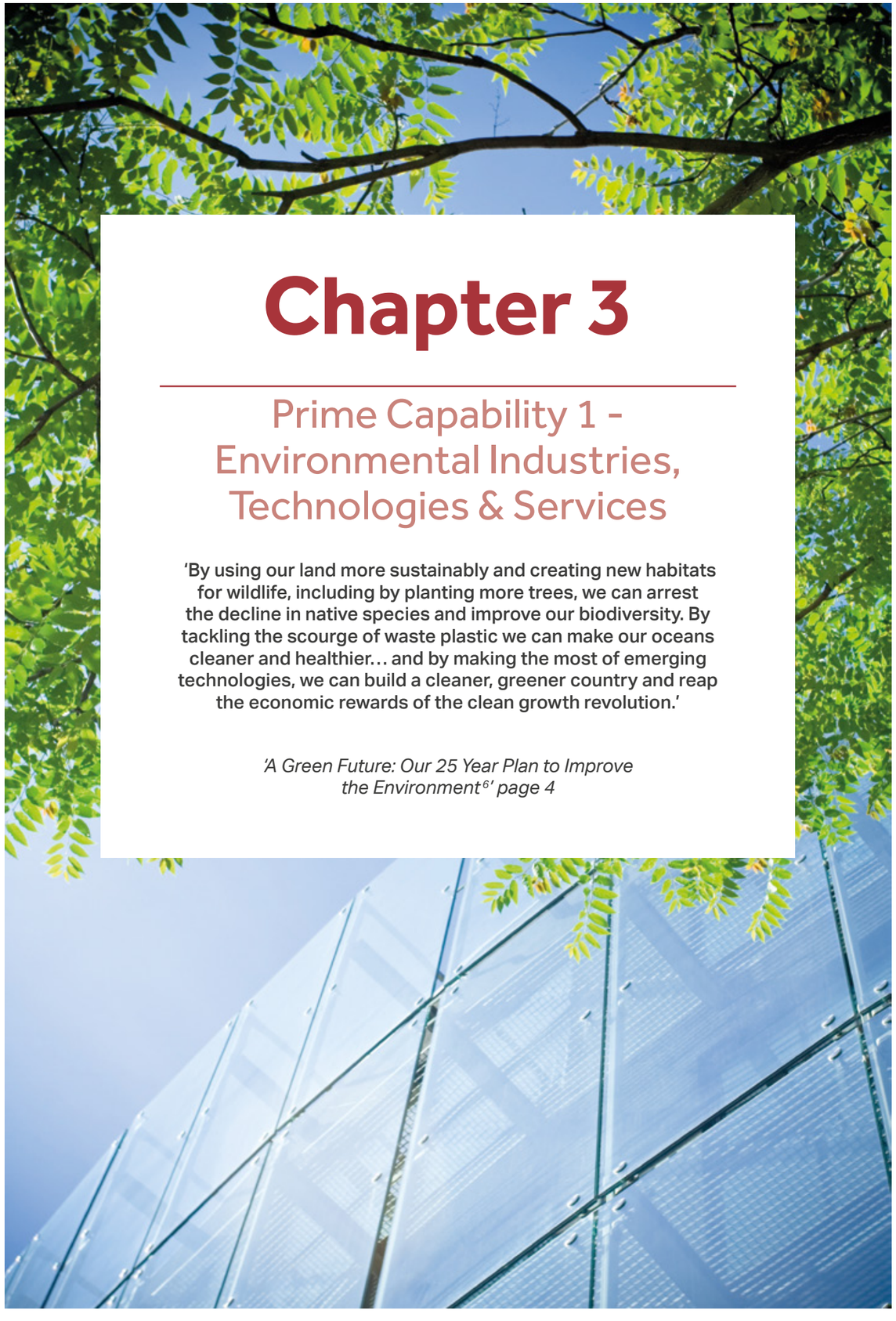


Chapter 3

Prime Capability 1 - Environmental Industries, Technologies & Services

'By using our land more sustainably and creating new habitats for wildlife, including by planting more trees, we can arrest the decline in native species and improve our biodiversity. By tackling the scourge of waste plastic we can make our oceans cleaner and healthier… and by making the most of emerging technologies, we can build a cleaner, greener country and reap the economic rewards of the clean growth revolution.'

'A Green Future: Our 25 Year Plan to Improve the Environment[6]' page 4

3.1 National and international trends and size of global markets

The 25 Year Environment Plan and the North West Coastal Arc Partnership for Clean and Sustainable Growth both recognize that improving the environment also brings the potential for significant economic benefit. That applies not just to 'low carbon' energy systems (see Chapter 4) but to multiple elements of the 25 Year Environment Plan that map closely on to sectors and disciplines that we include here under Environmental Industries, Technologies and Services (EITS). These include Agronomy, Crop and Food Sciences (3.1.1 below and Chapter 2 of the 25 year plan), Water Science & Technology (3.1.2 below, and covered in elements of Chapters 2 and 4 of the 25 year plan) and Waste Management & Disposal (3.1.3 below, and Chapter 4 of the 25 year plan).

The 25 year plan is part of the UK's wider environmental commitments to a legally binding target of reducing carbon and other greenhouse gas (GHG) emissions by at least 80% by 2050. This means the national market for low carbon goods and services will grow significantly over this period. While many elements of this are covered in Chapters 4 and 5, agriculture and the water and waste industries are significant sources of greenhouse gas emissions. More sustainable approaches in these sectors must recognise wider demographic and socioeconomic changes. Over the next 30 years, the world population will exceed 9 billion and the global economy will quadruple.

Almost 70 per cent of the population will live in urban areas. Food and energy demand will double, with renewable sources including biofuels and bioenergy accounting for 10 per cent of commercial supplies.

The North West Coastal Arc Clean Partnership for Growth & Sustainable and 'A Green Future: Our 25 Year Plan to Improve the Environment'

Agronomy, Crop Science and Food Sciences

The 25 Year Environment Plan[6] sets out a series of measures to improve how we manage and incentivise land management including a new environmental land management system beyond the Common Agricultural Policy, using fertilizers more efficiently, promoting Integrated Pest Management and reducing the impact of chemical pesticides. It places more emphasis on soil, water and environmental management both to protect the environment and resources, but also to ensure efficient crop performance. It recognizes that growing crops will become more complex and akin to manufacturing in the sense that measurements, data, and control are critically important to manage costs, maximize yields, and boost profits.

Water Science & Technology

The 25 Year Environment Plan sets out a key target around clean and plentiful water, reducing damaging abstraction from rivers and groundwater, improving river basin water quality and biodiversity indicators and improving bathing water quality. Protecting water assets in turn improves biodiversity, securing the value of wildlife, woodland and coasts and making sure decision-making on land use supports multiple benefits to society and ultimately boosts the long-term resilience of homes, businesses and infrastructure.

Waste Management & Disposal

The 25 Year Environment Plan sets out a number of ambitious UK policy targets for waste minimisation working towards the stated ambitions of eliminating avoidable plastic waste by end of 2042 and zero avoidable waste by 2050.

Climate change mitigation will require the cultivation of crops for energy and the production of bio-based ingredients to displace petrochemicals. The need for innovation to deliver Clean and Sustainable Growth globally has never been more urgent, nor a greater opportunity for UK research and businesses.

3.1.1 Agronomy, Crop Science and Food Sciences

In 2015, agriculture, together with food preparation, was the biggest single productive sector in the UK. The UK's agri-food supply chain accounts for an annual turnover of £96 billion with revenues of £14.3 billion. It accounts for 7% of the UK's GDP, and employs around 4 million people. Agronomy is a large and key part of agricultural science that focusses on the technical study of crops and the soils in which they grow. Future challenges focus on raising productivity while minimising energy and resource use. The agri-tech industry, supporting farmers and growers with all kinds of technology, is also a multi-billion pound sector; the UK has a 4–5% share of the world market. The Bioeconomy of the North of England SIA[8] (2017) highlighted the role of agri-tech and biotechnology to improve agricultural resilience, resource use efficiency and productivity.

The global food and beverages market was estimated to be over $5,65 billion in 2017. Asia Pacific and Latin America are expected to see fastest growth and change in food markets due to a large potential consumer base and a changing lifestyle of the middle class population in China, India and Brazil.

The NWCA's vision for 'Clean and Sustainable Growth' focusses on developing the tools - the eco-innovations - needed to deliver the aims and aspirations of the 25 Year Environment Plan as well as The Clean Growth and Industrial Strategies.

The Clean and Sustainable economy in the UK

As well as the three specific sectors discussed below, Environmental Industries, Technologies and Services forms one element in the multi-sectoral Clean and Sustainable Growth economy. In 2015 BIS published a review[5] of that economy across the UK, focussing on low-carbon. In summary:

THE DIRECT LOW CARBON ECONOMY GENERATED

£26.2bn

in GVA13 in 2013

Which suggests it is about five times larger than Aerospace, two and a half times the size of Pharmaceuticals, almost twice as big as Chemicals and approximately equivalent to Food and Drink in GVA terms.

Between

2010 & 2013

the direct low carbon economy grew by **12%** in terms of employment and **25%** in terms of turnover.

A total of

11,550

businesses were directly engaged in the low carbon economy across the UK in 2013.

Of the 9 regions in England, the Northwest has the greatest employment in the low carbon economy.

80,500 from a total of 391,700

Gross Value Added (GVA) increased by **29%,** with a compound annual growth rate of **8.7 percent** and [in 2015 stood] at **£44.9 billion**. This is almost nine times larger than aerospace, and four times larger than the chemicals sector.

M-SParc Science Park, Anglesey

The science underpinning crop production clearly relates closely to food science, which the Institute of Food Technologists defines as, 'the discipline in which the engineering, biological, and physical sciences are used to study the nature of foods, the causes of deterioration, the principles underlying food processing, and the improvement of foods for the consuming public'. One key point of intersection between crop production and food science is the global growth in demand for 'healthy food', whether so-called 'functional food and drink products' or products that meet individual dietary requirements (in 2017 the 'free-from' market was valued at $25billion and growing). Another intersection is the drive to reduce food waste, almost 15m tonnes per year in the UK with 6m tonnes of food ending-up in landfill (linked also to Waste Management & Disposal below).

Environmental Plant Phenotyping Innovation Centre (EPPIC) to support global agri-food productivity

Lancaster University is scoping a state-of-the-art multi-environment phenotyping facility to support a step-change in global agri-food yields. As a national interdisciplinary 'beacon' research facility it would allow the development of next generation crops and a range of bio-product developments including pharmaceuticals, flavour and functional foods for enhanced nutrition. Focused on global climate change impacts and adaptation, it will provide multiple climates, soil, plant and atmospheric conditions.

3.1.2 Water Science & Technology

Water, sanitation and drainage services are provided by 32 privately-owned companies in England and Wales.

Ensuring resilient, reliable and sustainable supply and waste water services are essential for individuals, for the economy and for the environment. Future threats to the sector are likely to increase, including the frequency and unpredictably of extreme weather events (floods and droughts) due to climate change, cyber security threats and a rapidly changing labour market.

The global world market is estimated by Goldman Sachs (2008) to be worth around $425 billion, with a long-term growth of 4%-6% per annum[9]. In industrial markets an average annual growth of 3%-5% (USA and Western Europe) is expected through an improvement in existing water and waste water infrastructure within 5 to10 years, compared with 10% or more in developing markets (China and India) through the creation of a new water and waste water infrastructure.

Owing to the substantial imbalance between supply and demand, the strongest growth areas in the global water market will come from high-end water treatment technologies such as ultrafiltration, reverse osmosis, desalination, disinfection systems and water testing.

Projections about environmental and socio-economic changes are not precise, therefore long-term planning for Clean and Sustainable Growth and resilience depends heavily on data analysis and modelling multiple 'what if' scenarios. In the water sector, in particular, there are many significant near-term capital investment decisions that have very long-term consequences, and so decision sciences and environmental computing are crucial for those systems (Chapter 6). For example, in one sector alone, flood risk management, in England the Environment Agency invested approximately £17m per year on modelling and mapping studies[10], which influence annual capital spend currently running at approximately £700m[11].

The importance of analytics products and services, a part of the digital economy, is set to grow in line with trends in smart infrastructure and data science.

Turning Coffee Cups into Beautiful Papers

Due to their mixed-material composition – paper with a plastic lining – disposable drinks cups require a more specialized recycling technique than many paper re-processors can offer. Cumbria-based paper manufacturer James Cropper has developed a new process to recycle some of the 2.5 billion takeaway coffee cups thrown away every year in the UK. It's trademarked CupCycling™ process allows the company to separate the plastic and paper and use the fibre to make bespoke papers and packaging, while the plastic lining is processed at a separate facility. Their innovation represents the world's first recycling process dedicated to upcycling take-away cups.
James Cropper, Cumbria.
https://www.cupcycling.co.uk

3.1.3 Waste Management & Disposal

The Global Solid Waste Management Market is set to be in excess of $US 350 billion by 2024 as waste generation rates double over the next 20 years. The waste sector in the UK has undergone a technical transformation as resource efficiency targets and Landfill Tax diversion have driven higher rates of recycling, diversion of waste form landfill and innovative ways of upcycling a wide range of resources. The circular economy is changing the way resources are valued and the focus across all sectors is sustainable resource management. Whether in research or skills, these trends again emphasise the connections between capabilities within the wider Clean and Sustainable Growth agenda.

The UK's waste management industry has a total annual turnover of £9 billion. There are 70,000 people employed in the sector across 3,000 companies.

Table 3.1

Environmental Industries Technologies and Services Research and Innovation Assets

Asset	Location	Agronomy, Crop & Food Science	Waste Manage-ment & Disposal	Water Science & Technology
BEACON Biorefining Centre of Excellence	N Wales	×	×	
Biocomposites Centre	N Wales		×	×
British Oceanographic Data Centre	M'side			×
Built Environment & Sustainable Technologies Institute at LJMU	M'side	×	×	×
Centre for Ecology & Hydrology	Lancs & N Wales	×		×
Centre for Environmental Biotechnology at Bangor	N Wales		×	
Centre for Global Eco-Innovation (CGE)	Lancs	×	×	×
Centre for National Parks and Protected Areas (CNPPA)	Cumbria	×		×
Centre for Offshore Renewable Engineering	M'side			
Centre for Waste Management at UCLAN	Lancs		×	
Centre for Water Soluble Polymers	N Wales			×
Centre of Excellence in Sustainable Food Systems	M'side	×		
Combined Food and Power Centre of Excellence	N Wales		×	
Edge Hill University	Lancs	×		
Environment Centre Wales at Bangor University	N Wales			×
Hartree Centre	M'side	×	×	×
Institute for Risk & Uncertainty	M'side			×
Lancaster Environment Centre	Lancs	×		×
Lancaster Leadership Centre	Lancs	×	×	×
Low Carbon Eco-Innovatory	M'side		×	×
Lloyd's Register Foundation	M'side			×
Marine Centre Wales	N Wales			×
M-SParc (the Menai Science Park)	N Wales		×	
National Oceanography Centre	M'side			×
Research Vessel Prince Madog	N Wales			×
River Eden Demonstration Test Catchment	Cumbria	×		×
School of Environment, Natural Resources and Geography, Bangor University	N Wales	×	×	×
School of Environmental Sciences, University of Liverpool	M'side	×		×
School of Ocean Sciences, Bangor	N Wales			×
Sensor City, Liverpool	M'side	×	×	×
SEACAMS 2	N Wales			×
Sêr Cymru National Research Network for Low Carbon, Energy and Environment	N Wales		×	

For example, there is significant growth in energy from waste markets nationally and globally and new waste treatment technologies, a clear link between waste management and our Future Energy Systems capability (Chapter 4). Similarly, there are linkages between EITS and Advanced Manufacturing, Chemicals and Materials through the need for further innovation to stimulate plastic recycling processes and for new bio-plastics to replace oil-based polymers.

3.2 Local science, innovation and industrial assets

Of the sixty internationally significant NWCA research and innovation assets identified by this audit, thirty-two have activities related to one on more aspects of the Environmental Industries, Technologies and Science Prime Capability (Table 3.1 and see Annex 3 for full details). Of these, eighteen undertake research that encompasses the Future Energy systems capability as well as EITS, and ten in which research links EITS with Advanced Manufacturing, Chemicals and Materials.

Notable businesses include United Utilities, Welsh Water, Nestle, AMEC, ACM Environmental, Sita, numerous Global Environmental consultancies and testing services in addition to a growing number of high growth SMEs e.g. Yordas Group.

As is evident throughout, this audit encompasses multiple aspects of Clean and Sustainable Growth, some across all three capabilities of this SIA, described in Chapter 6. Notable examples with a primary focus on Environmental Industries, Technologies and Services include (i) the Lancaster Environment Centre, (ii) the Sêr Cymru National Research Network for Low Carbon, Energy and Environment and (iii) two elements of the research capability of the Natural Environment Research Council (the Centre for Ecology & Hydrology and the National Oceanography Centre).

The **Lancaster Environment Centre (LEC)** represents one of the world's largest centres for environmental research, with academic expertise spanning the natural and social sciences, offering balanced perspectives on what are complex societal challenges. The Plant and Crop Science Group represent world-leading capability. They work from the molecular to the crop scale with researchers and end-users of research, with a particular strength in applying research to provide solutions to real-world problems, particularly in relation to agri-food challenges.

Bangor University is home to the Sêr Cymru **National Research Network for Low Carbon, Energy and Environment (NRN-LCEE)** a pan-Wales initiative funded by the Welsh Government and the Higher Education Funding Council for Wales. The network supports collaborative and interdisciplinary research in Wales into the interactions between land, water, the provision of food and energy production.

The Centre for Ecology & Hydrology (CEH) is a UK Government research facility co-located with the Lancaster Environment Centre on the Lancaster University campus and Bangor University's Environment Centre Wales in Bangor. CEH has national capability (recognised as internationally leading) in earth observation, natural hazard management, sustainable energy potential and impacts, informatics and water management that generates knowledge to populate toolkits for optimising decision making at a range of scales.

The National Oceanography Centre (NOC) is the United Kingdom's centre of excellence for oceanographic sciences and is one of the world's top oceanographic institutions.

The NOC undertakes world leading research in large scale oceanography and ocean measurement technology innovation. Liverpool University and NOC host the British Oceanographic Data Centre (BODC) - a national facility for looking after and distributing data concerning the marine environment. It is internationally recognised for work on tides, sea level and shelf sea physics, along with the development of new instruments and techniques for observing the oceans.

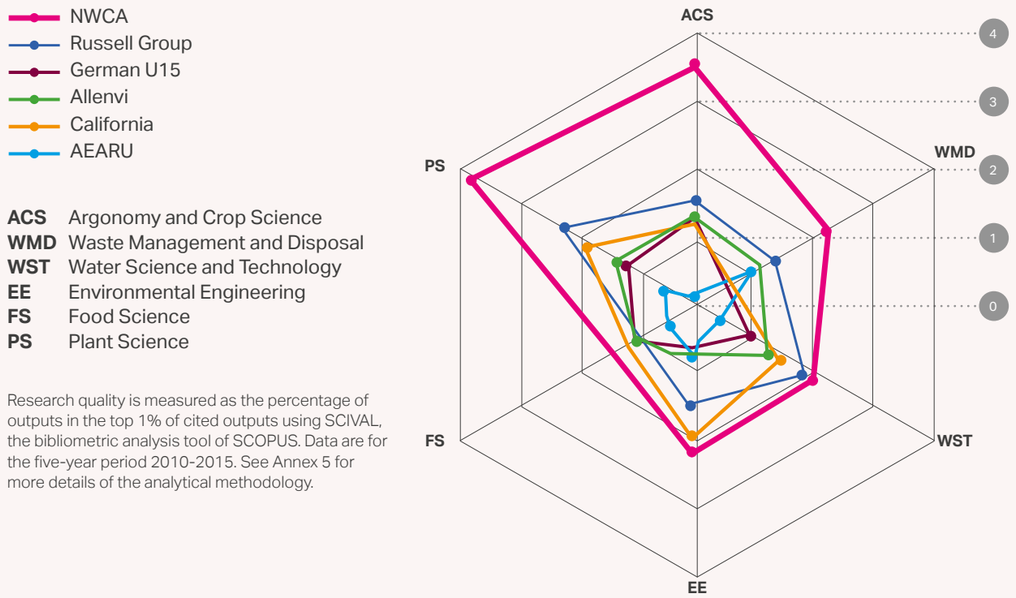
In addition to our local research and innovation assets the region has good links to other Clean and Sustainable Growth assets on the periphery of the NWCA. A notable example is the Tyndall Centre for Climate Change in Manchester. Established in 2000 with funding from the UK Research Councils, The Tyndall Centre for Climate Change's work covers the whole spectrum of geographical, time and human scales, linking research efforts across disciplines through an integrated approach.

"The Yordas Group, based in LEC, provides chemicals based regulatory advice and services to both industry and government bodies across the globe. In the initial conceptual stages, and before the incorporation of Yordas in 2007, the university provided pivotal strategic advice and access to scientific research and resource based in LEC. Ten years on, and we now employ over 50 staff from various disciplines including chemistry, human toxicology, ecotoxicology, software engineering and marketing.
We enjoy the benefits of a very multi-national workforce and now serve companies from over 30 countries. Our growth has been fundamentally underpinned by utilisation of the university's various student engagement opportunities, collaborative R&D programmes and international reach, underpinned by expertise across the institution. Around 70% of our employees to date originated from the university."
Chief Executive,
The Yordas Group

The industry focus is on innovation, research and development in priority fields such as Energy and Waste Management, Water Treatment, Environmental Monitoring and the Built Environment.

Figure 3.1

Research quality for the NWCA in the six sub-disciplines included under our Environmental Industries, Technologies and Services (EITS) capability, compared with other major university groups or regions.

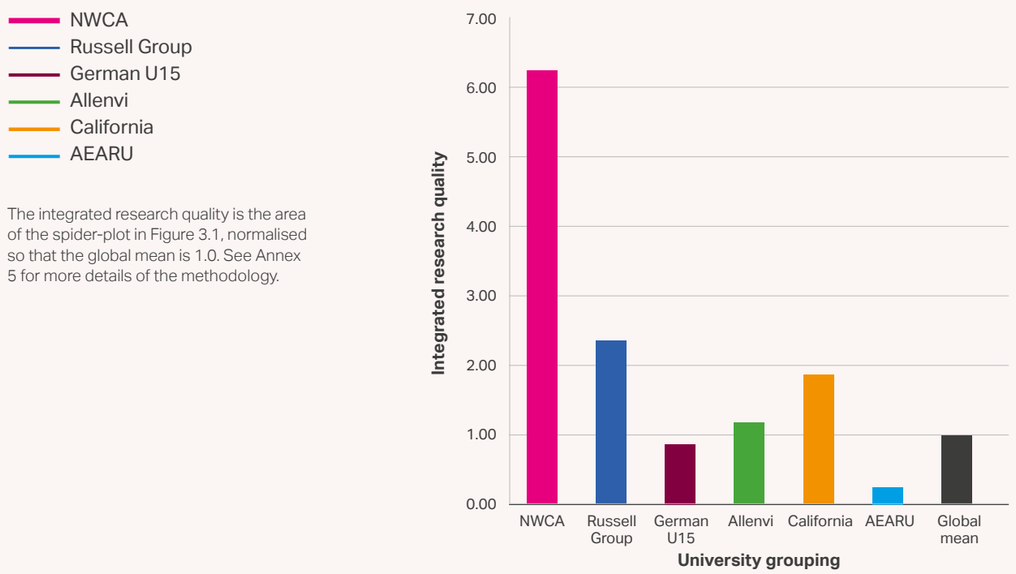


ACS Argonomy and Crop Science
WMD Waste Management and Disposal
WST Water Science and Technology
EE Environmental Engineering
FS Food Science
PS Plant Science

Research quality is measured as the percentage of outputs in the top 1% of cited outputs using SCIVAL, the bibliometric analysis tool of SCOPUS. Data are for the five-year period 2010-2015. See Annex 5 for more details of the analytical methodology.

Figure 3.2

Integrated research quality across Environmental Industries, Technologies and Services for the NWCA compared with other major university groups or regions.



The integrated research quality is the area of the spider-plot in Figure 3.1, normalised so that the global mean is 1.0. See Annex 5 for more details of the methodology.

3.3 Local science and innovation talent

3.3.1 The current workforce and the likely future skills needs and sources

Our audit of the current NWCA workforce relevant to Clean and Sustainable Growth showed the challenge of separating sectors that are strongly inter-linked. For that reason, we cover this across all capabilities in Annex 6. There are also substantial cross-capability overlaps in training provision and need at all levels, so these common elements are also covered in Annex 6, while we focus here on specific skills need and provision for EITS.

One common theme across the EITS sub-capabilities is the need for training that keeps pace with the rapid evolution of the skills needed across these sectors. In Agronomy, Crop Science and Food Sciences training at all levels needs to recognise that the growing emphasis on 'smart production' systems noted in the 25-year plan[6], demands skills very different from the 'traditional' skills of our land-based industries. Within the region, this is exemplified by the £3 million Food and Farming Innovation Technology Centre at Myerscough College (Lancashire), the £8 million National Centre for Horticulture, Environment and Sustainable Technology at Reaseheath College (Cheshire), the Agri-Food Training Partnership (AFTP) a collaboration focused on agri-food training including Bangor University and the 'Food Challenges for the 21st Century' postgraduate training at Lancaster University developed in partnership with Waitrose.

This audit has highlighted the lack of focused training to meet the needs of the Water Science & Technology sector, a notable gap given its economic value and wider significance.

Within the NWCA this need has been recognised, for example, by the PG Cert/Dip/Masters in Water, Energy & the Environment at Liverpool John Moores University, the PG Cert/Dip/Masters in Flood and Coastal Risk Management at Lancaster University, and the Flood Risk, Assessment, Modelling and Engineering (FRAME) Degree in development at the University of Chester.

The new resource-oriented direction of the Waste Management & Disposal sector calls for a transformation in its skill requirements and demand for operational staff with a technical, process-related background[12]. Within the NWCA this need is being met by the Centre for Waste Management at the University of Central Lancashire where a range of postgraduate CPD courses accredited by the Chartered Institute of Waste Management (CIWM) are delivered on a full or part-time basis. Courses focus on Waste Awareness, Resource Solutions and Resource Optimisation for the Low Carbon Economy.

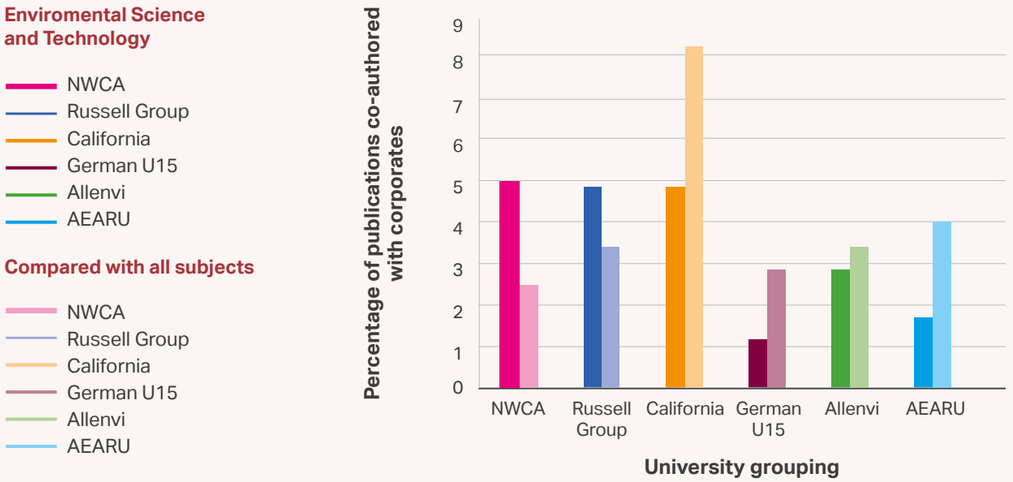
The award-winning Centre for Global Eco-innovation (see p20) has supported over 100 SME led postgraduate level research projects with businesses across Lancashire, Cumbria, Cheshire and Merseyside in the last 5 years. The Centre's pioneering post-graduate programme is designed to give ambitious graduates opportunities to kick-start a well-paid career in the UK and overseas, by linking doctoral-level research with ambitious and growing enterprises. The programme recognises the need for multi-disciplinary skills that go beyond a narrow technology domain and demand a mix of science, management and entrepreneurial thinking as key skill sets.

3.3.2 Evidence-based assessment of the region's existing science and innovation talent

We use here the approach to comparing research quality described in Chapter 2, i.e. defining quality as the percentage of outputs in the top 1% of citations in the field, and comparing the NWCA with leading national and international university groupings, plus California, included here as a region recognised for its leadership in innovation. Even with this very rigorous comparison the quality of the NWCA's research outputs in the EITS subjects is consistently above that of the national and international university groupings chosen as comparators (Figure 3.1). Measured in this way research in the Agronomy and Crop Science, Plant Science and Waste Management sub-disciplines is exceptionally strong, and the three remaining sub-disciplines are also all above all comparators. As a result of this consistent strength across all EITS sub-disciplines the NWCA's integrated research quality in EITS scores 6.2 against a global mean of 1.0, and substantially exceeds that of all the comparators (Figure 3.2). In summary, the NWCA has exceptional strength in depth across EITS and this supports our other eco-innovation capabilities. For example, Waste Management and Disposal is also relevant to Advanced Manufacturing, Chemicals and Materials, while Water Science and Technology relates closely to some elements of Future Energy Systems.

Figure 3.3

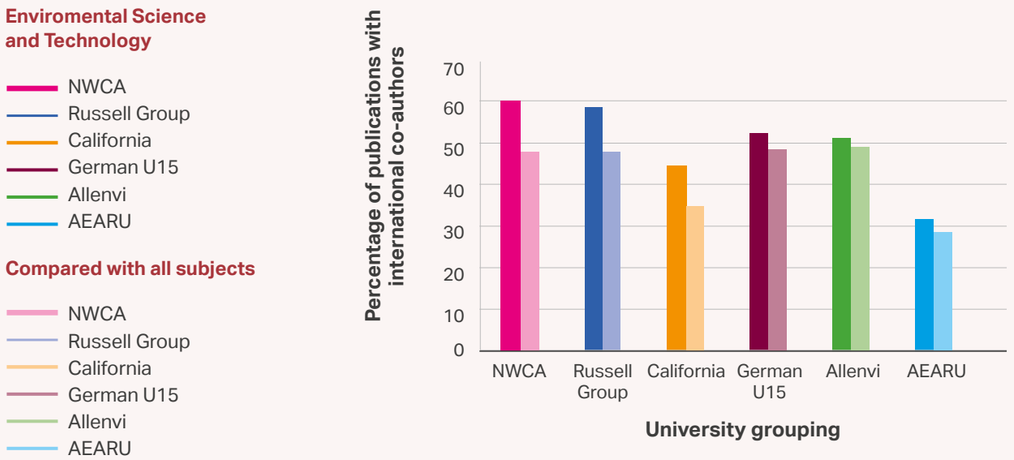
Percentage of Environmental Industries, Technologies and Services (EITS) research outputs co-authored with colleagues from a non-academic (corporate) organisation. Data for the NWCA are compared with other major university groups or regions.



Data are derived from SCIVAL, the bibliometric analysis tool of SCOPUS, for the five-year period 2010-2015. See Annex 5 for more details of the methodology.

Figure 3.4

Percentage of Environmental Industries, Technologies and Services (EITS) research outputs co-authored with colleagues from outside the UK. Data for the NWCA are compared with other major university groups or regions.



Data are derived from SCIVAL, the bibliometric analysis tool of SCOPUS, for the five-year period 2010-2015. See Annex 5 for more details of the methodology.

Environmental Plant Phenotyping Innovation Centre (EPPIC) to support global agri-food productivity

Axion Recycling has grown a business around innovation in polymer recycling. Established in 2002, with two staff, the business is now an SME of c. 100 employees which focuses on using innovative technology and chemical and engineering expertise to produce technology, products and services to increase the amount of recycling product from mainly Automotive Shredder Residue (ASR). The company's technology can separate complex plastic materials from other ASR and produce high quality recycled polymers and products, largely for the construction, drainage, household and storage industry. With the emergence of the circular economy, businesses such as this provide local sustainability development. Due to the majority of the markets served being local, this business adds the key element of traceability to the circular economy.

The success of this business has been aided by a sister consultancy department, which offers expert advice to the sector and enabled the business to build its reputation. Axion's collaboration with Northwest regional universities and Innovate UK/Horizon2020 funding have also been significant, as has the ability to attract graduates in the environmental/sustainability industry. Having technology at the leading edge of the sorting and recycling sector and offering the added value of consultancy services have been identified as key drivers of success.

3.4 National and international engagement

Engagement between the NWCA's research based and national and international research users in EITS is evident from the many assets listed in Section 3.2. Other measures of engagement emerge from the SCIVAL analysis of research metrics for publications with corporate co-authors and publications with international co-authors.

Across all the non-UK university groups audited, a smaller percentage of research outputs are jointly published with corporate co-authors in EITS than expected from the mean across all subjects (Figure 3.3). By contrast, the Russell group and especially the NWCA published more papers with corporate co-authors in EITS research areas than the mean of all subjects (Figure 3.3). In EITS the NWCA publishes more research outputs with corporate co-authors (5.1%) than any of the university groups or regions chosen as comparators, including the Russell group and California (4.9%).

EITS publishes a greater percentage of research outputs jointly with international co-authors than expected from the mean across all subjects (Figure 3.4). This is the case for NWCA and all the groups audited. The NWCA publishes a higher percentage of its EITS research outputs with international partners (61%) than all our chosen comparators. As with the other Prime Capabilities, the NWCA stands up well in terms of publications with international partners, even against these strong comparators.

"I was particularly interested in an industry focused PhD because it would allow me to contribute to fundamental science research alongside creating an opportunity to see a direct real-world impact of my work. There is a global drive for greater partnerships between academic and industry and it was exciting to be able to be a part of a unique scheme."
Stephanie Bryan, CGE graduate researcher with Arcis Biotechnology Limited.

3.5 Developments in the wider funding landscape

3.5.1 The wider landscape

In common with all three Prime Capabilities of this SIA, EITS is closely related to the needs of the Clean Growth Strategy and Industrial Strategy Challenge Fund, and we further see a clear potential fit with the recently announced UKRI Strength in Places programme. The Government's Industrial Strategy identifies Clean Growth as one of the Grand Challenges to put the UK at the forefront of industries of the future. The strategy sets out a comprehensive set of policies and proposals that aim to accelerate the pace of 'clean growth', i.e. deliver increased economic growth and decreased emissions and will be a key driver for investment in innovation via The Industrial Strategy Challenge Fund. This will provide funding and support to UK businesses and researchers and is part of the government's £4.7 billion increase in research and development over the next 4 years. The Smart Cities' Agenda, especially in relation to new housing needs, will lead to increased demand for water and water treatment solutions, in addition to waste processing innovation. Housing growth offers opportunities to design and develop innovative solutions for delivering low carbon homes effectively, alongside retrofitting existing buildings in the public, commercial and domestic sectors.

The National Infrastructure Assessment, published in 2018, is also pertinent as a current focus is overcoming threats to UK prosperity and quality of life by congestion and lack of capacity. Environmental science and technology research is at the heart of understanding these issues, particularly in terms of the priority areas associated with transport, air quality and reducing the risks of extreme weather including drought and flooding.

Transforming Food Production represents £90 million of Industrial Strategy Challenge funding to help business and research to work together to transform food production systems to create a more resilient food supply better able to manage climate change impacts. Funding will be directed towards translation hubs, innovation accelerator funds, demonstrator projects and international research.

This challenge will help find new ways to maintain food supply in a way that cuts pollution, safeguards soils, minimises waste, and protects air quality and water supplies.