



# Chapter 7

## Conclusions

**'...the world is changing fast. A successful Industrial Strategy needs to combine agility with patience. We need a clear and consistent direction, policies and institutions that are trusted by business, investors, local leaders, universities and researchers, which allow them to invest in a shared vision of the future.'**

*Industrial Strategy White Paper<sup>1</sup> page 242*

### 7.1 Gap analysis: connecting current capabilities with future opportunities

The overarching hypothesis for this SIA was 'The NWCA will realise its potential as a global market leader for low-carbon and sustainable products, processes and services through greater networking, integration and connectivity across the whole of the region's research base and business community, beyond that which exists in our current networks'.

Those assets include not just research and innovation infrastructure but also strength in depth in the human assets of highly skilled researchers and technicians, and the innovative, forward-looking mind-set of those in our business community. As detailed in chapters 1-6 the region's capabilities map well on to the intersecting priorities identified in the UK Industrial Strategy White paper, the Clean Growth Strategy and the 25 Year Environment Plan (see Table 1.2 for example). We start from a position of strength and our priority now is to build on that strength to secure the region's global leadership in delivering eco-innovative products, services and technologies - the solutions needed to deliver Clean and Sustainable Growth in the coming decades.

However, the audit has also further clarified the challenge of 'networking, integration and connectivity'. That challenge remains substantial despite a strong existing culture of collaboration, but this is also an opportunity to build on what we have now to work together to address this issue. The audit has highlighted five broad gaps that limit our ability to connect current capabilities with future market/application opportunities.

As detailed below, of these five gaps, three were anticipated in the hypotheses defined in our expression of interest, and two more emerged from the consultations undertaken during the audit itself. These gaps, in turn, highlight the opportunities that will enhance the region's capabilities and leadership in Clean and Sustainable Growth (see Section 7.2).

#### Gap A. Poor understanding of the opportunities from Clean and Sustainable growth

In the expression of interest, we hypothesised that '...current regional (and UK) strategies will be considerably enhanced by a deeper understanding of the scope and market potential for the full spectrum of products, processes and services required for global sustainable growth (i.e. those beyond low carbon energy generation)'.

The audit confirmed a widespread misconception of the nature and need for Clean and Sustainable Growth. Many of those who were interviewed were unclear how 'Clean and Sustainable Growth' was relevant to their own planning, both in business and local/regional policy (Annex 8). This highlights a major disconnect between thinking 'on the ground' and global and national policy drivers, including the UK Industrial Strategy, the UK Clean Growth Strategy and the UK 25 Year Environment Plan. The complementary resources, skills and experiences of all NWCA partners, HEIs and businesses of all sizes, have the power to voice this need to a wide audience, and so support not only the technical innovations needed for Clean and Sustainable Growth but also the awareness and behavioural change needed for its successful implementation.

#### Gap B. Lack of connectivity across the region's assets for research, development and demonstration for Clean and Sustainable Growth

Our over-arching hypothesis referred to the need for 'greater networking, integration and connectivity', which applies across all elements of the audit, but in the expression of interest we further hypothesised that '...valuable, additional mechanism(s) may be identified to optimize synergies across the NWCA's unique mix of large companies and SME business assets, skills and research.'

Again, this audit has confirmed that synergies could be optimized, and began to identify specific examples. Inputs from businesses and stakeholders recognised lack of connectivity between sectors, and the audit also highlighted the remaining challenge of improving connectivity between academic disciplines. Both are a legacy of 20th century models of thinking that must change if we are, collectively, to meet the challenges of Clean and Sustainable Growth. The audit also identified the power of universities to act as catalysts to 'join-up' currently unconnected sectors and opportunities, for example by supporting 'open innovation' through CGE and other cross-cutting activities (Chapter 6). Yet the audit made clear that we have only just started this journey. The audit has drawn out our distinct 'capabilities', but also the inherent integration required at the heart of Clean and Sustainable Growth. The many points of contact between capabilities were clear, and re-emphasised the need to find new ways of working that are truly 'post-disciplinary' to meet the challenges and opportunities of Clean and Sustainable Growth.

**The SIA has confirmed the NWCA's strength in depth in terms of nationally and internationally-leading science, innovation and industrial capabilities across the region.**



A specific 'valuable, additional mechanism .... to optimize synergies across the NWCA' identified through the audit was a 'joined up' approach to demonstration facilities: the 'test-bed' opportunity, a need clearly identified by businesses and stakeholders (Annex 8). The region is growing a range of demonstration facilities that looks to be unparalleled globally. However, there has been little consideration to date of the power of 'mutual access' to researchers, innovators and industry from across our geography and partners. The model is currently based on 'home turf' but the audit identifies real potential for a more collaborative vision.

#### **Gap C. A substantial skills-gap in at all levels in sectors relevant to Clean and Sustainable Growth**

In the expression of interest, we hypothesised that '... the region's HEIs have a specific role in attracting and training the skilled people and eco-innovation talent needed by the region, and providing these people with the experience and opportunity to stay in the region and contribute to its growth'. Our consultation with more than 100 stakeholders, including extensive input from industry (Annex 8) confirmed that the 'skills agenda' was very high on the priorities of businesses and our wider stakeholder community. Our audit highlights two particular aspects to this skills gap, (i) apprenticeships and (ii) widening the skill-set of STEM graduates.

#### **Gap D. Limited use of the partner's international networks to maximise shared benefits**

The audit identified the scale and diversity of international research and innovation connections of NWCA university partners (Table 6.2). These international campuses, partnerships and 'commercialisation' offices represent an important bridge for two-way business innovation supporting Clean and Sustainable Growth.

#### **Examples of skills and training needs**

There is a need for much better provision of apprenticeships at all levels and relevant to businesses across the whole spectrum relevant to Clean and Sustainable Growth. This need was identified by our numerical analysis (Annex 6) but also, critically, by our stakeholder consultation (Annex 8), and despite notable achievements such as Lancashire Energy HQ at Blackpool and Fylde College. There is a particular gap in high-level apprenticeships. It seems likely that a collaborative approach across NWCA partners might allow the development of a unique training 'offer' in the region to address this need.

Within this audit the businesses highlighted 'difficulties accessing skilled workers with STEM skills ...', echoing the 'People' chapter of the Industrial Strategy White paper—for example on p97 '.... we need to tackle particular shortages of STEM skills'. The LEPs expanded on this and noted '...eco-innovation is a sphere of multiple careers in a lifetime - opportunities need to be created to transition between these easily'. This relates to the other graduate skills gap that was identified in this audit, STEM graduates lacking the broader skill-set needed by business. That need coincides with what is described in the 2017 NESTA 'The Future of Skills' report as '....higher-order cognitive skills such as originality, fluency of ideas and active learning. Skills related to system thinking — the ability to recognise, understand and act on interconnections and feedback loops in sociotechnical systems — such as judgement and decision making, systems analysis and systems evaluation....'. For us, that relates closely to the need highlighted in the Industrial Strategy 'Within R&D, the 'D' for development needs a particular boost.'

However, as with UK-based facilities each institution's connections remain 'siloed'. While that may be entirely appropriate for teaching activities, it may constrain opportunities for taking a more coordinated approach and integrating these facilities in order to scale-up impact and to support industrial trade opportunities across NWCA partners.

#### **Gap E. Poor integration in funding research and innovation in Clean and Sustainable Growth**

This gap emerged from discussions across partners involved in the Centre for Global Eco-Innovation (CGE) and related projects (page 20). Phase 1 of CGE (2012-2016) was a single project that allowed Lancaster University and the University of Liverpool to work with SMEs from across the region, then covered by a single European Structural and Investment Fund (ESIF) programme. The current ESIF programme, as with further recent related regional funding such as Local Growth Deal, is effectively 'devolved' to single LEP areas. This has meant that as the network of CGE partners expanded in phase 2, each of the four new projects were evaluated and effectively funded separately by Cheshire, Cumbria, Lancashire, and Liverpool City Region LEPs. This has resulted in operational inefficiencies to programme development and delivery, and unnecessary multiplication of administrative effort. There was a very clear view from all stakeholders, businesses and LEPs, as well as from HEIs, that this detracted from the ability of the project to support business and deliver its economic and environmental targets at scale. We welcome the freedoms and flexibilities introduced in new funding streams such as the recently announced Strength in Places call under UKRI, and would urge Government to consider this issue under emergent programmes such as the proposed Shared Prosperity fund.

## 7.2 Target opportunities for Clean and Sustainable Growth

The five gaps noted above lead directly into the five opportunities described below.

### Opportunity 1 Communicating the economic importance of Clean and Sustainable Growth

This audit itself is providing a detailed and publicly-available evidence base of research/innovation assets and networks in Clean and Sustainable Growth across the NWCA. It also provides regionally-specific information about scale, location and eco-innovation needs of the many industrial sectors and markets that contribute to, and benefit from, the drive for Clean and Sustainable Growth. Communication will need to consider multiple audiences, business sectors, national, regional and local government and LEPs, and, underpinning those, the wider public.

There are immediate opportunities in both 'Green Great Britain Week' outlined in the Clean Growth Strategy<sup>1</sup> and the proposal in the 25 Year Environment Plan<sup>6</sup> to make 2019 a 'year of action for the environment'. Both are excellent opportunities for NWCA partners to work together to use the outcomes of this audit to highlight the immense benefits of Clean and Sustainable Growth for the economy and people, as well as the environment.

In the medium-long term, the recently announced feasibility study for a £60 million 'Eden Project of the North' based in Morecambe Bay could be a unique and transformational opportunity for the region.

One route forward, drawing on expertise and examples from across the NWCA, could be to integrate an internationally-leading gateway for education and the engagement of the public around Clean and Sustainable Growth as part of "Eden Project of the North", complementing the opportunity for new research, development and demonstration facilities (Opportunity 2).

### Opportunity 2 Improving connectivity between the region's assets for Clean and Sustainable Growth

This audit provides policy makers, innovation funders and industry with the necessary evidence base to facilitate strategic decisions both locally and nationally on large-scale investments that will ultimately deliver the ambition of a globally-leading Clean and Sustainable Growth capability in the NWCA. This will be able to contribute significantly to UK productivity, prosperity and sustainability.

One key message from this audit is that Clean and Sustainable Growth must cut across business sectors and academic disciplines. Responding to that message might use multiple approaches but the audit has identified the opportunity to develop a single point of focus—for example an International Centre of Excellence for Clean and Sustainable Growth. A Centre of Excellence would act as a gateway for stakeholders to access the NWCA's existing prime capabilities, targeting the challenges and opportunities at the interaction of the Clean Growth Strategy<sup>1</sup> and 25 Year Environment Plan<sup>6</sup>. Again, the proposed 'Eden Project for the North' offers a unique opportunity to develop new research, development and demonstration capacity, serving the whole of the NWCA partnership, both its research base and business communities, and developed alongside public engagement facilities (Opportunity 1).

### A new Eden Project for the North in Morecambe Bay

The Lancashire Enterprise Partnership, Lancashire County Council, Lancaster City Council and Lancaster University are currently working with the Eden Project to develop the Eden Project North in Morecambe Bay, a transformational project to develop an internationally significant visitor attraction, a unique centre for environmental and related research and for public engagement with science.

Morecambe Bay forms an integral part of a network of natural assets across Cumbria, Yorkshire and Lancashire that attracts millions of visitors from across the globe each year. The Eden North project will provide a year-round destination for the region. A recognisable global icon of 'wellbeing, wonder and curiosity', it would combine research, innovation and outreach and transform the local and broader regional economy. The project is currently undergoing a series of detailed feasibility studies.

The aim would be to scale-up to a new level the NWCA's ability to support our corporates and SMEs to develop and show-case new Clean and Sustainable products, processes and services for global trade through collaboration across the regional research base. There are also opportunities for facilities at different locations focused on particular research disciplines or business sectors. For example, there may be specific opportunities to address the current lack of a world-leading facility for collaborative R&D in water management, to deliver new products and services encompassing drinking water supply, waste water management (treatment systems, drainage) and irrigation, as well as those related to enhancing resilience (including flood risk management). This would clearly map effectively on to both the Clean Growth Strategy<sup>1</sup> and the 25 Year Environment Plan.

Finally, returning to the need for 'greater networking, integration and connectivity', highlighted in our expression of interest, the audit has identified specific opportunities for a more 'joined-up' approach to the region's existing research, development, demonstration and co-location facilities. Several specific possibilities have emerged from the audit and we will advance these in focused discussions between relevant partners, typically two or three organisations.

### Examples of cognate but currently isolated activities

Hydrogen-based energy systems at Keele and Liverpool/LJMU. Below-ground energy resources at Keele, Chester and, given Lancashire's shale gas resources, potentially also UCLan.

'Place-based synergies' between North Wales, Lancashire and Cumbria: in essence their shared geographies with extensive uplands and coasts supporting the region's urban areas, for example as both a source of water, food and recreation but also a key resource for reducing 'down-stream' flood risk.

In-depth SME R&D post-graduate student supported projects to support product, process and service development, including the Centre for Global Eco-Innovation that currently only involves Lancaster, Liverpool, Liverpool John Moores, Cumbria and Chester, together with the University of Wales' Knowledge Economy Skills Scholarships programmes, led by Bangor University.

### Opportunity 3 Enhanced support for connecting business to global markets

The audit has identified the opportunity to take a more coordinated approach to leveraging the international campuses and technology transfer facilities of the region's HEIs in order to develop SME internationalisation support programmes across the HE partners. This ambition will need to start with discussions between our HEIs, but will ultimately require the involvement of regional global corporates and key government agencies including DIT. As a first step, we will share the SIA with DIT trade and export staff with two aims. Firstly, to help identify UK companies that could export goods and services into growth markets. Secondly, to assist DIT to develop a strong inward investment offer for innovative business developing the products, services and technologies needed to meet the demands of the global market for Clean and Sustainable Growth. Indeed, the opportunities here are relevant to businesses across all sectors.

### Opportunity 4 Training and retaining regional talent to support and lead Clean and Sustainable Growth

The wider concerns around the 'skills gap' led to the identification of two issues, apprenticeships and widening the skill sets of STEM graduates. Again, the complementary resources of partner organisations, building on current provision might allow a step-change in how both pre-degree, undergraduate and postgraduate training is seen and delivered. By working together, we can ultimately develop and secure the currently unfulfilled potential of regional talent to support and lead Clean and Sustainable Growth.

Improving integration and connectivity in training might start with a 'phase 2', in-depth audit of the region's training offers relevant to Clean & Sustainable Growth across FE and HE providers, how these relate to each other and how they could be connected to provide a 'skills escalator', perhaps through a virtual Clean Growth Training Academy. Such a training academy might start with pre-degree apprenticeships but extend through to include the collaborative development of relevant skills programmes within degree and other formal programmes and through CPD. This might include increased engagement with Degree Apprenticeships. The vision is to complement technical training with leadership and management elements, building on existing activities (Chapter 6) such as those developed across several NWCA partners through the various elements of the Centre for Global Eco-Innovation (see page 20). The aim is to attract world-class talent to the region and retain the 'eco-innovators' of the future within the NWCA.

### Opportunity 5. Freedom and flexibility in supporting industrial R&D for Clean and Sustainable Growth, particularly in SMEs

The vast majority of the innovation assets, physical and revenue, identified in this audit have been/ are supported by European Investment and Structural Funds and it is critical that emergent funding streams enable the continuation and evolution of HEI-SME innovation support programmes. A clear conclusion from the audit is that achieving our aspirations of significantly increased SME R&D for Clean and Sustainable Growth requires funding mechanisms (for example the multiple mechanisms of government investment highlighted in the Clean Growth Strategy<sup>2</sup>) that operate at an appropriate and transformational regional scale across individual LEP boundaries.





Eden North concept

### 7.3 Next steps

The preceding sections have outlined specific opportunities identified through this audit. Together they define a set of actions needed to deliver the greater networking, integration and connectivity that the audit confirms are essential for the NWCA to fully exploit its capabilities and become a global leader in developing both the solutions (products, services and technologies) and the skilled people needed for Clean and Sustainable Growth.

This audit has also proved the strength of the NWCA partnership and shown a real commitment by the organisations involved to create a strategic alliance, develop an action plan and convene an implementation group to drive progress. The conclusion of the audit is the starting point for the plan of co-ordinated action on Clean and Sustainable Growth described in Table 7.1.

Throughout the audit we have linked the NWCA's capabilities to current UK strategy, in particular the UK Industrial Strategy White paper, the Clean Growth Strategy and the 25 Year Environment Plan. Our action plan is equally focused on those strategy documents.

The first chapter of this audit begins with the following quote from Industrial Strategy White paper 'The move to cleaner economic growth – through low carbon technologies and the efficient use of resources – is one of the greatest industrial opportunities of our time. By one estimate, the UK's clean economy could grow at four times the rate of GDP. Whole new industries will be created, and existing industries transformed as we move towards a low carbon, more resource-efficient economy'.

These opportunities are very large, but also time constrained and the subject of intense research and innovation by all industrialised nations. Taking full benefit from these opportunities to grow UK competitiveness in global markets, and to develop the tools to deliver the wider aims of these strategy documents, requires action now. This includes meeting our national commitment to limit greenhouse gas emissions, which as described on page 242 of the Industrial Strategy '...is not just an economic opportunity; it is also a moral duty', a responsibility also highlighted in the report of the Committee on Climate Change report published in June 2018<sup>31</sup>.

This implementation plan defines the mechanisms by which the outcome of this audit will be put into practice to empower the region to work collectively to drive forward the economic, social and environmental benefits provided by Clean and Sustainable Growth. The learning, innovation assets and benefits developed as a result of the audit can then be applied across the UK to increase productivity, create good jobs and scale-up earning power right across the country and so maximise the nation's competitiveness in this fast-growing global market.

Since the formal submission of this SIA in July 2018, the Intergovernmental Panel on Climate Change (IPCC) published a special report<sup>32</sup> on the impacts of global warming of 1.5°C above pre-industrial levels. The report makes clear that limiting warming to 1.5°C would prevent many of the risks associated with a 2°C rise.

The IPCC report states that to limit global warming to 1.5°C "...would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems. These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options."

This conclusion of the IPCC report further reinforces a major outcome of this audit in highlighting the urgent need for Clean and Sustainable Growth that addresses the needs of all sectors and industrial systems.

Table 7.1

**Next Steps: a plan for implementing the opportunities identified by this Science and Innovation Audit**

Next steps	
June 2018	Draft report submitted to BEIS.
July 2018	Initial "awareness raising" flyer prepared to ensure audiences within the region and beyond are aware of the expected publication of the SIA in the Autumn (e.g. for use at the EIC Eco-Innovation conference).
Late summer-early Autumn 2018	Discussions between all partners leading to formal terms of reference for the North West Coastal Arc Alliance for Clean and Sustainable Growth, formalising the relationships developed through the partnership preparing this SIA. Next steps post publication – a discussion meeting with BEIS. October 2018. Final Clean and Sustainable Growth SIA published and formally launched. Regional launch of SIA and the North West Coastal Arc Alliance for Clean and Sustainable Growth.
Autumn 2018	"Clean and Sustainable Growth Roadshow" by all Alliance partners to communicate the key outcomes and recommendations of the audit "on the ground" in all the sub-regions of the NWCA. Partner representatives on alliance steering group agreed, and times/dates of monthly meetings of the steering group agreed until July 2019. Planning for Alliance communications under the '2019 Year of Action for the Environment' begins. Steering group leads a scoping exercise to review work-streams. The current proposal is that the work-streams will be based on Opportunities 1-4 above, but that Opportunity 4 in particular might generate multiple work-streams.
Winter 2018-2019	Initial alliance communications and engagement activities under '2019 Year of Action for the Environment' (continues through the year).
Early 2019	Final work streams agreed, including decisions on which partner leads which work-stream.
Spring 2019	Work streams carry out their activities.
Early summer 2019	Work-stream assessments and recommendations submitted to alliance steering group.
Late summer 2019	Steering group agrees priority actions.

