies and others. Supporting industrial capabilities, the North East LEP region possesses a number of academic and external intermediaries with world-class expertise, facilities and skills in this field including: Durham University (global strategic partnership with P&G, involvement in the Regional Growth Fund financed 'CEMENT' SMC3 consortium project to commercialise surface science technologies and the EPSRC Soft Matter and Functional Interfaces Doctoral Training Centre); Newcastle University (INEX, School of Chemical Engineering & Advanced Materials); the Centre for Process Innovation (CPI) (core facilities and skills e.g deposition equipment and sputtering techniques) and others. In accordance with recognised strengths, and reflecting national innovation policy support to this emerging area[25], the North East LEP should explore opportunities to support the regional 'first mover advantage' in this technology field whilst also investigating opportunities to integrate competencies in surface science into pre-identified (and other) AEAs
2. Public Sector – The public sector in the region employs one quarter of all people – the highest proportion amongst the English regions. Building on the work of NESTA, North East LEP should work with the seven LA's and Combined Authority to develop individual innovation strategies within each of the LA's to ensure a systematic approach to developing, extracting and managing innovation is achieved. Representatives from the LA should also be involved in the North East LEP Innovation Board and task group. The North East LEP should also consider contracting with NESTA to develop and deliver a series of public sector innovation programmes that have the potential to be scaled-up with the LA's, NHS etc
3. Energy Generation, Storage, Utilisation and Process Efficiency – The North East LEP area can draw upon geo-physical assets, academic expertise at Durham and

[25] BIS' 'Eight Great Technologies' of Advanced Materials and Nanotechnology relies heavily on surface science.
Surface science recognised by TSB in Advanced Materials Enabling Technologies Priority Areas and underpinning High Value Manufacturing Catapult

Newcastle Universities, and established engineering and energy firms, to exploit its competitive advantage in alternative energy – particularly unconventional gas extraction. Linked to interest by the petrochemical cluster in Teesside as a long-term feedstock, the North East LEP and TVU should explore collaborative options to support this emerging opportunity

4. Ageing – Ageing demographics and its impact on society presents an opportunity for technical and social innovation. Organisations including Newcastle University (Changing Age for Business Initiative), Newcastle Science City, Newcastle College, Newcastle City Council, business and voluntary organisations are increasingly committed and exploring commercial opportunities. The North East LEP should consider supporting this area by exploring the business case for intervention at the demand-side of investment to combine recognised capabilities in early-stage research within the region – particularly within Newcastle Biomedicine. For instance, Voice North is a unique asset which, if scaled-up, could provide an effective mechanism for undertaking open innovation with the private and public sector to (re)design and develop new products and services;
5. Microelectronic Technologies - The region is home to a number of businesses, organisations and academic centres dedicated to emerging electronic technologies, embedded systems and printable electronics. Building on the work of the Northern Way, One NorthEast and capabilities (and industrial experience) of PETEC, CPI, business and others, the North East LEP should investigate building capacity at the commercialisation stage of the technology chain to support the diversification of the existing regional industry base, increase multinational end-user engagement and inward investment opportunities;
6. Future Cities, Urban Innovation and Technology Demonstration Sites – The North East LEP area has a number of innovation actors interested or already providing products, solutions and/or service offerings to emerging thinking, business models and applications around 'smart' future cities. For instance, Northern Powergrid, Newcastle and Durham Universities are involved in the £54m smart grid Customer-Led Network Revolutions project. Newcastle Science Central is earmarked to be one of the principle sites for collaborative innovation around smart grid, micro-renewable energy technologies, intelligent transport systems, integrated heat networks etc. North East LEP should investigate how it can support this activity by working with public and private sector actors, and engaging with external organisations e.g. TSB Future Cities Catapult, to develop a series of connected, future cities throughout the North East LEP area
7. Design - The North East LEP area, primarily through the presence of Northumbria University, has a particularly strong national and international reputation for its design courses. Over the last few years, Design Network North has made significant advances in increasing awareness, publicising the benefits and enabling access to design skills and practices by regional businesses. However, this has not translated into the generation of a strong design business sector recognised nationally and internationally. The recent decision of Northumbria University Design School to locate some of its activities and students to the Northern Design Centre and the co-location that results with emerging design businesses and Design Network North offers opportunities to explore what would be required to enlarge the region's footprint on the UK design map.

10. CONCLUSION AND RECOMMENDATIONS

Smart specialisation is about maximising the knowledge-based development potential of a region based on an evidenced-based assessment of a region's competitive advantages. The purpose of this report has been to begin that process by building on the findings of the North East LEP Independent Review and North East LEP's commitment to 'making, trading and innovating' by identifying four exemplar AEAs that are distinctive, yet economically important, both currently and potentially in the future, to the North East LEP area.

The initial investigation and assessment of the four AEAs has not been about selecting priority sectors or 'picking winners'. Rather, identifying those AEAs is about providing a balanced 'portfolio' approach to the North East LEP's innovation and economic development activities and ambitions based on identified strengths, robustness and diversity of the industrial base, physical innovation assets, capabilities and potential, the importance of known vs. emerging technology opportunities, the importance of financial vs. intellectual capital to wealth creation, the importance of public and/or private markets, geographical location advantages, and home and/or export markets.

In passenger vehicle manufacturing, the North East LEP area is home to strategically important multinational corporations that are anchored in the AEA and which offer the North East LEP and its partners opportunities to support the development and diversification of supply chains, and act as an animator to new and emerging technology and market opportunities e.g. electric vehicles and hydrogen fuel cells. In subsea and offshore technology, the region is home to world leading companies in this niche and rapidly expanding sector and there is potential to strengthen the technology base, attract new firms, build export capacity and upgrade the supply chain. For life sciences and healthcare, the rationale for intervention is primarily based on sustaining and building on the region's position as a leading centre for pharmaceutical manufacturing and exports, while creating a supportive and embedded innovation ecosystem (skills, finance etc) to build capacity in the life science and healthcare SME base. For creative, digital, software and technology- based services the rationale for intervention is to build on the presence of significant strengths in software, a strong cohort of young dynamic SMEs and global players.

Within the body of this report we have advocated policy interventions worthy of consideration by North East LEP and its partners. However, it's important to acknowledge that different AEAs have diverse characteristics and therefore different intervention strategies. Nevertheless, the portfolio approach can be adapted as new AEAs or specific technology, industry and/or market opportunities emerge. Moreover, it is also worth highlighting at this point that the remit of this research project was concentrated on the commercialisation stage of the innovation chain. Therefore, North East LEP and partners should also take into consideration how actors within those AEAs join up with early stage R&D, technology and innovation opportunities associated with Horizon 2020, UK Research Councils and other basic research funding programmes.

Moving from a granular level to strategic view, the next stage for the North East LEP and its partners, including the Combined Authority, is to consider the longer-term process for integrating the processes and principles of smart specialisation into its EUSIF, SEP,

innovation strategy and subsequent delivery programmes. Leadership and governance is an important next step in this process and without buy-in from multiple innovation actors in the North East LEP geography it is unlikely to generate the traction it requires to translate from strategy into action. An appointment of a permanent North East LEP Innovation Director and associated 'innovation brand' will be important in animating internal actors and organisations outside of the North East LEP area. The S3 project team would advocate a stronger working relationship with TVU (and other LEPs) around complimentary synergies and collaborative opportunities. For instance, in the example of TVU, synergies exist across advanced manufacturing, energy, digital technologies and healthcare.

From establishing the process, leadership and governance arrangements, the North East LEP must also take into consideration the development of a shared vision of innovation amongst multiple groups –an activity that will be aided by the overarching innovation strategy developed by the Chair of the North East LEP Innovation Board. The North East LEP will also need to consider which specific policy priorities they select either from this research exercise and/or other research and consultation events. North East LEP will also need to develop and execute an action plan with a fit for purpose policy mix, and consider the monitoring and evaluation of selected smart interventions. In all facets of the process, a 'lean innovation approach' should be applied rigorously which ensures demand-side activity works in parallel with supply-side interventions. In the context of adopting this suggested approach to developing a smart specialisation strategy, the S3 project team would encourage the North East LEP to join the EC S3 Platform as a useful tool for peer review, learning and guidance.

In conclusion, developing a place-based innovation strategy is a delicate balance. On the one hand, smart specialisation is about identifying areas of competitive advantage and supporting those activities with evidence-based interventions. On the other hand, and embracing theories associated with complexity economics and evolutionary economic geography, smart specialisation is also about building an innovation system (firms, people, physical innovation assets etc) that are experimental, flexible and adaptable to new and emerging technologies, industries and market opportunities. This smart specialisation report is the first step in providing the evidence and preliminary analysis of four AEAs that are stationed but fluctuate between those two sides of the coin.

APPENDIX 1: Desk Based Research

A number of documents have been reviewed to help in the process of identifying areas of economic activity in the north east region.

Advanced Institute of Management Research	Plastic Electronics: Putting the UK at the forefront of a new technological revolution. Written by Zella King, AIM Innovation Fellow, University of Reading
Automotive Council	Driving success – a strategy for growth and sustainability in the UK automotive sector – Summary document from the Automotive Council & DBIS July 2013
Bdaily	The various stories of surveys and companies in this short report have been sourced from the Internet, e.g. NE Business, bdaily, etc.
BERR in association with UKTI	PLASTIC ELECTRONICS IN THE UK: A guide to UK capability 2008/9
BIS	Regional Economic Performance Indicators 2012. The Regional Economics Performance Indicators is a compendium publication compiled of statistics.
BIS	An analysis of current and historic KTPs in the North.
BIS	An analysis of innovation indicators, e.g. R&D, and employment in high and medium high technology industries.
BIS	Paul, Rebekah Commentary on Regional Economic Performance Indicators. (September 2012)
BIS	SIR ANDREW WITTY'S INDEPENDENT REVIEW OF UNIVERSITIES AND GROWTH Preliminary findings JULY 2013
BIS	Innovation and Research Strategy for Growth Presented to Parliament by the Secretary of State for Business, Innovation and Skills by Command of Her Majesty (December 2011)
BIS	BIS ECONOMICS PAPER NO. 18 INDUSTRIAL STRATEGY: UK SECTOR ANALYSIS, SEPTEMBER 2012
BIS	Plastic Electronics: A uk strategy for success: Realising the UK Potential
CLG	Functional Economic Market Areas - an economic note
Cranfield University School of Management	Innovation in Logistics Services (2007)
Creative Cultural Education	From an interview with Paul Collard, Chair of the Steering Group and Chief Executive of Creative, Cultural Education, October 2011.
CURDS	Pike & Robson CURDS, North East Monthly Reports to the National Institute of Economic and Social Research from April 2012 to July 2013

CURDS	Internal Report prepared by Dr Stuart Dawley North East Region: Summary Review of Labour Market Intelligence (2011-12)
DECC	The Capability & Capacity of the UK Offshore Oil & Gas Fabrication sector (2011)
Durham County Council	Durham County Council citing UKTI data in their 2013 priority sector analyses.
Durham County Council	Business Durham Communication Durham County Council 2013
Durham University	Dr Jon Warren, Department of Geography at Durham University has recently undertaken research into working in contact centres. Some information taken from article in the Journal 5/11/13.
EKOS	North East Access to Finance: Fund Evaluation Research June 2013
EKOS	North East Access to Finance: Strategic Overview and Recommendations June 2013
ERDF	Beneficiaries
ETech	ETech (2013) draft report on low carbon vehicle manufacture
European Commission	Working document 2006 Innovative strategies and actions
European Commission	Research and innovation strategies for smart specialisation: COHESION POLICY 2014-2020. The European Commission adopted legislative proposals for cohesion policy for 2014-2020 in October 2011. This factsheet is one in a series highlighting key elements of the future approach.
European Commission	INNOVATION UNION SCOREBOARD 2010 The Innovation Union's performance scoreboard for Research and Innovation 1 February 2011. The IUS report, its annexes and the indicators' database are available at http://www.proinno-europe.eu/metrics
Eurostat Quality Profile	Greenhouse gas emissions, base year 1990: August 2010
Eurostat Quality Profile	Gross Domestic Expenditure on R&D as a percentage of GDP: Total gross domestic expenditure on research and experimental development (GERD) as a percentage of gross domestic product (GDP).
Florida, Richard	Richard Florida, Cities and the Creative Class 2005.
GHK, CURDS & Technopolis Group	Plastic Electronics final
Inno-Grips	INNO-Grips Policy Brief No. 4 Disruptive Innovation: Implications for Competitiveness and Innovation Policy
Institute of Mechanical Engineers	ENERGY FROM WASTE - A WASTED OPPORTUNITY? (no date)

IPPR North	AT THE CROSSROADS? TRANSPORT AND SOCIAL EXCLUSION IN THE NORTH EAST
Marketwise	North East England Inward Investment Key Facts Research: Report to Inform Regional Image Strategy [DRAFT] August 2008
NE Business	The various stories of surveys and companies in this short report have been sourced from the Internet, e.g. NE Business, bdaily, etc.
NELEP	Independent Economic Review (2013)
NELEP	Colin Mason writing in The North East Independent Economic Review Summary of the Expert Paper and Evidence Base (undated)
NELEP	Advanced Engineering propostion (confidential)
NELEP	NORTH EAST LEP: ADVANCED ENGINEERING PROPOSITION (confidential)
NELEP	North East Independent Economic Review 2013 and the underpinning evidence base see www.nelep.co.uk
NESTA	Creative clusters and innovation Putting creativity on the map Caroline Chapain, Phil Cooke, Lisa De Propris, Stewart MacNeill and Juan Mateos-Garcia Research report: November 2010
NESTA	UK INNOVATION INDEX: Measuring the contribution of innovation to economic growth and how this varies across sectors.
NESTA	Nesta Research report: November 2010 Creative clusters and innovation. Putting creativity on the map. Caroline Chapain, Phil Cooke, Lisa De Propris, Stewart MacNeill and Juan Mateos Garcia
NESTA	NESTA Innovation Map see http://www.nesta.org.uk/home1/assets/features/innovation_map
NESTA	Nesta Research report: November 2010 Creative clusters and innovation. Putting creativity on the map. Caroline Chapain, Phil Cooke, Lisa De Propris, Stewart MacNeill and Juan Mateos Garcia
NJM European, Economic & Management Consultants Ltd	Assessment of Commercial Opportunities in the North East's Biotechnology Market (2008)
NOMIS	Employment by occupation in the North Eastern LEP (Jul 2012-Jun 2013)
North East LEP	Creative and digital Briefing document (no date)
North East LEP	North East Independent Economic Review April 2012
North East LEP	Centre for Offshore Renewable Engineering Briefing Document

North East LEP	Towards a Prospectus for European Common Strategic Framework Funds 2014-2020 in the North East LEP Area
North East LEP	The North East LEP Independent Economic Review: Summary of the Expert Paper and Evidence Base (2013?)
Northern Economic Futures Commission	UK FIRST? Improving Northern Access to Foreign Direct Investment. Prepared by IPPR March 2013
One North East	COMMERCIAL CREATIVE SECTOR RESEARCH Report Appendices: One North East (no date)
One North East	digital Key Facts (no date)
One North East	Ekosgen: Investment and Aftercare Team Evaluation: November 2010
One North East	The North East Automotive Sector briefing document containing FAME data
One North East	Key Facts: Chemicals & Process Industries (no date)
One North East	Engineering & Production: Key Facts
One North East	Food & Drink Sector Briefing document
One North East	Healthcare & Life Sciences Key Facts
One North East	THE AUTOMOTIVE SECTOR, NISSAN AND THE REGIONAL ECONOMY
One North East	Ultra Low Carbon Vehicles Key Facts
One North East	One North East: a selection of reports, promotional material and confidential documents prepared for the former Regional Development Agency.
ONS	ONS R&D Expenditure by Region.
Policy Exchange	Eight Great Technologies: David Willetts (2013)
Policy Exchange	Chris Yiu, Bits and Billions: A blueprint for high-impact digital entrepreneurship in the UK 2012
Regeneris	Labour Market, Skills and Talent Study, November 2010, Regeneris Consulting Ltd
Richardson, R; et al	Richardson et al from a lecture given at Newcastle University on the contact Industry (2013).
Robson, Hall & McCabe	The high value manufacturing sector in the North East – part of the North East Skills Strategy 2012- 2016 evidence base (2011)
Science City	Various documents and proposals concerning Life Sciences, e.g. NICR Centre for Paediatric Oncology, impact statements, environment statements, etc.
Skillset	Skillset the Sector Skills Council for the Creative Sector see http://www.creativeskillset.org/
SSC	British Council, Analysis of baseline indicators and employment change in Creative Industries between 2001 and 2007
Sunderland Software City	Sunderland Software city (SSC)BASELINE ANALYSISFINAL 11th June 2012

Sunderland Software City	Sunderland Software City (SSC)EDUCATION BASELINE ANALYSIS FINAL 19thJuly 2012
Sunderland Software City	Evaluation of Sunderland Software City: Case Studies of Software and Technology Clusters. What does it mean for Sunderland Software City? April 2012
Sunderland Software City	Evaluation of Sunderland Software City: Baseline Evaluation Report: December 2012
The Northern Way	The Power of 3: Regional capability, National excellence, Global significance (no date)
The Work Foundation	Transport Barriers to Youth Unemployment (2013)
TSB Interim Findings	Links between eight great technologies and strategic partnership sectors
UKTI	Great Britain and Northern Ireland Investment Report 2011/12
UKTI	Offshore Wind in the UK 2012

APPENDIX 2: Consultations

2.1 Semi-Structured Interviews/Consultations

Zero Carbon Futures
Design Network North
Accenture
DYNAMO
Peter Smith Consultancy (TVU smart specialisation contractor)
NEPIC
Local Authority (LA 7) Economic Development Directors
Centre for Process Innovation (CPI)
National Renewable Energy Centre (NaREC)
Sunderland Software City
North East and North Cumbria Academic Health Science Network
Bionow
First for Pharma

2.2 Attendance at Pre-Arranged Events

Driving Innovation, 26th September 2013
First for Pharma dinner invitation, 11th November 2013

2.3 Businesses/Organisations Consulted

Nissan
Smith Electric Vehicles
Hyperdrive
Reevu Worldwide Ltd
Sythomer
Nifco UK Ltd
Ford Component Manufacturing
Effective Transport Solutions
Ubisoft Reflection Ltd
Hook Pictures
ITV signpost
Dene Films
Tyneside Cinema
Northern Film & Media
Generator
Arjuna Technologies
Innovation & Technology Group
Gospelware
Waymark IT
Hedgehog Lab
Dontyne Systems
Loft Music

Steve Luck
Demolition
Vector 76
Wipeout Music
Blank Studios
Share my Playlist
Generator
Northern Film & Media
MSD
Sanofi
Aesica Pharmaceuticals
Fujifilm Diosynth Biotechnologies
OJ-Bio/Orla Protein Technologies
SCM Pharma
High Force Research
Cogent
Covance

2.4 Business Intermediaries

Area of Economic Activitiy	**Organisation**
General Business	EEF
	NECC
	FSB
	CBI
	IoD
Subsea and Offshore Technology	Subsea UK
Subsea and Offshore Technology	Energi Coast
Subsea and Offshore Technology	NOF Energy
Creative, digital and software	Software City
	Digital City
Life sciences & pharmaceuticals	First for Pharma

	BioNow
Healthcare	AHSN
Chemical manufacture & formulation	Nepic/CPI
Aerospace and defence	NDI
Passenger vehicle manufacture	Zero Carbon Futures
Construction	Constructing Excellence in the North East
Food & drink	Taste North East
Knowledge intensive business services	Service Network
	Accenture
Other manufacturing	EEF
Nuclear	NOF Energy
Low carbon energy generation	NAREC
Retail & wholesale	NE1
Others	Durham Enterprise
	NetPark
	BIC
	Tedco
	NBSL
	Entrust
	PNE
Finance	Nstar
	IPGroup
	Rivers Capital
	FW Capital
	NEL Fund Managers

	North East Finance

2.5 Submission from Newcastle University

Innovation Vision for Drug Discovery, Therapeutics and Diagnostics

A research and innovation centre to deliver new therapies, drugs and diagnostics in collaboration with pharma and SMEs.

The innovation vision for Drug Discovery, Therapeutics and Diagnostics is to build on excellence in Translational Medicine to improve patient outcomes through increased therapeutic efficacy and specificity.

Our aim is to develop a healthcare environment where research excellence, collaboration, open innovation, education and health services combine to deliver world-class healthcare that meets the needs of patients throughout the North-East of England and beyond. Using our established strengths in ageing and chronic diseases, rare diseases, cancer, education and training, we will deliver new treatments and develop innovative ways to implement them in practice. We will develop an optimally trained workforce, and work closely with the life sciences industry. This will create a sustainable model, providing international leadership whilst improving health and generating economic growth within a socio-economically deprived region.

The objectives are:

- To engage all patients in research through informed consent for use of their samples and records in clinical and commercial research and through continuing participation in clinical studies
- To deliver internationally-recognised advances to improve the understanding of age-related chronic diseases and rare diseases in adults and children
- To translate this knowledge into improved diagnostic prevention and treatment solutions
- To develop an innovative training programme in translational research and healthcare innovation
- To foster economic growth through industrial collaboration based on these advantages, building on our informatics, patient cohorts and clinical research infrastructure.

The Nicholson report (Innovation, Health and Wealth[1]) identified that innovation in the NHS supports the growth of the UK life science industry, in part through NHS-industry partnerships that will develop international business opportunities. It emphasises the need for innovation and leadership training that will deliver high impact innovation and sets out the challenges for the Academic Health Science Networks. The Savory report on NHS adoption of NHS-invented technologies[2] identifies innovation as lacking in the NHS and demands an approach based on open innovation as established in other industrial sectors. Investment in clinical research generates a 40% rate of return annually, comprising an

internal rate of return of 9% and a GDP benefit of 30%[3], a substantially higher return on investment than most other industry sectors.

Why Newcastle University

Collaborative awards with industry have increased from £11m in 2012 to £25m in 2013; in the same period, patents filed have increased from 5 to 15. Our bioincubators host 15 companies. Since 2004, our collaborations regionally have generated around 240 jobs and contributed £70m to the regional economy, as evidenced by external reports. Since 2000, we have spun out 10 companies. A mature spin out, e-therapeutics, is AIM-listed and capitalised at around £90m. Last year we had the highest number of recruiting trials (400) in the NIHR portfolio and the fourth highest number of trials patients (137,000) in the NHS. We have major open innovation collaborations, including a £5m partnership with Astex Phamaceuticals and a £850k partnership with GSK (including a GSK visiting professor). We have open innovation projects with Unilever, Astra Zeneca, P&G, Boots, L'Oreal, Becton Dickinson, PTC, Roche, Genentech and Sanofi Aventis. We run one of four NIHR Diagnostic Evidence Cooperatives. We have a well-established open innovation training programme for clinicians in partnership with pharma.

The Vision

We will be the leading NHS centre for translational medicine through our links with industry.

We will develop our research infrastructure to encourage open innovation, taking advantage of the Academic Heath Science Network to embed research and innovation across the region.

Every patient we treat will be a participant in research, in partnership with pharma, building on our informatics platform, biobanking and universal consent.

We will train clinicians and health professionals in innovation and needs-based collaborative solutions.

We will build on our well-developed clinical research infrastructure for trials, diagnostics and therapeutics.

We will enhance our innovation infrastructure by investing in our areas of competitive advantage: chronic disease, rare diseases and cancer. We are one of two leading UK centres in paediatrics and will develop trial infrastructure and capital investment to support the Great North Children's Hospital in rare childhood diseases, autism and childhood cancer.

The Partners to this project are:

- Newcastle University
- Newcastle NHS Foundation Trust and Northumberland Tyne and Wear Health Trust
- Science City (Newcastle University and Newcastle City Council)
- Industry representatives

Innovation Vision for the Centre for Synthetic Biology and Bioexploitation of Microbial and Molecular Machines

A research and innovation centre to enable the arrival of the design-to-build bioeconomy revolution

The innovation vision for the Centre for Synthetic Biology and Bioexploitation of Microbial and Molecular Machines (CeSBEM[3]) is to build on excellence in bacterial cell biology, computational science and industrial collaboration to develop new products and services that accurately and consistently capture the entire lifecycle of product development in synthetic biology.

Synthetic biology involves making biology easier to engineer, in turn making it easier to use biology to do useful things. Synthetic biology frameworks are lacking because there is a knowledge and practice gap between our understanding of basic bacterial physiology, biochemistry, genetics, the sub-cellular molecular machinery that mediates biological processes and the computational tools and approaches that are needed for the CAD and CAM of complex multi-scaled biological systems and their constituent molecular machines. There is also a need to recognise and respond to reasonable societal anxieties about the possibilities posed by Synthetic Biology, which raises questions about science meddling in nature and producing risks it is not in a position to control.

The objectives are:

- the formulation of advanced generic Synthetic Biology workbench techniques, resources and principles to engineer industrially important microbial and sub-cellular molecular machines for the benefit of the environment, our health and to support our economy
- the development of novel approaches, technologies and infrastructure for the Computer-Aided Design (CAD) and Manufacturing (CAM) of bacterial cells, proteins, pathways and molecular machines
- to further our understanding of the genetics, biochemistry, and more generally, the physiology of bacteria to underpin industrial innovation
- to ensure that appropriate safeguards are developed, that scientific responsibility is practiced and public confidence is retained

Synthetic Biology promises to substantially contribute to the UK economy and society. The Chancellor of the Exchequer George Osborne estimated that the "global synthetic biology market is predicted to grow to £11 billion by 2016". The potential benefits of this rapidly growing field are detailed in a number of key documents including the UK Synthetic Biology Roadmap[1] and the Royal Society Engineering report[2].

Why Newcastle University

Newcastle University has a unique confluence of expertise that allows us to narrow the knowledge and practice gap between bacterial cell biology and the computational tools for DAD and CAM in synthetic biology. We have:

- a world-leading reputation in the technologies underpinning the synthetic biology of bacterial systems through its 70 researcher-strong Centre for Synthetic Biology and BioExploitation (CSBB – www.ncl.ac.uk/csbb) and Centre for Bacterial Cell Biology (CBCB – www.ncl.ac.uk/cbcb)
- a very strong core of 15 computational researchers with expertise in the computational design of synthetic biological systems

The Vision

Our ambition for the CeSBEM^3 is to build upon the innovation environment that we have already developed by bringing together a critical mass of university research in bacterial cell biology, computational design, hydrodynamics, process engineering mathematics biology, societal ethics and scalable computing; commercial businesses (Autodesk, Microsoft Research, Croda Biologics, Demuris, Fujifilm Diosynth Technologies); the National Biologics Centre and the Centre for Process Innovation; the public. This will create a collaborative innovation environment unique in the world and at scale to deliver integrated inclusive solutions in manufacturing through open innovation. It will benefit, researchers and industry in the areas of industrial biotechnology including fermentation, bioprocess design, metabolic engineering, biofuels and therapeutic production

The CeSBEM^3 will include:

- Colocation of bacterial cell biology, computational design and industrial partners
- Higher level skills training in partnership with industry
- New and advanced tools for synthetic biology to meet the challenges of the UK Synthetic Biology Roadmap
- The SynBioSmith Remote Automation Lab – a tool to enable others outside universities and industry to undertake synthetic biology experiments without the need of a physical laboratory, serving among others the DIY Bio movement
- A needs-based approach to solutions for industry through process innovation
- Responsible innovation through public involvement and debate on policy and ethics through the University's Policy and Ethics in Life Sciences centre (PEALS)

The Partners to this project are:

- Newcastle University
- Industry

Innovation Vision for the Campus for Ageing and Vitality

A research and innovation centre to help support the delivery of inclusive solutions to meet the challenges and opportunities created by our ageing society.

The innovation vision for the Campus for Ageing and Vitality is to build upon its existing innovation hub to help create new products and services for our ageing society at scale. The objectives are to:

- Improve the lives of older people.
- Create economic growth
- Make Newcastle a global centre of excellence on ageing
- To be mechanism for the university to deliver social impact.

One of society's greatest challenges is our ageing population. However it also represents incredible opportunities. Life expectancy in the UK is increasing at an amazing 5 hours every day. It is here to stay and is a global phenomenon. The emerging market that this is creating will need new products and services that support; independence, wellbeing, home living and choice. The over 50's in the UK own 80% of the wealth, so the market has finance but has largely been ignored. If we can get it right there is a significant return on investment. In particular through:

- Improving quality of life while at the same time reducing the cost of support for the NHS and Local authorities.

Why Newcastle University

Through the Newcastle Initiative on Changing Age we already have an age focused innovation hub:

- Over 25 years research expertise into the medical conditions associated with ageing.
- Approaching 250 researchers based in a £40 million research centre at the Campus for Ageing and Vitality.
- recognition as a world leader receiving the Queens award
- An age focused Business Innovation Facility (BIF) where companies can collocate with researchers in a collaborative environment.
- A Newcastle innovation pathway with partners such as Newcastle Science City, ASHN and the NUTH.
- Innovative age inclusive clinical/ research environments including CRESTA, CARU, brain bank, Clinical trials and imaging facilities.
- cross disciplinary research into ageing including, digital inclusion, assistive technologies, housing, transport and medicine
- a thriving public engagement programme including the VOICENorth a panel of over 1,000 older people to help with research and business engagement
- A 11 hectare site which is secured for Campus for Ageing and Vitality additional development
- A successful ERDF project which proves the market appetite, innovation pathway and return on investment (see external report by Biggar Economics)
- Strategic focus within the university through the Newcastle Initiative on Changing Age.

The Vision

Our ambition for the Campus is to build upon the innovation environment that we have already developed by bringing together at scale in one unique place a critical mass of: university research, the public, health and care professionals, commercial businesses and the voluntary sector. This will create a collaborative innovation environment at scale which delivers integrated inclusive solutions which support; independence, wellbeing, home living and choice for our ageing society.

The campus is designed to be an exemplar of inclusiveness. It will aim to contribute to policy, strategy and practice for local and national integrated care service delivery. It also aims to create a focus in which key knowledge, capabilities and facilities are available to help develop new products and services, better suited to an ageing society. The Campus will be a hub of ageing related business activity and will create a centre from which networks of knowledge and practise spread globally. In effect a Silicon Valley for Ageing.

The Campus could/ will include:

- Fitness opportunities for older people and facilities designed to create an awareness of how to keep people healthy
- Multidisciplinary clinics for patients addressing the multiple conditions of older age
- Adjacent facilities where patients can access both statutory and voluntary care and support organisations.
- A state-of-the-art care facility for older people specialising in the care of people with cognitive and movement problems.
- Major research facilities in experimental medicine related to bio-gerontology examining the basic cellular mechanisms underlying the ageing process and neural investigation of cognitive degeneration
- A nationally recognised trials unit for the conduct of clinical trials with older people
- An experimental unit for the development of technology to assist older people in their daily living using mechanical engineering and computer science
- A centre for the training of care workers in the use of technology in the care environment
- Teaching facilities for medical, academic, social service and industry personnel.
- Business premises incorporating offices, workshops and laboratories to encourage the commercial exploitation of innovation with industry partners.
- Leisure and conference facilities to provide a location for the social mixing of clients, to encourage cross disciplinary collaboration and a backdrop for a range of events.

The Partners to this project are:

- Newcastle University
- Newcastle NHS Foundation Trust and Northumberland Tyne and Wear Health Trust
- Science City (Newcastle University and Newcastle City Council)
- Industry representatives

2.6 Submission from Durham University

Area of Economic Activity	**Research Activity** *Details of research grants, awards, research centres, physical facilities, numbers of staff, key areas of expertise/focus etc.*	**Teaching** *Current or planned teaching modules, undergraduate and postgraduate programmes, links to colleges/schools, CPD etc.*	**Industry Links** *Collaborative activities with business (regional and non regional) including KTPs, FP etc. Details can be kept anonymous if necessary.*	**Other activities** *e.g. Links to catapults, TSB, shared facilities, public sector linkages – anything that may be relevant*
Life sciences (medical technology, biotechnology, pharmaceuticals)	Research Income 2011-13: £8.8m Centres of Excellence: Biophysical Sciences Institute, Wolfson Research Institute. Departments: School of Biological and Biomedical Sciences (44 staff, 50 postdocs, 50+PhDs); Chemistry (40staff, 100 postdocs and postgrads); Medicine and Health, Anthropology.	BSc, Masters and PhD programmes available in all departments. Soft Matter and Functional Interfaces CDT. New Pharmacy Masters starting October 2013.	P&G Global Partner 2011. Collaborations with lead businesses in Agri-chemicals, Pharmaceuticals, Bioprocessing including Astra Zeneca, Bayer, Syngenta, Croda, Monsanto, GSK **KTPs** JSR Farms (02-04), Microbac (£124,602), CPI (£194,123) BBSRC Network in Bioenergy and Biotechnology: £0.8m Metals in Biology network with national industrial and academic partners	CPI Memorandum of Understanding, National Centre for Biologics Manufacturing. Facilities: EPSRC National Solid-state NMR service. Cell technology suite; Microscopy and Bio-Imaging; Proteomics; Genomics; Protein Crystallography; GJ Russell Electron Microscopy Facility; Durham University Neuroimaging Centre

Passenger vehicle manufacturing and technology	Research Income 2011-13: £0.9m Centres of Excellence: Centre for Electronic Systems, Centre for Communication Systems, The Centre for Through Life Engineering, EPSRC Impact Acceleration Award Automotive theme, the Mechanics Research Group, Institute for Advanced Research Computing for big data analysis. Departments: Engineering and Computer Science(62 members of staff), Physics (82 academic members of staff)	BSc, Masters and PhD programmes available in all departments. Taught MSc course in Communications Engineering,	Engaged with Nissan, Caterpillar, Cummins, Scott Racing, Tallent Engineering, Avid Technology and other leading vehicle manufacturers. **KTPs** SEV Group (£92,696)	Links with Transport KTN, TSB Transport lead and new Transport Catapult. Links to EPSRC. Facilities: Wind tunnel facility
Subsea and offshore technologies	Research Income 2011-13: £8.8m. Centres of Excellence: Durham Energy Institute, The Energy Group; Sea Level Research Unit (Geography); Departments: Engineering and Computer Science, Earth Sciences (34 academic staff, 36 postdoctoral staff), Geography.	BSc, Masters and PhD programmes available in all departments. Taught MSc in New and Renewable Energy	Statoil, Chevron, Hess, Maersk, Shell, Centrica, Dong Energy. Low Carbon Network bid submitted (£0.4m). Supergen Wind Project (£4.85m) **KTPs** CTC Marine (06-07), Narec (£149,650)	Facilities: Ocean Bottom Instrumentation Facility (Earth Sciences); Environmental Geochemistry Facilities; Sir Kinglesy Dunham Earth Imaging Laboratory. Narec (condition monitoring),

Digital, software and creative industries	Research Income 2011-13: £7.8m Centre of Excellence: Institute for Advanced Research Computing, Institute of Computational Cosmology, The Innovative Computing Research Group. Departments: Physics, Engineering and Computer Science, Mathematical Sciences	BSc, Masters and PhD programmes available in all departments. Taught MSc in Internet Distributed Systems Technology	IBM Memoradum of Understanding/Strategic Partner, Bowes Museum, Jeppesen (Boeing), Syngenta. **KTPs** Summit Media (£389,990), Icona Solutions (£91,065), Network Mapping (£207,457), 3D Laser Mapping (£199,958)	Facilities: ICC and N8 high performance computing facilities; Digital Imaging Laboratory.

Durham University – Overview of Future Energy Networks Expertise

Durham University's Durham Energy Institute (DEI) is a leading UK energy research institute. Receiving over £36M of funding for energy research in the past 7 years has put the DEI in the top quartile of UK higher education institutes, making it one of the UK's leading university research communities focusing on the research and development of offshore wind, electricity transmission, and smart grids.

The DEI's unique offering is that it links societal research to these technology areas. The DEI tackles the societal aspects of energy technology development and use, which has been increasingly recognised as an important aspect of energy research, previously overlooked. DEI aspires to initiate the behavioural step change required for society to realise a low carbon future, whilst in the process establishing DEI as an internationally leading institution for integrating energy science with society.

Durham Energy Institute members undertaking research in Energy Conversion, Transmission and Distribution are based in the School of Engineering and Computing Sciences of the University. The principle research areas in this theme include wind power, smart grids, turbomachinery and power systems and transmission networks.

The multidisciplinary Energy research group within Durham University's Engineering and Computing Sciences tackles the challenges presented by energy engineering, in particular the conversion of energy from new and renewable sources and integration into energy networks, which fits in well with current national strategies. Over the past 7 years the group has expanded from 3 to 33 researchers, focusing on 4 areas:

1. Large-scale wind turbine technology, particularly for offshore including the application of indirect and direct-drive technology, condition monitoring and reliability.
2. Smart grids and embedded generation at the distribution level, including micro-combined heat and power, solar heating and micro-wind,
3. The integration and control of new and renewable energy sources into distribution networks including innovative generator topologies and power electronics for embedded generation.
4. Electricity networks to accommodate the rise of embedded generation in the system and in the markets, and deal with the challenges of diversified generation and demand side management.

In the area of power electronics, converter systems are being investigated depending on the energy system involved and the design of generator employed. Power electronics are being developed and studied for wind wave and tidal stream systems as well as for more conventional systems such as variable speed diesel systems.

Selected current research impact activities drawn from the research at Durham University include:

- Advising National Grid on cost-benefit analysis methods for transmission planning, and on wind generation's contribution to securing peak demand.
- Developing methodologies for integration of intermittent wind power into efficient and reliable operation of the power system.
- Work on preventing wide-area power blackouts.

Durham University – Overview of Diagnostics Expertise

The Biophysical Sciences Institute (BSI) at Durham University was established in 2007. The BSI is a beacon for new discoveries at Durham University and was created in response to the ever-increasing need to carry out research that crosses the boundaries between biology and the other physical sciences. Its members are drawn from university Departments and Schools including the Biological and Biomedical, Chemistry, Engineering and Computing Sciences, Mathematical Sciences, Physics and Psychology, all have been assessed as conducting research of international quality in the 2008 Research Assessment Exercise (RAE), as well as being recognised as internationally excellent or world leading. Many of today's major biological challenges, such as heart disease, crop protection and age-related macular degeneration demand this interdisciplinary approach.

The BSI and Durham University were recently presented 'as a global leader in multidisciplinary research' in the US Congress (Feb 2012) by Jeff Weedman (Procter & Gamble Global Business Development Vice President).

The Wolfson Research Institute at Durham University is based in a purpose-built building on the University's Queen's Campus, at Stockton-on–Tees and began operation in November 2001. The Wolfson Research Institute conducts research on human health and well-being and also brings together researchers from across almost all of Durham University's academic departments, along with their national and international networks. The institute seeks to improve health and the quality of people's lives by informing policy and practice and has a particular commitment to the health and well-being of people living in the North East of England. There are strong relationships with the National Health Service and local government, and a flourishing programme of collaborative research.

Through collaborative and multidisciplinary research the BSI and Wolfson Research Institute work together to solve major biological challenges by developing new scientific methods and technologies.

Leading research within the two institutes involving diagnostics include:

- **Development of novel imaging methods** for a range of biological challenges, both at the microscopic imaging level and also for large samples. Current projects include: the use of Single Plane Illumination Microscopy (SPIM) linked with a heart

synchronisation method to image beating Zebra fish hearts. Biospectroscopy, were a fibre optic based imaging spectroscope normally used in astronomical telescopes, has been applied to a microscope to study local changes in the spectra emitted by samples, adaptive optics applied to widefield, confocal and non-linear microscopy to correct for tissue aberrations and micro-endoscopes (under 1mm in diameter) and cameras for long term embedded in vivo imaging. A strong emphasis in the BSI is converting the data recorded, either from an imaging instrument or a spectrometer, into quantified data with a strong emphasis on then presenting this data in a visual form.

- **3D Visualisation** -Through the BSI's collaborations with computer science, engineering, psychology and physics, complex data sets are being analysed and presented in 3D. As well as presenting the information in this manner research is underway as to how this is perceived and understood by the user. Stereo Tumour Imaging is a project exploring the way clinicians assess images in 3D in relation to cancer diagnosis.
- **Structural Determination -** A large focus of the BSI that cuts across several departments is the use of X-ray diffraction and electron microscopy to look at structures at different levels. Research in Protein Structural Analysis and Electron Microscopy makes a large contribution to this area.
- **Biological Modelling** - Mathematical and fundamental physical principles are used to derive models explaining complex biological processes. These models are then combined with experimental data to gain a better understanding of biological systems. Areas of research includes: Patterns of vibration in icosahedral Viruses, elasticity of biopolymers and other bio-macromolecules, and modelling of the cytoskeleton and its function.
- **Biomolecular Interactions** - Biological questions concerning the interaction of a herbicide with plant enzymes, the recognition of DNA by bacterial proteins, or the composition of cytoskeletal proteins are address using a wide range of chemical, biochemical, and biophysical methods.
- **Cell Structure** – this research discussion group is a forum for scientists who elucidate the principle structural elements as well as the mechanisms that govern the architecture and behaviour of cells. This is broad theme that includes research on viruses, yeast, plants, and several vertebrate model systems. The members of the group consider the study of cell structure itself to be their primary research aim (or at least part of their research) in areas such as cytoskeletal, nuclear and cell membrane dynamics in normal or pathological conditions (e.g. viral infection, fungal infections, cancer, muscular dystrophies, premature ageing and other human degenerative diseases). Moreover, using sophisticated microscopical equipment they can address cellular architecture at the ultra-structural level and examine

fundamental processes such as cellular asymmetry, cell migration, cell division and cellular signalling.

- **Optimising Diagnosis of Symptomatic Cancer** - This programme builds on ongoing work of the Evaluation, Research and Development Unit and seeks to improve diagnosis of cancer through six interlinked projects. It will consider the issue from the patients' aspect (why they do or do not attend surgery with a symptom) and the GPs' aspect (what is the risk of cancer when a symptom is mentioned?), and will examine what is the optimum method of organising investigations for suspected cancer. It will also look at wider systemic questions such as what are current referral patterns; what level of risk needs rapid investigation, and how can the system be improved, both from an economic and a societal perspective?

  Throughout the research programme, there will be close working with those responsible for improving cancer services. Part of the role of the Evaluation, Research and Development Unit is to support evidence-based commissioning, including the improvement of care pathways and tackling health inequalities. Participants are delighted to have the chance to work in a field such as this, where findings directly impact upon clinical practice and health policy and where the benefits to patients are so immediately tangible.
- **Synthesis and characterisation of functional magnetic resonance probes**, developing responsive and targeted paramagnetic contrast agents (e.g. to tumours for cancer imaging) for Magnetic Resonance Imaging and Spectroscopy (MRI/MRS).
- **Cognitive Neuroscience** - the Department of Psychology has a very active research programme in the area of cognitive neuroscience, including the study of the neural bases of attention, memory, action, and visual perception. We use a variety of techniques to answer our questions relating to adult and infant brains including fMRI, TMS, tDCS, EEG, eye movement tracking, biophysiological recording as well as the analysis of visuomotor action and psychophysical performance. Our work on understanding how the undamaged brain works feeds directly into our research concerning the design and efficacy of neurorehabilitation paradigms with a large cohort of patients with brain damage in the North-East. More information may be found through the Department of Psychology and the Centre for Vision and Visual Cognition.

The **Durham University Neuroimaging Centre** has the primary role of encouraging and facilitating research using the University's new Magnetic Resonance Imaging (MRI) facility. The facility is shared equally between the University and South Tees Hospitals NHS Trust, and is situated at the James Cook University Hospital in Middlesbrough. The Centre organises regular scientific meetings, facilitates and coordinates in-house and external training, and co-ordinates meetings of facility users for discussions on specific topics.

Durham University's Centre for Communication System was established in 1988 as an interdisciplinary centre involving academic staff from the School of Engineering and Computing Sciences, and the Department of Mathematics. The focus of the Centre is on studying techniques concerned with the efficient use of the spectrum for future radio networks in various frequency bands ranging from HF to mm waves. It brings together mathematical modelling, radio network expertise, cryptography and coding, radio frequency circuit, antenna design and radio systems for estimating the radio channel effects on radio communication and radar systems.

Research themes within the centre extend to all areas of wireless systems, which have penetrated most aspects of our daily life, ranging from communication systems, to energy efficient buildings, on body networks, radio imaging for medical and security applications, radar systems for monitoring the environment, and digital signal processing systems, which are areas of interest to the spectrum regulators, government agencies and industry.

Work in the area of communications has allowed the development of two unique systems (channel sounders) for mobile radio propagation studies. The systems have the ability to perform measurements at multiple frequencies (2-6 GHz and 60 GHz) with single or multiple transmit and multiple receive channels (MIMO). The architecture of the sounder permits the monitoring of the spectrum to study its occupancy. Results of propagation measurements performed for Third Generation Mobile Radio Systems have been incorporated in three documents of the International Telecommunications Union. The sounders are listed in the COST 273 book on Mobile Broadband Multimedia Networks. The Communications team recently purchased an 80m^3 radio frequency anechoic EMC chamber and signed a research agreement with Sinon for the use of a mobile radio vehicle for propagation studies

Research within the Centre for Communication Systems involves:

- **Radio channel measurements** in the HF to mm frequency bands. To support this research a number of wideband channel sounders using state of the art digital and RF circuits have been designed and implemented.
- **Wideband channel models** which relates the channel measurements obtained with the sounder to the environment, taking into account aspects such as frequency, bandwidth, location, antenna height, angle of arrival, angle of departure, and time variations of the channel.
- **Mobile radio channel measurements** have been performed with various bandwidths up to 300 MHz in the UHF band with different architectures including multiple antenna measurements and simultaneous multiple frequency band measurements such as the Frequency Division Duplex (FDD) measurements for 3G mobile radio systems, and in the higher frequency bands at 2.45 GHz, 3.5 GHz, 5.2 GHz and 5.8 GHz bands. The multiple receive architecture of the sounder enables active measurements to be obtained in both indoor and outdoor environments which include simultaneous multiple frequency measurements for single input single

output (SISO), single input multiple output (SIMO) and multiple input multiple output (MIMO) applications.

- The Centre has also developed a **simulator for Metropolitan area networks** IEEE 802.16-d standard which uses the sounder's channel measurements. Passive measurements to monitor the usage of the spectrum have been modeled for more efficient use of the white space in the spectrum.
- Investigating **relay networks spectrum occupancy with distributed sensing**. The 60 GHz converters enable the characterization of the mm band with bandwidths from 1-6 GHz for high speed networks and for on body networks.

The overall goal conducted in the centre has been to develop a better understanding of mobile radio propagation and to produce channel information which could help with the design and evaluation of reliable and spectrally efficient radio communication systems. Applications for car to car communications, in building monitoring of the usage of energy, radio imaging for through the wall detection and ground penetrating radar are the subject of current research.

Other Research Interests include:

- Radio propagation studies for long range communications via slywave
- Wireless communications for mobile radio applications
- Communications Networks: network simulation, routing algorithms, intelligent network control.
- Short range low rate PAN wireless networks, sensor networks, optimisation for low power consumption.
- Intelligent control of an ant based routing algorithm for communication networks.

The Centre for Communications Systems has launched a taught MSc course in Communications Engineering, and also offers MSc and PhD by Research opportunities. The Taught MSc covers Radio and Digital Communications, Communication Networks, Digital Signal Processing and RF Circuit Design.

Appendix 3: Areas of Economic Activity: Summary Sheets

3.1 Passenger Vehicle Manufacturing

Market	Current Market Opportunities:	Home to the largest UK car manufacturer, Nissan, with substantial export market and chosen location for Hitachi to produce train carriages for UK contract. Opportunities for supply chain in regional, national and export markets. Automotive sector alone worth £11.2bn in GVA to UK economy.
	Future Potential:	Manufacture of low carbon or low emissions vehicles. By 2040 almost none of Europe's new cars will be powered solely by a traditional petrol or diesel engine. The UK government's industrial strategy for the automotive sector –Driving Success – has committed the Government and industry to invest around £1 billion over 10 years in a new Advanced Propulsion Centre (location to be confirmed) to develop, commercialise and manufacture advanced propulsion technologies in the UK. This investment is expected to secure at least 30,000 jobs currently linked to producing engines and could create additional jobs in new supply chains
	Relevance to EU Horizon 2020 societal challenges[26]:	Strong links with Horizon 2020 most notably in terms of this sector's contribution to green integrated transport systems.
	Opportunities for diversification:	Low carbon/low emission vehicles. New markets for supply chain
Core Companies	Name:	**Automotive** - Nissan, Unipres, Calsonic Kansei, Johnson Controls, Lear Corporation, Faltec Europe, GT Group, NSK Bearings, Gestamp Tallent, TRW Systems, Vantec Europe, Explorer Group (motor homes), **LCV-** Nissan, Sevcon, Avid, Smiths Electric Vehicles, Hyperdrive, Proton Power Systems. **Train** – Hitachi, Siemens (components only) **Commercia**l – Komatsu, Caterpillar

[26] Health demographic change and well-being; Food security, sustainable agriculture and the bio-based economy; Secure, clean and efficient energy; Smart, green and integrated transport; Climate action, resource efficiency and raw materials; Inclusive, innovative and secure societies.

	Ownership: Type of Activity: Location: Employment:	Mainly FDI although indigenous SMEs in supply chain and in LCV sector. Manufacture Largely around Sunderland Nissan Plant with EZ around Nissan Plant, but organisations across NELEP area and into TVU. Merchant Park, Newton Aycliffe is the 140 acre site for Hitachi's plant and immediate supply chain. North East is the UK's first designated Low Carbon Economic Area and is therefore pioneering the adoption of electric vehicles and low carbon vehicle technologies. 2013 UK government figures estimate there are 129,000 people directly employed in the UK automotive sector. ETech (2010) estimated 13,700 in the North East.
Nature of Innovation		Much R&D in the OEMs is outside the region. Strength in EV demonstrator projects in the NE. Some innovative SMEs in supply chain and innovation in LCV technology.
Export Performance		PVM is a significant cluster with exporting power, specialisations, supply chain links with national and international reach as well as embeddedness (or stickiness) in the NE
Skills Profile/Needs		Highly flexible workforce – Nissan seen as exemplar of output per worker. Increasingly high levels of STEM skills sought across the sector (and many others). The Department for Business announced in July 2013 that the Automotive Council, co-chaired by Business Secretary Vince Cable and Professor Richard Parry-Jones, is aiming to recruit more than 7,600 apprentices and 1,700 graduates over the next five years. Gateshead College is a key training provider for Nissan and several of its key suppliers, and has established *The Skills Academy for Sustainable Manufacturing and Innovation (SASMI)* at the Nissan plant. The College also has a number of dedicated training facilities in the region, including its *Skills Academy for Automotive, Engineering, Manufacturing and* Logistics and its *AutoSkills Centre*.
Related Regional Value Chain		Established supply chain that encompasses manufacture, assembly and distribution strengths.

Regional Business Services (e.g. legal, financial)	No weaknesses in professional and business services have emerged from desk research.
Business Networks/Specialised Business Support	Where a company includes high end R&D then their links will often be fragmented, national and involving multi-national manufacturing supply and value chains. To date no weaknesses in support agencies have been highlighted by the sector.
Physical Infrastructure (incl. science parks, ports, broadband)	Designated as first Low Carbon Economic Area. Availability of sites with Enterprise Zone status. The PVM supply chain serves a number of OEMs located outside of the region, highlighting that the area's locational advantages more than outweigh its relative distance from traditional automotive locations. Another key strength is found in access to markets: road rail and sea access allows efficient domestic and global supply of materials and distribution. The region's transport infrastructure has been specifically developed in order to meet the needs of PVM companies which require a high degree of assurance that suppliers will be able to deliver synchronously manufactured components to the production line at precisely the right time.
Enabling environment for innovation e.g. universities, catapult centres (regional and UK)	*Zero Carbon Futures*, is a new body with significant financial backing from the UK Government to take forward R&D in ultra-low carbon vehicle technology. Through this organisation, which is a wholly owned subsidiary of Gateshead College, the *Sustainable Manufacturing and Renewable Technology (SMART) Park* has been created including R&D facilities as well as an open-access test track. Durham University's Centre for Automotive Research brings together relevant expertise from the departments of Engineering, Mathematics and Physics to support the motor industry worldwide. Research themes include aerodynamics, hybrid-electric vehicles, statistical mathematics, stress, vibration and acoustic analysis. Sunderland University's AMAP has a Centre of excellence in LCV Technology.

	CPI – fuel cell/hydrogen expertise. With funding from EPSRC and NELEP a 'Driving Innovation' event was held to link the automotive sector with expertise at Newcastle, Durham, Northumbria and Sunderland universities was held in October 2013. The initial mapping identified expertise in Newcastle University and Durham University in: • Energy Recovery • Engine Development • Precision/micro-manufacturing • Autonomous Driving • Advanced Materials • Structural Mechanics • Coatings Metrology • Smart Electronics • Lighting/HUDs • Electrical Power Trains • Sensors • Eco Driving • Vehicle Communication UK – July 2013 £1bn committed to a new Advanced Propulsion Centre. TSB administering up to £75mn call announced in November 2013. The Automotive Council and Engineering and Physical Sciences Research Council (EPSRC) will set up an advisory group to help align research funding with industry challenges where relevant. This will ensure the UK remains at the forefront of R&D work. In addition, the industry will set out its view of the key technologies for the UK, how it can access more EU R&D funding and look at identifying future technologies such as intelligent networking of cars. NewRail is the Centre for Railway Research at Newcastle University. Working at both national and international levels it has established strong research and consultancy links with railway operators and manufacturers in the UK, throughout Europe and internationally. NewRail is the preferred university research supplier to Bombardier Transportation particularly with regard to materials and structures. NewRail is also one of the Alstom Transport top 10 rail engineering universities in the world. In addition, NewRail is the preferred university consultancy

	supplier to Siemens Maintenance (UK) and the only university on the UITP (International Association of Public Transport) advisory board. NewRail is a member of the European Rail Research Advisory Board (ERRAC) and a member of the International Rail Research Board (IRRB). In the past five years alone, NewRail has been involved in rail projects that have a total project value in excess of 100 million Euros and these have involved over 200 different international partners.
Use of emerging technologies (8 Great Technologies[27])	Advanced Materials, Energy Storage.
Horizon 2020 Key Sector Representation[28]	Advanced materials and advanced manufacturing
Previous public investment: ERDF ONE RGF	Significant investment from public sector bodies for FDI and elsewhere re LCV e.g. ONE invested in 700 electric vehicle charging points across the region. TSB funded North East's Electric Vehicle Demonstration project (SWITCH-EV).
Witty Review	Automotive – Quotient value 2-3 (Employment location quotient)
National and International Exemplars in this Area of Economic Activity	Baden-Wurttemberg

[27] The Big Data Revolution and Energy-Efficient Computing; Satellites and Commercial Applications of Space; Robotics and Autonomous Systems; Life Sciences, Genomics and Synthetic Biology; Regenerative Medicine; Agri-Science; Advanced Materials and Nano-Technology; Energy and its Storage

[28] ICT, nanotechnologies, advanced materials, biotechnology, advanced manufacturing and processing, and space

3.2 Subsea and Offshore Technology

Market	Current Market Opportunities:	Oil and Gas, Offshore Renewables, Telecoms, Defence (dominated by Oil and Gas at present)
	Future Potential:	Subsea sector globally set to quadruple by 2020 to £85bn (Subsea UK 2013) Total global (onshore and offshore) oil and gas exploration and production sector capex expected to grow from $716.3 billion in 2012 to $850.5 billion in 2013 (GlobalData Inc) Offshore wind capex forecast to be €15 billion per annum (Douglas Westwood) Wave and tidal renewables set to employ 20,000 people by 2035 (UK Renewables 2013).
	Relevance to EU Horizon 2020 societal challenges[29]:	Secure, clean and efficient energy; Climate action, resource efficiency and raw materials
	Opportunities for diversification:	Offshore renewables, decommissioning, new oil and gas markets
Core Companies	Numbers in region vs. UK	50 companies in the wider region involved in subsea , 15,000 employees, £1.5bn turnover. UK - in excess of 750 companies, 66,000 employees and £9bn turnover
	Key firms:	A&P, Barrier Group, BEL Valves, Bridon, DUCO, Flexlife, Fabricom Offshore Services, GE Oil and Gas (Wellstream); IHC Engineering Business, OGN Group, OSBIT Power, PDL Solutions, Penspen Integrity, Shepherd Offshore Services, SMD, Technip Offshore Wind, Tekmar Energy
	Ownership:	Mixed – privately owned/foreign subsidiaries
	Type of Activity:	Advanced manufacturing, design engineering, KIBS
	Location:	Across the NELEP area and beyond

[29] Health demographic change and well-being; Food security, sustainable agriculture and the bio-based economy; Secure, clean and efficient energy; Smart, green and integrated transport; Climate action, resource efficiency and raw materials; Inclusive, innovative and secure societies.

Nature of Innovation	Problem solving driven by client needs and ability to provide quality solutions
Export Performance	Very high
Skills Profile/Needs	High – need experienced qualified engineers (mechanical, electrical, chemical) and technicians Relevant skills provision from regional universities and colleges including • Newcastle College's Energy Academy • Newcastle University: wide range of engineering degrees including Offshore Engineering BEng; Marine Engineering BEng and MSc; Marine and offshore power systems MSc; Renewable energy enterprise and management Msc; Renewable energy flexible training programme Msc; Pipeline Engineering MSc and Subsea Engineering and Management MSc (both delivered and designed with regional industry); • Northumbria University: wide range of engineering degrees including Electrical Power Engineering Msc and Wind energy and power systems PhD; • Teesside University: Electrical and Electronic Engineering BEng; Renewable Energy Engineering BEng; Mechanical Engineering Msc • Durham University; wide range of engineering degrees and New and Renewable Energy MSc and PhD
Related Regional Value Chain	Strong
Regional Business Services (e.g. legal, financial)	Strong
Business Networks/Specialised Business Support	**NOF Energy** – highly proactive business development organisation working on behalf of companies in the oil, gas, nuclear and offshore renewable sector; Subsea UK - Subsea UK is the champion for the UK subsea industry acting for the entire supply chain bringing together operators, contractors, suppliers and people in the industry. Subsea NE – regional advocacy body for the subsea sector in the region **Energi Coast** - is the representative group for the North East of England's offshore renewables sector, promoting the extensive

	offshore renewable energy sector expertise from the region; Society of Underwater Technologies NAREC's Renewables Innovation Network (offering training; bid/grant writing support; support to access finance and innovation vouchers; audit of SMEs potential to serve the offshore renewable market)
Physical Infrastructure (incl. science parks, ports, broadband)	Ports and Load Out Quays Enterprise Zones and Centres for Offshore Renewable Energy Technology Parks Business Parks
Enabling environment for innovation e.g. universities, catapult centres (regional and UK)	**Newcastle University** has won £7m in funding to develop the Neptune National Centre for Subsea and Offshore Engineering on the back of its strengths in: • High pressure materials • Extreme environment electronics • Underwater communications • Pipeline engineering **Durham University** has strengths in: The Energy Research Group within the School of Engineering and Computing Sciences who are active in research associated with the commercial development of offshore wind power. The group is also part of the EPSRC Supergen Wind project, collaborating with nine other universities and research institutes. Durham University Department of Chemistry is involved in the development of specialist coatings for application to marine vessels and offshore wind turbines. **NAREC** - part of the Offshore Catapult (based in Glasgow), largely an asset-based testing centre (for blades, turbines etc) at industrial scale. It has developed a Renewable Energy Technology Accelerator programme to collaborate with industry; encouraging and supporting companies in North East England to develop new products across the supply chain for the offshore renewable energy market. Funding 3 innovation projects: 1. Smart Cable Development for Improved Lifecycle costing of offshore power networks (with Tecnalia, PDL, JDR)

	2. Tidal Energy Converter Nacelle Intervention System 3. Inter-array cable trencher (with IHC Engineering Business) ITF (Industry Technology Facilitator) Policy drivers - EU's Renewables Directive adopted in April 2009 - the UK government has pledged to ensure that by 2020 the country will source 15% of its energy from renewable sources
Use of emerging technologies (8 Great Technologies[30])	Robotics and Autonomous Systems, Advanced Materials and Energy Storage
Horizon 2020 Key Sector Representation [31]	Advanced materials Advanced manufacturing and processing
Previous public investment: ERDF ONE RGF	Substantial including: ERDF: North Bank of the Tyne; RETA (Renewable Energy Technology Centre Limited (RETA); Former Swan Hunter Low Carbon Enterprise Zone; NAREC Blade Test Facility, incubation facility and Marine Test Facility; Renewable Energy Manufacturing Technology/TWI Technology Centre ONE: Approximately £50m invested in energy and environment pillar including Single Programme investments in NaREC, Durham/Newcastle University, Renew Tees Valley, North East Energy, NOF Energy etc SIF – NaREC secured approximately £30m in SIF expenditure from BIS to finance 100m blade turbine test facility and 15MW 'project fujin' drive train rig RGF: Investments in offshore energy companies and wider enabling organisations include: • PD Teessport x2 • Offshore Group Newcastle • Wellstream • Shepherd Offshore

[30] The Big Data Revolution and Energy-Efficient Computing; Satellites and Commercial Applications of Space; Robotics and Autonomous Systems; Life Sciences, Genomics and Synthetic Biology; Regenerative Medicine; Agri-Science; Advanced Materials and Nano-Technology; Energy and its Storage

[31] ICT, nanotechnologies, advanced materials, biotechnology, advanced manufacturing and processing, and space

	• Newcastle CC (site enabling works) • NaREC • International Pipeline Products • Heerema • Dyer Engineering • A&P Tyne • Able UK • Red Marine • Monitor Coatings • AV Dawson • Alnmaritec • Bridon International • JDR Cables
Witty Review	Not recognised in oil & gas location quotient (SIC code definitions not applicable for NE LEP area). Significant offshore wind assets e.g NaREC
National and International Exemplars in this Area of Economic Activity	Aberdeen, Norway

3.3 Life Sciences and Healthcare

Market	Current Market Opportunities: Future Potential: Relevance to EU Horizon 2020 societal challenges[32]:	Public healthcare (NHS, CCGs), private consumer healthcare, export opportunities to new and emerging markets Market is expected to remain flat between 2014-2015 with growth to pick up in 2016 onwards (Deloitte 2013) Health, demographic change and well-being
Core Companies	Numbers in region vs. UK	**Medical Technology** - According to BIS (2012), the North East has approximately 80 medical technology companies compared with 3,129 in the UK. 59% are micro-businesses. National figures highlight a decline in overall number of medical tech companies **Biotechnology** - The North East has 45 biotechnology companies e.g. small molecule, antibodies and therapeutic protein firms compared to 979 companies in the UK. 98% of biotechnology companies are SMEs **Pharma** – The UK has 148 pharma manufacturing sites. The sub-sector is highly concentrated with 24 companies employing 80% of workforce. In total, there are 387 companies in the UK pharma sector employing approximately 70,000 people. There are 13 sites of pharma manufacturing in the NE (focussed mainly on specialist and small molecule activity). In total, 2,600 employees are employed in the 13 sites with the South East (8,700), North West (5,200) and East of England 3,700) above the NE. Key multinationals: Piramal Healthcare; Fujifilm Diosynth; MSD; GSK; Aesica; Shasun Pharma; Thermo Fisher Scientific

[32] Health demographic change and well-being; Food security, sustainable agriculture and the bio-based economy; Secure, clean and efficient energy; Smart, green and integrated transport; Climate action, resource efficiency and raw materials; Inclusive, innovative and secure societies.

	Ownership: Type of Activity:	• **GlaxoSmithKline**, the world's second largest pharmaceutical maker, which employs over 1,100 staff at its 60-acre Barnard Castle site in County Durham • **Covance,** one of the top 10 clinical research organisation firms in the world employing over 150 people at its operation in Alnwick, Northumberland • **MSD,** in Cramlington, Northumberland, is one of the most advanced pharmaceutical manufacturing and packaging facilities in the world • **Aesica,** a leading supplier of active pharmaceutical ingredients, formulations and custom synthesis solutions • **Piramal Healthcare,** providing clinical trial, formulations and packaging of active pharmaceutical ingredients in Morpeth, Northumberland With the exception of Aesica Pharma which is headquartered in Newcastle, all of the big pharma based in the region are foreign-owned branch plant operations. The remainder of the region's industrial base is comprised of a mixture of indigenous and foreign-owned companies. The North East's main concentration of firm activity is in custom synthesis and supply and pharma formulation and manufacture. The North East possesses very few dedicated biotechnology, medical device or diagnostics companies and therefore the regions value chain is concentrated predominantly in the latter stages of the innovation/supply chain. All of the big pharma and healthcare companies in the North East are formulation, manufacturing and packaging facilities with no R&D capabilities. Medical technology: 1,800 employees (71,000 employees in UK)

		Biotechnology: unknown (26,000 employees) Industrial biotechnology: unknown (1,600) Pharma: 2,600 employees (70,000) Nationally, biotechnology (drug discovery and development) has particular clusters around academic centres of golden triangle, Manchester and Edinburgh/Glasgow
	Employment:	Medical technology (devices and diagnostics) is geographically dispersed but strong in the Midlands (both West and East). In particular, Yorkshire is strong in orthopaedic devices, IVD (SE and East of England) and wound care (Midlands and Yorkshire
	Location:	Manufacturing of pharma products is widely dispersed but there is a cluster of speciality pharma manufacturing in the South and East of England, North West, Scotland and in the North East. 55% of biotechnology companies are located in and around Tyne & Wear (Newcastle is the main centre). The region's pharma industry is geographically concentrated in Northumbeland (Piramal, Covance, MSD, Shasun) with pockets of industry located in Teesside (Fujifilm), Newcastle (Aesica) and Barnard Castle (GSK). A number of custom synthesis and supply firms are also located in Teesside with many of them ex-ICI assets and personnel.
Nature of Innovation		Weak amongst pharma industry but strong within biotech and med tech sector
Export Performance		Very high in pharmaceutical industry
Skills Profile/Needs		High – need contract manufacturers (molecular biology, biomedical science), diagnostic and analytical posts, chemists, microbiologists and biochemists In 2010/11, approximately 13,695 students undertook medical & healthcare related courses at Newcastle University (5,075) and Northumbria University (8,620)

	The North East' principle labour/skills gaps are recruiting for experienced life science business people/CEOs, bioprocessing, process control technicians, sales managers
Related Regional Value Chain	The NE has very few companies operating in the early innovation/discovery chain of the life sciences sector. The region has a handful of drug discovery companies e.g Shield Therapeutics, Demuris, E-Therapeutics, Molplex and medical device and diagnostics companies e.g OJ-Bio, QuantumDX, Waters Corporation, Peacocks etc. The North East's principle strengths in the value/innovation chain is via support to the formulation and manufacturing industry through a number of custom synthesis and supply companies e.g HFR, Parker Hannifin, Cambridge Research Biochemicals, Lyrachem, NZomincs etc and in companies providing specialist business support to the sector e.g CPI, Covance, Datatrial, Thermo Fisher Scientific etc
Business Networks/Specialised Business Support	Bionow NEPIC First for Pharma
Physical Infrastructure (incl. science parks, ports, broadband)	Newcastle Bio-incubator Campus for Ageing & Vitality North East Business and Innovation Centre (NE BIC) NetPark
Enabling environment for innovation e.g. universities, catapult centres (regional and UK)	**Newcastle University,** www.ncl.ac.uk **Newcastle Biomedicine** (www.ncl.ac.uk/biomedicine) is the academic-NHS Partnership that joins Newcastle University with the Newcastle upon Tyne Hospitals NHS Foundation Trust and embraces other academic institutions and NHS Hospitals across the region. Newcastle is ranked as one of the top British universities for both hospital and laboratory-based clinical subjects. At its core are seven research institutes: - Institute for Ageing and Health, www.ncl.ac.uk/iah

	- Institute of Cellular Medicine, www.ncl.ac.uk/icm - Institute for Cell and Molecular Biosciences, www.ncl.ac.uk/camb - Institute of Health and Society, www.ncl.ac.uk/ihs - Institute of Genetic Medicine, www.ncl.ac.uk/igm - Institute of Neuroscience, www.ncl.ac.uk/ion - Northern Institute for Cancer Research, www.ncl.ac.uk/nicr Newcastle University has the following Medical Sciences Research Centres: - Centre for Bacterial Cell Biology - Centre for Behaviour and Evolution - Centre for Brain Ageing and Vitality - Centre for Haemato-Oncology - Centre for Integrated Systems Biology of Ageing & Nutrition - Human Nutrition Research Centre - Medical Toxicology Centre - Centre for Oral Health Research - Stem Cells and Regenerative Medicine - The Wellcome Trust Centre for Mitochondrial Research The university is host to nationally significant research centres such as NIHR Biomedical Research Centre in Ageing & Chronic Disease and the NIHR Biomedical Research Unit in Dementia. Two national Medical Research Council coordinating centres in neuro-muscular diseases and brain ageing are also hosted in Newcastle. Newcastle Biomedicine centre of excellence in translational medicine with more clinical trials conducted in Newcastle NHS Trust than any other site in the UK (14,000 patients in 2012 – UKCLRN 2012). Pfizer recently announced INSPIRE status at Newcastle NHS Trust. Newcastle University has MOU with Cell Therapy Catapult

	Northumbria University, www.northumbria.ac.uk Research and Innovation at Northumbria University is undertaken across a wide range of subjects both within individual faculties and in specialist research centres and clusters including: - Bio-molecular and Biomedical Research Centre - Brain, Performance and Nutrition Research Centre - Centre for Translational Research in Public Health - Cognition and Communication Research Centre - Community, Health and Education Studies Research Centre - Sport Exercise and Wellbeing - Building Information Modelling (BIM) academy **Sunderland University**, www.sunderland.ac.uk Sunderland has been teaching pharmacy for more than 90 years and it has the 6th best pharmacy school in the UK (Guardian League Table 2013) Health Sciences and Wellbeing research group focusses on following thematic areas: • Pharma and biological sciences • Mental health, healthcare and health behaviours **Durham University** The Biophysical Sciences Institute (BSI) at Durham University is a beacon for new discoveries crossing the research boundaries between biology and the other physical sciences. Its members are drawn from a large proportion of University Schools including the Biological and Biomedical, Chemistry, Engineering and Computing Sciences, Mathematical Sciences, Physics and Psychology, all of which have been assessed as conducting research of international quality in the 2008 Research Assessment Exercise (RAE.). Recognised as internationally excellent or world leading, the BSI and Durham University were

	recently presented 'as a global leader in multidisciplinary research' in the US Congress by Jeff Weedman (Procter & Gamble Global Business Development Vice President). The Wolfson Research Institute at Durham University is based in a purpose-built building on the University's Queen's Campus. The Institute conducts research on human health and well-being and also brings together researchers from across almost all of Durham University's academic departments, along with their national and international networks. The institute seeks to improve health and the quality of people's lives by informing policy and practice and has a particular commitment to the health and well-being of people living in the North East of England. There are strong relationships with the National Health Service and local government, and a flourishing programme of collaborative research. Through collaborative and multidisciplinary research the BSI and Wolfson Research Institute work together to solve major biological challenges by developing new scientific methods and technologies. **Teesside University** The Health and Social Care Institute aims to create an environment that promotes, supports and develops high quality research on health and social care topics. **FUSE** One of five UKCRC Public Health Research Centres of Excellence **Academic Health Science Network**North East and North Cumbria has secured £4.2m over three years to establish a AHSN
Use of emerging technologies (8 Great Technologies[33])	Synthetic biology

[33] The Big Data Revolution and Energy-Efficient Computing; Satellites and Commercial Applications of Space; Robotics and Autonomous Systems; Life Sciences, Genomics and Synthetic Biology; Regenerative Medicine; Agri-Science; Advanced Materials and Nano-Technology; Energy and its Storage

Horizon 2020 Key Sector Representation [34]	Biotechnology, and advanced manufacturing and processing
Previous public investment: ERDF ONE RGF	**ERDF:** Since 2007, ERDF money to support life sciences and healthcare projects has been spent on the following institutions: Northumbria University Healthcare Technology Development Programme (£0.69m), University of Sunderland's Health Science Complex (£0.98m), Newcastle University's Translational Research Building (£2.55m). The figures do not take into account ERDF monies invested in business support activity e.g. NEPIC, NSC etc. **ONE:** Approximately £30m of Single Programme expenditure was spent on life sciences and healthcare pillar over the duration of ONEs strategy for success programme. Expenditure included investment in CELS, ICFL, CPI, NEPIC, Newcastle University (BBTC) and Durham University. **RGF**: 5 companies awarded RGF grants (Shasun, Aesica, Piramal; SCM Pharma and Molplex). NEPIC also secured RGF investment but not directly applicable to life sciences.
Witty Review	Quotient value 1-2 on employment location quotient (2012)
National and International Exemplars in this Area of Economic Activity	Cambridge, Oxford, London, North West and Scotland. Boston, New Jersey/New York, Bay Area and Los Angeles. In EMEA, France (Paris region), Germany (Munich, Berlin) and Switzerland (Basel, Zurich and Geneva).

[34] ICT, nanotechnologies, advanced materials, biotechnology, advanced manufacturing and processing, and space

3.4 Creative, Digital, Software (CDS) and Technology Based Services (TBS)

Market	Current Market Opportunities:	Enormous market and commercial opportunities especially in digital and software.
	Future Potential:	Future potential within the region for CDS companies comes from making connections with companies in other key AEAs, e.g. PVM, Subsea, low carbon, health and life sciences. TBS also has future potential with possibilities for re-shoring higher value delivery centre activities, while recognising extreme cost pressure will lead lower value activities to continue to be relocated to India (per nPower's recent announcement).
	Relevance to EU Horizon 2020 societal challenges[35]:	Digital technology can be a significant enabler in meeting many societal challenges
	Opportunities for diversification:	Opportunities for diversification are great and thought must go into how companies can better understand their value propositions (believed to be the area where the biggest difference can be made). The Government's digital by default agenda is significant in this respect.
Core Companies	Numbers in region vs. UK	1,800 (1.7% of all creative enterprises the lowest of any region, e.g. London 35.5%) Number of Creative Enterprises by Region (ONS 2011 Experimental statistics). The region has a high number of games companies – the largest community of games developers outside of London.
	Name:	Many including: 4th Aspect, Fifth Generation Technologies Ltd (brand name 5G), Accenture, Arjuna Technologies Ltd, Aspire Technology Solutions, Atomhawk, AYO digital, BT, ContactBabel, Convergys, Datawright Computer Services, Design 365, Digital Spark, Dontyne, EUTECHNyx, Firebrand, Global Management Platform, Gospelware, Hedgehop Lab, Hewlett Packard, Leighton, Made, Mediaworks, Mobeus Jewellers, Opencast, Pinster, Realrider, Red Maple, Sage Group Plc, ScreachTV, Sky, Spark Resonse, Tesco Bank, TryLife, TSG, TH:Nk, Ubisoft,

[35] Health demographic change and well-being; Food security, sustainable agriculture and the bio-based economy; Secure, clean and efficient energy; Smart, green and integrated transport; Climate action, resource efficiency and raw materials; Inclusive, innovative and secure societies.

		Unique Magazines, Vianet, Virgin Money, Waymark IT, Wipe Out Music, Yougossip.
	Ownership:	Healthy mixture of multinationals, FDI, indigenous large businesses, SMEs, micro-businesses and freelancers.
	Type of Activity:	Technology solutions, business services, software, games, media, telecommunications, design
	Location:	Across NELEP area. Particular concentrations in Sunderland, especially Sunderland Software City; Newcastle including the horseshoe from Ouseburn to toffee factory to Northern Design Centre; business parks including Quorum, Cobalt, Doxford Park
	Employment:	Dynamo estimate 26,000 working in the broader NE in the digital and IT sector.
Nature of Innovation		Diverse and fragmented – driven by digital technologies and an insatiable global demand. CDS is a naturally innovative area of the economy and the high skilled young workforce would suggest high levels of absorptive capacity. For TBS Innovation potential greatest in training, skills development and re-engineering business processes.
Export Performance		Good but could be much better in CDS – potential is fantastic for higher sales to rest of UK as well as international. Reach of TBS is often global, but this connectedness means individuals with high level skills and firms are highly mobile.
Skills Profile/Needs		In the main, CDS is populated with young highly skilled creatives – skills needs are technological, particularly software engineers and business skills. Contact Centres have played a major part in helping to rebalance the region's economy. The North East workforce has an enviable reputation for low staff turnover and low rates of absenteeism. The region has a strength in that the workforce is attractive to inward investors. More and highly developed ICT and communication skills can only help to secure further investment. Skills for delivery/service centres should not be viewed in a narrow sense as these are often

	highly skilled and technical roles. To date strong links between education, support agencies and contact centres have ensured that skills flow has been maintained, however, competition for level 3+ STEM skills (particularly ICTS skills) and communication skills is high and individuals with these skills tend to be young and highly mobile.
Related Regional Value Chain	Diverse and fragmented
Business Networks/Specialised Business Support	On paper intermediaries and support agencies look strong and are well respected but workshop participants wanted more specialist skills in the eco-system. Networks and reach are good. One of the strengths of the region for this sector is its smallness which means that it is easy for exciting informal cross disciplinary groups and networks to form.
Physical and Virtual Infrastructure (incl. science parks, ports, broadband)	Of no real interest to the smaller CDS firms – they tend to be micro small businesses that prefer to colonise cheap under used buildings in city centres. Pilgrim Street initiative mentioned frequently as being a valuable springboard for businesses. It is worth remembering that CDS companies have a reputation for regenerating run down areas – both socially and economically. However business parks, high spec communications and connections significant for TBS. Capacity in the region is good although thought should go into TTW patterns and how this might impact on the firms' productivity. Gateshead Technology Innovation Ltd (G-ti), is delivering a high capacity, high speed, open access network to all organisations located in the new Baltic Business Quarter and central Gateshead area. The state-of-the art optical network is supporting new and emerging telecoms services such as video conferencing, video on demand, streaming media, data storage and protection, disaster recovery and image processing. The area has built-in resilience of a standard only available in very few locations in the UK. Newcastle upon Tyne has been selected as a UK super-connected city and has been provisionally awarded investment of up to £6m in the existing infrastructure, including wireless connectivity to achieve ultrafast broadband by 2015. Strategic sites will see broadband speeds of up to 300Mbps.

	Sunderland City Council has signed a deal with IBM to build a new city wide cloud infrastructure, one of the first of its kind in Europe, which will create significant benefits for business. The iNorthumberland Digital Economy Programme will create access to an improved broadband network infrastructure for over 2,600 businesses in the region. ERDF have invested £2.74m in the programme which is led by Northumberland County Council who will provide match funding. The Digital Economy Centre for Excellence is also set for development, a specialised online resource it aims to attract 2,119 small and medium enterprise users by 2015. The centre is designed to ensure businesses get the support they need using a wealth of resources that can be streamed live, interactive or downloaded. 293 jobs will to be created with the new resource which will also increase the number of businesses with broadband connection from 79.8% to 95% by 2015.
Enabling environment for innovation e.g. universities, catapult centres (regional and UK)	• From Northumbria University approximately 100 students graduate each year in Animation and Special Effects. Leading research takes place at all the region's universities including Teesside and examples of specialisms include eScience and the Grid, Informatics, Digital Technology and Media, Software Evolution, eBusiness and Virtual Reality. • Newcastle University's School of Computing Science's research themes include: Asynchronous Systems; Cloud Computing; Complex Systems: e-science; Games Technologies; Security: Bioinformatics: Mobile Computing and Pedagogy. Expertise at the Digital Institute at Newcastle University has attracted more than £50million in research grants. Their main themes of activity are: Digital Science; Digital Engineering; Digital Culture and Digital Inclusion. Culture Lab at Newcastle supports the work of researchers and students involved in high level, experimental and multi-disciplinary

	creative arts, while the Game Lab carries out research related to video game technology. • Durham University's Institute of Advanced Research Computing is the catalyst for the interdisciplinary cross-fertilization of methods and techniques, prompting the development and application of new techniques in computer science across the sciences, social science and the arts and humanities. Durham's HPC facilities are amongst the best in the UK and in the "Top 500" in the world. High Performance Computing combined with cutting edge data analytics, computer-based modelling and simulation and computational methods are at the core of iARC 's approach. Research themes include Big Data, Big Processing, Intelligent Imaging, Cybersecurity, Future Cities, Computational Humanities and Social Computing. • Working links have been forged between Sunderland Software City in the north of the region and Digital City at Teesside University. • The University of Sunderland has the UK's largest ICT training facility and supplies more computer graduates to Microsoft UK than any other British University. • The Digital Knowledge Exchange (DKE) is a collaborative partnership between Teesside and Sunderland Universities focussing on electronic games and animation support Programmes. • Knowledge Transfer Partnerships in software are strong (Sunderland University KTP programme features in TSB publicity material). • Sunderland Software City has established a valuable partnership that included two catapults.
Use of emerging technologies (8 Great Technologies[36])	Lots of digital and software activity around developing technologies for the Health sector. Opportunities for

[36] The Big Data Revolution and Energy-Efficient Computing; Satellites and Commercial Applications of Space; Robotics and Autonomous Systems; Life Sciences, Genomics and Synthetic Biology;

	big data – especially linked to clinical trials (a strength for the NELEP area)
Horizon 2020 Key Sector Representation[37]	ICT
Previous public investment: ERDF ONE RGF	ERDF investment has been strong as has investment from ONE. Investment packages put together, e.g. iNorthumberland Digital Economy Programme, Sunderland Software City, lots of media evidence of investment.
Witty Review	CDS Not highlighted in Witty Information Economy heat map NE LEP not recognised in the professional and business services heat map.
National and International Exemplars in this Area of Economic Activity	East London Tech City, Media City etc. For TBS multiple sites in the U.S., Scotland, Bangalore etc

Regenerative Medicine; Agri-Science; Advanced Materials and Nano-Technology; Energy and its Storage

[37] ICT, nanotechnologies, advanced materials, biotechnology, advanced manufacturing and processing, and space

APPENDIX 4: AEA SWOTS

4.1 Passenger Vehicle Manufacture

The North East is gaining in its reputation as an area of passenger vehicle manufacture. Over the last 25 years an automotive manufacturing cluster has established around Nissan, the UK's largest and most productive car plant. Nissan have taken a lead role in the development and production of low carbon vehicles described as a 'global megatrend' and presenting significant opportunities for the region. The announcement that Hitachi has chosen the NE for the manufacture of train carriages has further strengthened the region's reputation for high end passenger vehicle manufacture.

Strengths

- Significant exporting power with further potential identified for low carbon vehicles
- 'The North East with its hydrogen production in Teesside is one of the few places in the UK where a hydrogen/FC vehicle demonstrator would make sense' (E4Tech 2013)
- Zero Carbon Futures, a new body that boasts financial backing from the UK Government is taking forward R&D in ultra-low carbon vehicle technology
- Specialisations and supply chain links with national and international companies and markets (the NE also hosts Smith Electric Vehicles, the largest manufacturer of electric commercial vehicles and Avid Group who produce a range of low emission products, including electric all-terrain vehicles
- The European Centre of Excellence for battery manufacture
- The shift towards "high value' or 'advanced' manufacturing such as that found in PVM, has occurred as a result of competitive regional advantages found in design, technology, skills, innovation, creativity and excellent rail and sea links (IER)
- The region offers a wide range of locations for investment projects linked to automotive engineering, including sites and premises in close proximity to major OEMs
- Strong links to resource efficiency and sustainability especially with regard to low carbon vehicles. The Sustainable Manufacturing and Renewable Technology (SMART) Park puts the region at the forefront of technological innovation in the field of low carbon vehicle manufacture and demonstration
- The sector is supported by strong business networks, innovative hubs, modern business premises and a dedicated supporting network of public sector agencies, universities and colleges
- Bespoke courses set up in partnership with companies and between FE and HE are constructed to meet with the evolving and specialist needs of the PVM sub sector.
- The Skills Academy for Sustainable Manufacturing and Innovation (SASMI) is a world class learning facility for low carbon vehicle manufacture, located in Sunderland for Automotive, Engineering, Manufacturing and Logistics

Weaknesses

- E4Tech research amongst others have highlighted that many aspects of R&D take place outside the region

Opportunities

- Demand for mobility remains high in mature economies and is increasing at enormous rates in developing ones
- Jobs and inward investment as Hitachi Rail establishes itself and NISSAN continues to grow output
- Opportunities exist in localising the supply base, reducing transport costs and increasing resilience in the production process
- With a long history of innovation, future technologies to watch are; electronics and ICT, new composite material and new non-fossil fuel forms of propulsion
- Innovative high value engineering creates opportunities for suppliers outside of PVM, e.g. innovators in services and emergent sectors such as digital, media, telecoms and software can also look for opportunities and niches created in the PVM sub sector.

Threats

- Rising energy prices may result in firms relocating to countries where energy prices are more competitive.
- The pace of internationalisation amongst large generalist car producers stimulates competitive pressures from low cost producers. Supply chains are becoming increasingly global with more national and regional specialisation – threats come from emerging economies (BRIC)
- The region may be under-resourced to realise its potential - an Ernst & Young report (June 2013) has shown that foreign investment to the NE is now 24% below 2010 levels
- The success of PVM depends on the dual capacity to innovate and grow global markets requiring strategic thinking around technological developments and where demand will come from in the future
- Strong leadership is needed to maintain competiveness in this AEA – especially in the LCV element of passenger vehicle manufacture. The large scale adoption of LCV would have to be tackled nationally and London's drive towards a zero emission zone will impact disproportionately on technology development." (E4Tech)
- E4Tech report that the NE lacks some critical mass with regard to LCV. A coherent supportive strategy and an approach that is flexible enough to open up niche opportunities to smaller businesses
- Demand for vehicles is accompanied by new pressures such as environmental concerns, urbanisation, and demand for differentiation as well as aforementioned energy prices.

4.2 Subsea and Offshore Technology

Subsea and offshore technology is used to conducted processes and operations beneath the surface of the sea and in the interface between the sea and connected (offshore) activities above. Products and services within in the subsea and offshore technology 'sector' can be broadly broken down into the following five groupings:

- Design and manufacture/fabrication of products and components (e.g. pipelines, umbilicals, cables, valves, manifolds, platforms, jackets) to operate subsea and offshore
- Design and fabrication of vehicles and machinery used subsea (e.g. trenchers, ploughs, remotely operated vehicles)
- Design and fabrication of equipment for vessels used to install products and deploy and recover vehicles/machinery (e.g. J Lay towers, S Lay towers, Launch and Recovery systems)
- Subsea and offshore installation, seabed intervention, inspection, maintenance and repair (IMR), and decommissioning activities
- Engineering Design and Knowledge Intensive Business Services (consultancy services, project management, specialist engineering design services and testing services)

Strengths

- Critical mass of successful companies (across NELEP and TVU areas) specialising in subsea and offshore technologies with mix of ownership (inward investment, privately owned, private equity, foreign owned subsidiaries). Long history of entrepreneurial activity in the sector.
- Multiple applications for the technologies - predominantly used to recover oil and gas reserves. However subsea technology also been widely used in telecommunications for laying and burying cables subsea and there are defence applications.
- Increasingly there are opportunities in offshore wind and more speculatively in other marine renewable energy activities, carbon transportation and storage, and mining and harvesting of seabed minerals.
- The UK subsea and offshore sector is widely acknowledged as a world leader in experience, technology and innovation. Strong export performance with key export markets for UK subsea companies are Europe (especially Norway), Africa (especially West Africa), North America and Asia. Future export growth is anticipated to come primarily from South America, Asia and North America. Some of these are, however, extremely difficult markets within which to operate.
- The subsea and offshore technology sector has a high GVA, noted as a weakness for the NELEP area in the SQW Review of Current Performance for the NELEP Independent Economic Review. This partly reflects the relatively high paid roles in the sector and a strong regional supply chain.
- Collective private sector leadership for the sector through Subsea NE and Energi Coast and support from trade/business development associations (including NOF

Energy, Subsea UK, EEF). This leads to the potential for effective lobbying and collective action on skills.

- The NELEP area boasts significant assets that help to anchor the subsea industry in the region including large brownfield sites, successful business parks and most particularly its ports (Port of Tyne, Port of Sunderland and Port of Blyth) and the load out quays, operated by Shepherd Offshore Services on the Walker Offshore Technology Park and Neptune Energy Park.
- Excellent access to UK Continental Shelf (oil and gas) and offshore wind areas. The area is located close to the largest development zone, Dogger Bank, and centrally located to service the other wind farms making the area ideally placed for manufacturing equipment and providing services.
- In addition the region has well-connected air, rail, and road infrastructure. Newcastle International and Durham Tees Valley airports offer a total of 30 daily scheduled routes to UK (including to Aberdeen) and European airports with connections to all locations via the major hubs. Newcastle is less than three hours by train from London.
- The oil and gas sector, into which most subsea technologies are deployed, is very capital intensive and willing to invest in technology as it is seeking to recover reserves in ever more technologically challenging environments. The sector is also subject to major safety concerns especially following the Deepwater Horizon disaster and given exploration in environmentally sensitive regions. This quality concern provides some barrier to competition from less developed countries.
- Relevant research in the region's universities and a proposal by Newcastle University to build the Neptune Centre for Subsea and Offshore Engineering on the Neptune Energy Park. Existence of other substantial test and research facilities at NaREC.
- Relevant skills provision from regional universities and colleges including:
    - Newcastle College's Energy Academy
    - Newcastle University: wide range of engineering degrees including Offshore Engineering BEng; Marine Engineering BEng and MSc; Marine and offshore power systems MSc; Renewable energy enterprise and management Msc; Renewable energy flexible training programme Msc; Pipeline Engineering MSc and Subsea Engineering and Management MSc (both delivered and designed with regional industry);
    - Northumbria University: wide range of engineering degrees including Electrical Power Engineering Msc and Wind energy and power systems PhD;
    - Teesside University: Electrical and Electronic Engineering BEng; Renewable Energy Engineering BEng; Mechanical Engineering Msc
    - Durham University; wide range of engineering degrees and New and Renewable Energy MSc and PhD

Weaknesses

- The North East England subsea and offshore sector is dwarfed by the sector in Aberdeen and no oil majors are located in the region.
- The oil and gas sector, into which most subsea technologies are deployed, has traditionally been seen as conservative in terms of technological advances. Investment is also highly dependent on the oil price.

- Offshore wind, the other potentially large market for subsea technology, is beset by uncertainty over future government subsidies and the lack of clear investment plans by the major operators. As yet there is no turbine manufacturer in the UK and current prospects are focused on the Humber and in Scotland.

Opportunities

- According to Subsea UK if growth prospects are realised the UK sector could grow to £11.1 billion by 2016. Subsea UK estimates that the global subsea sector is set to quadruple in size to £85bn in 2020.
- There are opportunities for some firms to diversify into offshore renewables. Innovation in offshore wind is absolutely crucial to adapt highly expensive techniques applicable to oil and gas to the needs of the offshore wind industry.
- Recent merger and acquisition activity in the sector is bringing investment into the region and there is potential to attract firms from the over-heating Aberdeen market.

Threats

- Other countries are investing significantly in subsea/oil and gas technology with Brazil's oil and gas R&D fund, managed by ANP, projected to raise almost £6 billion by 2020. Norway's demo 2000 programme has attracted about £7 million per annum and the US DeepStar scheme receives annual funding of £2.4 million. Subsea UK is therefore calling for significant funding for R&D and government led technology development programme.
- Skills shortages are an ongoing issue for the region's subsea employers with experienced engineers, operatives and technicians in short supply and demand from new entrants to the region and from other regions from Aberdeen to Australia fuelling shortages and escalating wages. In Ernst & Young's 2012 UK oilfield services review over 53% of respondents believed sourcing suitably qualified personnel was the main factor limiting growth in their organization — a greater challenge than access to finance.
- There is also an issue around the Scottish independence vote in 2014 given the key relationships between England and Scotland in oil and gas and offshore renewables.

4.3 Life Sciences and Healthcare

Strengths

- The North East has a large pharma industry and supply chain. Many of the world's leading pharma companies, including Merck, Piramal, Aesica and GSK operate manufacturing sites in the region employing directly in excess of 2,500 people. The North East is perhaps known most for its productivity in pharmaceutical contract manufacturing.
- Although an often quoted but unverified figure, the region is considered to produce 33% of the UKs turnover in pharma products.
- Supporting big pharma, the North East has a diverse but small supply chain with a number of companies operating across the R&D, custom synthesis and supply, and specialist support innovation value chain.
- Newcastle is one of the leading biomedical centres in the UK to conduct and support translational medicine. Newcastle Hospitals NHS Foundation Trust undertook the UKs largest number of clinical trials in 2012 recruiting more than 13,800 patients. Along with internationally-recognised Research Institutes and host to 2 of 6 UK Clinical Research Networks in stroke and neurodegenerative diseases, Newcastle Biomedicine operates a number of translational research facilities and innovation assets to support bench to beside products and services. In combination with excellent patient care provided at Newcastle Hospitals, including the Royal Victoria Infirmary, the Freeman Hospital and Dental Hospital, Newcastle Biomedicine operates ten clinical research platforms, including: four clinical trials research facilities (oncology, ageing, dentistry); imaging modalities; bio-banking and a dedicated cellular therapy facility.
- As a result of its research, clinical infrastructure and access to patient cohorts, Newcastle Hospitals has recently been awarded preferred INSPIRE (Investigator Networks, Site Partnerships and Infrastructure for Research Excellence) site status for clinical trials by Pfizer, the only site in the UK to hold such status
- The Campus for Ageing and Vitality at Newcastle University is already the largest in Europe and has the largest interdisciplinary research group in the field of ageing and age-related illnesses. It brings a range of activity and state of the art facilities together including the Newcastle Magnetic Resource Centre, Clinical Ageing Research Unit (CARU), and the Changing Age for Business initiative. The campus provides a focus for world class research led by The Institute for Ageing and Health, which is developing new research capacity and addressing the issues of an ageing population, particularly in the development of assistive technologies. The Institute's wide-ranging programme of investigation involves a core of around 200 researchers and postgraduate students, and attracts average grant income in excess of £6.5M per year.
- The Newcastle Biomedicine partnership has been recognised with a number of awards from UK Government including a renewal of status as England's NIHR Biomedical Research Centre in Ageing and NIHR Biomedical Research Unit in Dementia with Lewy Bodies, the only BRC outside of the South of England.
- North East and North Cumbria Academic Health Science Network

Weaknesses

- Relative to other UK and international bioscience regions, the North East possesses a weak industrial base (particularly SME base)
- Big pharma located in the region lack corporate decision-making and R&D capabilities and are therefore performance plant operations which remain susceptible to global market dynamics and corporate HQ decision-making
- The region has a limited track-record in private and public investment in the life science industry. For instance, the North East Finance for Business North East programme has invested in very few life science companies with the vast majority of investments falling under digital, IT and software companies. Grant support is also very weak with devolved authorities able to support businesses with a combination of capital and R&D grant-based fiscal packages.
- The North East has a chronic lack of bio-incubator space which is tailored for medical technology, biotechnology, chemistry and pharmaceutical companies. The only dedicated bioincubator space available to life science companies are operated by Newcastle University (ICFL and Medical School) and Wilton International. Newcastle University's bioincubators are both full. There is pockets of wet room laboratory space available in the North East BIC (Sunderland) and at NetPark (Sedgefield) but in comparison to more established bioscience centres e.g Golden Triangle, and emerging life science hubs e.g Manchester, Stevenage, Liverpool, Edinburgh etc, Newcastle and the North East is lacking available and good quality incubator space

Opportunities

- The Centre for Process Innovation (CPI) will be home to the £38m National Biologics Manufacturing Centre. Funded by BIS, the centre will help companies of all sizes in the biologics market to develop, prove, demonstrate, scale up and ultimately commercialise new biologics process technologies.
- The North East is potentially well-placed to take advantage of the increasing market for generics and biosimilars based on the North East's existing capabilities in custom synthesis, formulation and tablet manufacturing.
- The North East has the potential to position itself as a leading centre for research and commercial applications relating to the emerging technology of synthetic biology. TSB has identified synthetic biology as one of 'eight great UK technologies' and Witty (2013) has highlighted Newcastle as one of only 5 centres in the UK to receive central government investment in this technology area. Newcastle University has recently established the Centre for Synthetic Biology and Bio-exploitation drawing on the University's expertise in computing sciences, engineering, bioinformatics, bacterial cell biology etc. Although still embryonic, the North East's engineering, pharma and biotechnology firms are well placed to take advantage of proximity to Newcastle University in this emerging field.
- The North East via CPI and the Biopharma Bioprocessing Technology Centre (BBTC) is well-placed to leverage existing physical infrastructure and assets to work with existing engineering and bio-pharma companies, and attract new companies to the region, to test and scale-up new biopharma processes and products.

- Linked to Newcastle University's proposed Centre for Cloud Computing/School of Computing and Sunderland Software City, the region is potentially well positioned to become a leading centre for big data analysis linked broadly to public healthcare and tertiary care (particularly clinical trials analysis). Big data is a clear technology focus for the TSB.
- Increasing ageing demographics in the region but also globally represents an opportunity for the North East based on the region's existing academic and clinical research, and also increasing adoption of assistive technology by North East healthcare institutions, to take advantage of opportunities in the embryonic market. A review of the Newcastle University Changing Age for Business Programme identified the positive outputs (and outcomes) of regional companies that engaged in the ERDF funded programme.
- More broadly, regional industry has indicated an interest in aligning supply-side FE/HE institutions with demand requirements of business. For instance, biotech, medical technology and pharma companies have identified the desire to employ students that have completed apprenticeships/one year industry sandwich courses rather than graduates fresh-faced out of FE/HE education.

Threats

- The North East and broader global life sciences industry faces a number of significant threats, including:
    - Changing big pharma business models
    - Drying up of clinical developmental pipelines
    - Key patents expiring
    - High cost of clinical trial development (approximately $1bn for a new drug)
    - Reliance on branch/performance plant operations
    - Tighter immigration controls for bio/medical students
    - Price controls
    - Tighter regulations

4.4 Creative, Digital, Software and Technology Based Services

The S3 project team believe this area of economic activity offers major future opportunity within the North East LEP area. While this AEA is very difficult to characterise and quantify it is united by the combination of creative talent with enabling digital technology.

Strengths

The Independent Economic Review identified digital, media, telecoms and software as a fast expanding, diverse group of businesses linked to new communication technologies with exceptional growth potential.

A key resource in the region is students in ICTs – there is a growth in numbers, quality is up. High quality graduates are enhancing local employment and linkages between universities and local employers is strong.

NESTA research shows that the creative industries provide a disproportionate number of the innovative businesses in most parts of the country. The low barriers to entry help in this respect as well as low rents, low cost with a high quality of life.

Digital technology and media is a primary driver of new opportunities and is an area where the region has already established a strong and innovative reputation. NELEP writes that the North East has a thriving and diverse Creative and Digital sector with strong business networks, innovative hubs, modern business premises and a dedicated supporting network of public sector agencies, universities and colleges.

Sunderland Software City's Strategy 2020 has detailed how the North East will be home to 2,200 software companies who will employ over 15,000 people and contribute nearly £1.1bn to the regional economy (roughly doubling the existing number of companies). The City of Sunderland will benefit from three times the number of software businesses operating out of the city, providing employment for an additional 3000 people. Strategy 2020 also sets out how it will help address the national shortage of skilled software developers through engagement with education and pioneering initiatives such as the Coders Academy, which identifies and provides training and employment opportunities for young people who exhibit the characteristics of good developers.

The Sunderland Software City Partnership has excellent links with Tees Valley Digital City providing a well linked cohesive network.

The Digital and IT economy has held up well through the economic downturn leading to commentators suggesting it is recession proof. Games and video production as well as content-based businesses are a fast growing sector in the North East.

NESTA has identified that film, video and TV production companies tend to cluster and this is reflected in the significant growth seen in the concentration of film, video and TV production companies in the Toffee Factory which has become a hub for creative and digital businesses in Newcastle

The UK contact centre industry is still growing, although few greenfield sites are opening. In order to do this, there must be the future expansion possibilities. Respondents from Northern Ireland, Scotland and the North-East are most positive about this. (contactbabel 2012)

Demand from businesses is seen in the increasing trends to outsource sections of business activity to back office processing organisations

The region has low attrition rates in these operations(35% cf with London where rate is 69%). Contactbabel 2012

Weaknesses

Work has begun on giving rural households and businesses access to superfast broadband. Local partners need to work closely together and with BDUK, other funders and service providers to ensure full coverage of rural areas by 2016 is not hampered in any way.

New technology and new products mean establishing new supplier relationships and attention must be given to the critical links between digital strategy and wider ICT and procurement strategies.

The digital, media, telecoms & software sub sectors are closely linked, yet diverse, requiring a flexible approach to definitions38 and collaborative networks. While medium and large companies are well organised, many new starts involve younger and less experienced people setting up in business for the first time who may have additional support needs (IER 2013).

Yiu (2012) recommends that more energy and more funding must be focused towards getting talented young people to think about founding or working for a start-up when weighing their career options.

NESTA case studies show that the mere existence of a creative cluster is not enough for real benefits to emerge. The other crucial ingredient is connectivity between firms within a cluster, with collaborators, business partners and sources of innovation elsewhere (both in the UK and overseas), and finally, with firms in other sectors that can act as clients, and as a source of new and unexpected ideas and knowledge. These three layers of connectivity are underpinned by a dense web of informal interactions and networking.

Addressing digital skills gap is critical, amongst the general population and particularly older people. The National Audit Office (NAO) has recently found evidence of digital skills gaps across the civil service that have persisted over years. They propose that plans be put in place to address skills needs over the short, medium and long term. And that a centre of

[38] TSB define 'Digital' as the complex interaction of people, processes and technology that creates digital technologies – along with their socio-economic benefits. Definitions and parameters for other creative AEAs were harder to establish. NESTA have developed a methodology which could be replicated with some effort.

technical excellence must be at the heart of any digital strategy which aims to bring about fundamental redesign of services throughout the public sector.
Contact Centre work is perceived as low quality, with limited autonomy and low wages. Delivery/Service Centres also offer very highly skilled roles, but the way in which this is portrayed should reflect positively on the North East.

Opportunities

The underlying reason for optimism in growth across all creative industries is the opening up of new markets and new opportunities globally as a result of digital communications and global supply networks.

Companies can aim to grab more of the market share - European firms only account for about one quarter of the €2 trillion global market for information/communication technologies. A proactive approach to the implementation of high-speed internet has a positive impact on the ability to innovate, spread knowledge and distribute goods and services, and can reduce rural isolation. The UK coalition government has put in place policy and funding to support its Digital Strategy. Since coming to power, the current government has articulated a vision for the UK to emerge as a leading centre in the new high-tech economy, and to be the best place in the world for entrepreneurs to launch and grow innovative digital businesses (Yiu 2012)

There are opportunities for growth in the region if businesses can harness scientific and industrial capabilities to take advantage of technology-enabled transformations in manufacturing, infrastructure and the internet. There is also a strong connect to place with many niches and sub-sectors linked to urban life/universities and others linked to home based/market towns and rural life.

It is when the creative digital software sector links into other sectors and, for example Life Sciences, Government departments and university research are brought together that the strongest platform for economic growth is created. The Life Sciences currently forms a medium sized cluster with specific strengths in drug manufacture, diagnostics and assistive technology, all areas of the economy that have strong growth prospects (NESTA 2012)

A high proportion of people and businesses have both access to and possess the skills to use online public and private services. Over 80% of businesses and individuals are online but there remains significant numbers of people who cannot go online or do not wish to do so. New technology and new ways of engaging with people and delivering services require clever easy interfaces as well as new approaches and new skills development (ONS 2012)

Scaling up small businesses and supporting entrepreneurs in exciting digital businesses that deliver disruptive innovations, anchor an ecosystem of customers and suppliers, has the potential to generate growth, wealth and jobs (Yiu 2012).

Encouraging new exporters and innovators need not focus exclusively on the manufacturing sector – taking advantage of the growth in services and particularly seeking those who are in

emergent sectors such as digital, media, telecoms and software is highlighted by the IER has a key means of creating more and better jobs in the region39.
A wider range of investors needs to be encouraged to come together to recycle their gains into funding new businesses – taking an innovation from inception to market and preparing for long-term expansion takes time and money – and the ability to access external finance is critical.

ICT facilitated globalisation appears to be stimulating new complex and dynamic trends in the location of work, with spatial re-sorting of value chain functions and changing spatial divisions of labour at a global scale (Ranald Richardson 2013, CURDS). This is a highly complex changing environment which the region upon which the region may be able to capitalise, e.g. particularly the trend that sees companies competing on customer service and seeking support for their online services. Trends in this AEA have been identified by Richardson (2013) to include, the codification of knowledge, business, even more proactive and reflexive approach by firms, the opening up of new markets, the re-regulation of markets such as financial services allowing market entry and data/information flows, the liberalisation of telecoms markets, the growth of new educated labour pools around much of the world and the introduction of ICT and other technologies (driver and enabler).

Threats

Growth in the 'recession proof' digital and IT sector is in fact slower across Europe as a whole – the productivity gap caused in part by:

- lower levels of investment in R&D and innovation
- insufficient use of information/communications technologies
- difficult access to innovation in some sections of society

Creative organisations supported by the public sector are surviving in a context of ongoing austerity and cuts. This has stifled investment and funding to activities associated with creative and performing arts. Television has been hit particularly badly, largely due to the downturn in advertising revenues and shift to online advertising. Creative media and commercial consultancies are struggling with reduced revenues and difficulties in accessing finance. High rates of business failure have been observed in the UK as a whole.

Innovation in delivery of services is controversial in that job losses might result. High street retail will continue to be impacted by internet sales but many companies have innovated either by providing niche services or through by competing for online customers.

Anecdotal evidence from freelance TV production professionals and film-makers in the region suggests that work is still hard to find. Use of freelancers is thought to have fallen had fallen in TV, radio and facilities but increased in interactive media and computer games. Unfortunately representation of women has fallen in every sector (Robson Hall & McCabe

[39] Firms who export are more productive than non-exporters, achieve stronger financial performance are more resilient and likely to stay in business, achieve economies of scale not possible with domestic only sales, increase the commercial lifespan of their products and services. Increasing exports and company involvement in global supply chains will further strengthen the competitiveness of the economy.

2011)40. Representation of people from a Black and Minority Ethnic (BME) background has also fallen leading to concerns that lack of diversity will represents significant skills drain and loss of talent.

As well as providing the skills to generate creative content for digital products, the digital future relies heavily on many of the creative industries and their capacity to generate educational, entertaining, commercial and public service content and services. If the growth in the region's digital economy continues, this is likely to increase demand across a range of professions, creating challenges in how these different disciplines work together and apply their varied skills and knowledge sets to digital products.

The benefits that the digital sector can deliver are well known but there are still barriers preventing effective exploitation and the formation of new high-growth markets and business models, e.g., quality, resilience, trust, interoperability, security or inclusion (skills).

Barriers can be hard to overcome and hard to resolve due to misaligned incentives, conflicting interests, conservatism amongst stakeholders, lack of or out-dated regulations, lack of standards, incomplete or disjointed value chains and industry fragmentation.

Research in the commercial creative sector (2007) highlighted a lack of major clients and commissioners in the area e.g. head offices of leading companies that buy branding and marketing services, broadcasters with commissioning power, new media platform/mobile network owners, device manufacturers or major search engines such as Google or Yahoo. Thus underlining the crucial importance of supporting individual entrepreneurs and strengthening networks and links with the right companies and individuals.

Related to the above point is that support organisations are limited to doing just that: exciting digital start-ups will only have a real and lasting impact on the economy if they scale up.

High speed broadband may impact positively on poverty but the ratio of investment to potential impact is high. High speed broadband will make a difference to rural businesses and the Rural Community BB fund is very welcome but there are concerns that there is no definition of the 'final 10% area'41 .

[40] see also reports in The Guardian, 'Women in Film and TV'

[41] At the time of writing BT had not yet made their maps available not making their maps available.

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