Enabling Growth in the New Anglia Life Sciences & Bio-Economy Sector through Skills Development 2017-‘25

New Anglia LEP Sector Skills Plan – Life Sciences & Bio-economy

October 2017

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Introduction

The Life Sciences and Bio-economy is a broad sector, with long established sub-sectors such as human health life sciences with steady growth as well as newer, much smaller but faster growing sub-sectors such as synthetic biology and industrial biotechnology.

Nationally the sector is dominated by human health companies and research, the traditional life sciences sector and, whilst New Anglia has a presence in this market the critical mass of UK investment in core Life Sciences is in London and runs up the spine of the UK with only relatively few companies in Norfolk and Suffolk.

In contrast New Anglia has significant and nationally/internationally important critical mass in the wider bioeconomy, the sector which draws on biology (and links to other sciences), with major markets in dietary health linked to food, marine sciences and equine health science.

There are also exciting new developments from life sciences in areas such as soil health and the role of soil organisms in agriculture as well as the environment and human health.

The New Anglia Life Sciences and Bio-economy sector is therefore defined as containing:

- Human health life sciences including pharmaceuticals, medical devices and medtech;
- Agritech, food and the microbiome (gut, soil and rhizosphere);
- Bioinformatics;
- Equine cluster centred on Newmarket;
- Marine Sciences centred on CEFAS;
- Industrial bio-economy including bio-energy.

During the consultation process a consultee said: ‘most innovation occurs in industry when a mistake happens and a bright person sees how this can be applied’. This sums up the challenge for this sector, to create the conditions whereby chance discoveries can be developed into innovations meeting industrial needs. Traditionally this sector has relied on graduates, but the feedback was that a broader range of skills are needed whether by: equipping graduates with more practical experience; by recruiting young people via (often higher or degree) level apprenticeships to drive uptake of life sciences and bio-technology; or by developing the existing workforce with sector-critical skills in areas such as Big Data.

The sector has real potential for growth, but to do so it is commercialisation which has to be the focus, based on in many cases supporting life sciences and the bio-economy with data processing and industrial processing skills alongside core life science skills. Creating this mix of skills will challenge us all: employers, industry, education and skills providers, but if we can work together consultees believed that we can make substantial progress and grow one of New Anglia’s most important emerging sectors into a real powerhouse of the local economy.

Acknowledgements

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Overview of the Sector

The following four sections set out an overview of the sector, its skills provision and how consultees felt this will change in the next 5-10 years. The appendices and datapack explores these issues in more detail.

1. Sector Definition

The official Life Sciences definition as set out in the UK Life Sciences Strategy[1] is seen as being too narrow for New Anglia as it only focuses on human health and does not include many other industries which use biology and related life sciences. The New Anglia the life sciences sector needs to be seen as part of the wider bio-economy so it encompasses all the major areas using biological sciences locally.

The science economy in New Anglia is a diverse sector, from long established sub-sectors e.g. human health with steady but moderate growth as well as newer, smaller, but faster growing sub-sectors such as industrial and synthetic biotechnology. This is the approach taken by the East of England Science and Innovation Audit[2], a Bioeconomy review for BIS in 2016, the EU's Bioeconomy programmes and at NRP.

In the UK the life sciences sector is dominated by human health and, whilst New Anglia has a presence in this market, the critical mass of UK investment in health research is in London and the Midlands, with only relatively few companies in New Anglia. Norfolk and Suffolk do though have one significant advantage in human health research, based on its stable and relatively elderly population. This makes it ideally suited to the long term study of conditions normally associated with ageing and the linked rapid growth markets.

New Anglia has nationally/internationally important critical mass in the wider bioeconomy, the sector which uses biology (and other sciences) to develop innovations in dietary health, agriculture, marine sciences and equine health. There are exciting new developments from the life sciences research base in areas such as soil health and organisms which affect agriculture as well as the environment and human health.

The New Anglia Life Sciences and BioTech economy sector is therefore defined as:

- Human life sciences including pharmaceuticals, medical devices and technology;
- Agritech, food and the microbiome (gut, soil and rhizosphere);
- Bioinformatics;
- Equine cluster centred on Newmarket;
- Marine Sciences centred on CEFAS;
- Industrial bio-economy including bio-energy.

This broad definition is well aligned with BBSRC and their New Anglia investment. The consultation also showed real demand to link life and bio sciences to ICT, data and engineering to support the growth of the commercial life science and biotech sectors.

The agreed title is therefore the Life Science and Bio-economy Sector Skills Plan.

[1] BIS (2011), Strategy for UK Life Sciences
[2] HMG (2017), East of England Science and Innovation Audit

2. Employment

The New Anglia life science and bio-economy:

- Represents 3.7% of employment and 5.6% of the businesses in New Anglia;
- The sector employs 25,100 people (using the broad bio-economy definition as well as core life sciences), compared to 44,330 in GCGP, 31,300 in the Hertfordshire LEP area and 74,900 in the SELEP area;
- The 3.7% of local employment in New Anglia is virtually identical in Norfolk (3.7%) and Suffolk (3.8%), but less than the 6.6% in GCGP, the 7.4% seen in the Hertfordshire LEP area and 4.7% in SELEP;
- However, the growth seen over the period 2010-'15 at 37% for employment in New Anglia (Norfolk +33%, Suffolk +42%), is much faster than that seen nationally +18% or in the region +16%, or the increases in GCGP +20%, Hertfordshire LEP +9% and SELEP +29%, areas;
- The New Anglia sector has a GVA of £1.6billion, 4.5% of the economy compared to 3.7% of employment, showing that it is a relatively high GVA sector per capita. This GVA is almost equally split between Norfolk and Suffolk.
- Compared to comparator LEP areas the GVA of the sector as with employment is lower than in: GCGP 7.4% of the economy worth £2.8billion (GVA); Hertfordshire 6.1% of the economy worth £2.1billion; and, SELEP 5.5% of the economy worth £4.7billion.

This suggests that the sector is more mature in other areas and that whilst starting from a lower base, the sector is now gathering pace in the New Anglia area.

- At district level over half the districts have seen growth of +43-58% or more in employment in this sector over the period 2010-'15 including in: Broadland, Forest Heath, Ipswich, Mid Suffolk, Norwich, St Edmundsbury and Waveney, with Kings Lynn and West Norfolk recording growth of +92% (from a low base);
- Babergh, Breckland, Great Yarmouth, North Norfolk, South Norfolk and Suffolk Coastal have all seen more modest employment growth in the range +10-27%;
- Most of the growth in employment has been in manufacturing and services with no net increase in the workforce focused on R&D;
- The Location Quotient at 0.9 in 2015 shows that New Anglia still has a smaller sector relative to its total employment base than the national average, whereas GCGP with an LQ of 1.5 is still very strongly represented in this sector. Locally 3 districts have a LQ of more than 1: Mid Suffolk (1.2); South Norfolk (1.3); and, Waveney (1.2);
- The under-performance in employment in New Anglia compared to GCGP, Herts LEP and SELEP areas, is partly explained by fewer business units in the sector, with only 21 per 10,000 population in New Anglia compared to 32 in GCGP, 38 in Herts LEP and 28 in SELEP. This suggests that average business unit size is broadly comparable to these other LEP areas and the smaller sector locally is thus driven mainly by fewer companies in this sector across Norfolk and Suffolk.

National research suggests the sector will continue to grow strongly with Cogent (2015) estimating that between 2015-'25 the science industries need to recruit: 180,000-260,000 new staff, most for replacement demand, but with an estimated 77,000 new jobs created over the decade. Of these it suggests 2/3rds will be professional level jobs (broadly degree level and above) and 1/3rd technical level jobs (via apprenticeships).

Future skills demand In New Anglia is difficult to quantify because of the rapid growth of the industry, the fact that locally since 2010 the sector has grown faster than other areas, but also the acknowledged relative weakness of the commercial sector compared to the research base in Norfolk and Suffolk.

Some sub-sectors, notably the equine sector are also already reporting significant problems with recruitment e.g. with 2,500 stable staff in Newmarket, the industry is reporting a 15% shortfall in current staff availability despite training over 200 new recruits per year. This is potentially exacerbated by the fact that 15% of the staff are from overseas and the numbers from overseas are falling as migration rules are tightened.

In New Anglia, demand will depend critically on the share of commercial growth in the sector which can be secured by Norfolk and Suffolk. As set out below, consultees felt that this was critically dependent on developing a clear economic development vision and plan for the sector in New Anglia.

With these caveats in mind, future demand can be estimated by using the national projections from Cogent and applying this to the local workforce in this sector.

This suggests that, on a 2015 baseline of 25,100 staff in the sector, the demand for new staff will be between 9,690 and 14,245 by 2025 in the New Anglia area, with this made up of:

- A replacement demand in the sector of between 8,520 and 10,016 by 2025;
- Growth in the sector's employment of between 1,170 and 4,140 by 2025.

Of the estimated 2,655 jobs growth (average value) there is projected to be:

- 1,779 Professional level jobs (broadly degree level and above);
- 876 Technical level jobs (via apprenticeships).

3. Skills

Cogent (2015)[3] found that 75% of the biotechnology workforce is qualified to degree level or above. Consultees felt both that this focus on higher level skills is likely to continue, but also that the type of higher education provision needs to change and that there was a need to support the development of more applied training and new higher / degree apprenticeship routes e.g. industry' trailblazers' such as Laboratory Scientist / Laboratory Technician / Science industry Process Plant Engineer degree apprenticeship

Whilst there were 3,100 apprenticeship starts in 2014/15 in the health, life science and biotechnology sector in New Anglia, only 60 of these were outside the health sector, with the health and social care framework alone having nearly 2,700 starts.

Apprenticeships are currently focused on end users of life science technologies and not on the life sciences and bio-economy itself. Consultees feel that the introduction of the Apprenticeship Levy from April 2017 is potentially very significant for parts of the industry and will create a real incentive for change. There is demand for more applied forms of higher education and development of higher, degree and post graduate apprenticeships.

The 11 colleges in the New Anglia Colleges Group[4] educate 32,000 students and 8,000 apprentices per year, with half of their apprentices in manufacturing and engineering. In 'A' Level provision at the Colleges, 61% of students are studying STEM subjects

UEA is a major provider of UG provision for this sector with over 200 graduates per annum in Biological Sciences, as well as Environmental Sciences and Chemistry. The Norwich Research Park Bioscience Doctoral Training Partnership[5] supports PhDs in: food security; bioscience for health; bioenergy and industrial biotechnology; World class fundamental bioscience. Launched in 2014 it will support 125 PhD students over 5 years.

CEFAS has 85 PhD studentships in marine and environmental sciences and runs knowledge transfer and CPD courses for those in the industry. It works closely with UEA. Also in Suffolk the University of Suffolk is developing a growing portfolio of undergraduate provision in life sciences with a specialism in stem cells with a new MSc starting in 2017 as well as undergraduate courses in environmental sciences and health.

The Newmarket equine cluster is a major employer and generator of international business, with an international training role in training future staff for the racing, stud and wider horseracing industry and is the acknowledged global leader in this sector.

Short courses are provided by The Earlham Institute on the extraction and profiling of DNA and JIC has created on line learning tools for wheat breeding globally. The British Beet Research Organisation (BBRO) at NRP runs training days for thousands of industry members each year, with further courses run by NIAB TAG and commercial companies.

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[3] Cogent (2015), Science Industry Partnership: Skills Strategy 2025

[4] City College Norwich, College of West Anglia, East Norfolk VIth Form College, Easton and Otley College, Great Yarmouth College, Lowestoft College, Lowestoft VIth Form College, Paton VIth Form College, Suffolk New College, Suffolk One, West Suffolk College

[5] Run by the John Innes Centre, UEA, the Quadram Institute, The Sainsbury Laboratory and Earlham Institute

4. Opportunities and challenges

Consultees reported that the growth of the Life Sciences and Bio-economy would be focused in their view primarily in the commercial sector. Clearly if New Anglia took a larger share of industry growth, its workforce and skills demand would be higher.

Consultees however, highlighted that New Anglia is not alone in targeting this sector and that to attract growth in the sector it will be essential to focus on areas in which Norfolk and Suffolk have class leading expertise, both research and commercial, and to support this with investment. The key sectoral issues which consultees think will ultimately influence the future scale of the New Anglia life sciences and bio-economy sector are:

- Sector cohesion – this is currently perceived to be very weak, with a lack of business groups, networks and infrastructure to support collaborative action, in contrast to the business networks focused on Cambridge or London and Yorkshire in this sector.
- Commercialisation – this is seen as a significant challenge in Norfolk and Suffolk which has a World class R&D base in significant and growing sub-sectors of life sciences and the bio-economy, but a relatively small commercial sector to exploit this. The exception is the equine sector, the acknowledged global home of the horse racing sector. With this exception, economic development programmes addressing the commercial need would lead to a much larger increase in the demand for skills.
- End User Pull – developing end user 'pull' to apply innovative technology commercially was seen as an important factor in supporting local sector growth.
- Research base – the region is perceived to have a World class research base in some life science and bio-economy topics, with well-developed post graduate training provision drawing some of the best brains in the World to New Anglia. The ability to recruit internationally is seen as critical in sustaining the knowledge base and any potential or perceived, migration controls, are a real challenge to its global standing.
- The importance of New Anglia as a place to attract and retain world class talent.

If these issues are addressed consultees felt that future skills needs will be focused on:

- Commercialisation skills - feedback from employers, the research base itself and other stakeholders all stressed that more commercial skills were needed in future graduates in life sciences and the bio-economy.
- Skills levels and routes – qualification levels in the sector are high with most staff qualified to undergraduate level and above, but demand was reported for both more apprentices and higher apprenticeships up to level 7 to provide staff with the practical experience to drive change and growth in the life sciences and bio-economy.
- ICT, data and maths – consultees reported that skills needs are being transformed by the growth in data, the need for data scientists and for all staff to have advanced data and ICT skills. Consultees felt strongly that the education system at every level has yet to grasp the magnitude of this change. Industry 4.0/Internet of Things is now ubiquitous in health care, the food chain, the environment and resource sectors and requires a step change in skills provision. The demand for staff who combine life sciences with data management and technology skills is growing at every level.

The Plan

5. Sector Skills Plan Delivery

a) Priorities for Action

As a large and important sector in the New Anglia economy the Life sciences and bio-economy sector needs to plan for the skills needed in the future.

Consultees were clear that whilst there is a long list of potential actions by individual organisations or partnerships, it is important to focus these around a few priority areas. These are all areas in which it is believed that it is possible to align employer support with public sector interventions.

All consultees stressed that the priority actions which need taking in this sector in New Anglia are broader than skills, but that there are significant skills challenges which if addressed could help facilitate sector growth.

Through consultation these priority actions have been distilled down into one cross cutting action which is focused on setting priorities for economic growth of the sector locally and sector co-ordination, supported by six indicative skills focused actions which could be taken to help deliver the agreed economic development strategy.

The skills actions are focused on delivering the skills needed in a way which supports sector growth, through encouraging direct commercialisation as well as growth driven by technology pull (e.g. from the NHS) to drive more commercialisation.

The proposed actions are:

- Develop an Economic Development plan for Life Sciences and the Bio-economy in New Anglia as part of the implementation of the New Anglia Economic Strategy (2017);
- Promote the Need for International Recruitment and Training;
- Develop courses which provide more commercial exposure/experience for students to support growth of the bio-economy;
- Support the development of higher and degree apprenticeship routes which combine study with work experience;
- Create projects which focus on increasing ICT, data and maths skills – for both the existing and future workforce;
- Develop Increased Training in sectors Using Life Sciences to Develop ‘Informed Clients’ to Create a Market Pull for Life Science Innovation;
- Develop a New Anglia network of Education & Training Centres for Life Sciences and the Bio-economy.

The action plan below, initially focused on these six areas, should be kept under review by the proposed New Anglia Life Sciences and Bio-economy Group. As actions are delivered, the Group should seek to consult with employers and industry, to refresh, update and add to the action plan.

b) Economic Development Plan for Life Sciences & the Bio-economy

Consultations showed that the New Anglia Life Sciences and Bio-economy sector is conscious that it needs a much clearer economic development plan, which builds on the region's strengths in life sciences and the bio-economy to facilitate economic growth.

The lack of local business networks for the sector, little co-ordination of bio-economy growth and many un-coordinated actions means that the sector itself felt that the considerable growth potential it has is not being fully realised compared with comparator regions.

Consultees argued that to progress the sector it was important to:

- Have a clear plan to grow the Life Sciences and Bio-economy in New Anglia;
- Agree a leadership structure for the sector in New Anglia;
- Work collaboratively to develop the skills of the sector.

New Anglia Life Sciences and Bio-economy Plan – a clear vision and economic development plan is needed for the sector to identify the sub-sectors the New Anglia Life Sciences and Bio-economy growth should focus on.

As set out in Annex 1, the new Economic Strategy for Norfolk and Suffolk (2017) commits to developing a commercially led plan a number of 'competitive cluster(s) close to global centres', including Life Sciences and Biotechnology'. Each plan will be designed so that it:

- Encourages new companies and commercial investment.
- Establishes global and national links.
- Maximises local supply chain benefits.
- Markets the commercial opportunity.
- Develop the ecosystem that enables the cluster to thrive.

Focussing on our specific sectoral opportunities will deliver real value in sector specific interventions. This will drive economic benefits across our indicators and themes.

The consultations for this skills plan found strong support for this approach in the Life Sciences and Biotechnology sector.

The plan should include detailed analysis of the areas Norfolk and Suffolk can lead, given its research base and existing and potential business clusters. This must include benchmarking against comparator regions in the UK and overseas.

The plan needs to consider how the sector can benefit from other clusters e.g. ICT and digital in Ipswich (because of the growing importance of digital technologies in the bio-economy) and, other emerging economic development programmes such as the A11 Technology Corridor (given the strength of the bio-economy sector in Cambridgeshire and as Newmarket is located on the A11).

The development of the plan should also build on the East of England Science and Innovation Audit work in Spring 2017 (see annex 2). This sets out at regional level the areas in which the region is strong, including: Life Sciences; AgriTech; ICT and Digital: Advanced Manufacturing, which are the same as four of New Anglia's key sectors. Furthermore the SIA promotes the need to see the overlap between these four sectors as a major growth opportunity. This is in line with the feedback from all consultees, which stressed the need for life sciences to link to these other sectors.

One further suggestion from consultees was to use this process to agree on a small number of 'Grand Challenges' which respond to major strategic needs at regional or global level, in which New Anglia has research strengths aligned to commercial or sectoral expertise. These 'Grand Challenges' should be used to guide investment.

This plan also needs to set out the spatial dimension of growth, building on clusters such as NRP, equine science in Newmarket and marine science in Lowestoft.

Subject to the outcome and informed by the process to develop a commercially led plan for sector growth, consultees felt that Norfolk and Suffolk should seek to develop a sector leadership group and promote more collaborative working across the sector locally:

Sector Leadership Group – there is a need to develop a leadership group to provide a focus for economic investment in the life sciences and bio-economy in New Anglia. This group should be formed as an outcome of with the work on the economic growth plan as set out above, so that the group can take ownership of, help to lead and ultimately facilitate the delivery of the sector growth plan.

Feedback from consultees suggests a strong interest in promoting the local sector, which several consultees argued is currently not well represented, despite the area having one of the strongest biotech clusters in the UK. Consultees felt in particular that the local strength of the sector is not recognised outside the region which makes it hard to attract staff or new employers to the region. They felt that this must include promoting a proactive policy to attract global talent.

A number of consultees volunteered to help contribute to this process (see annex 1), although further representation and support from the business community needs to secured.

Co-ordination of Skills Development – consultees argued strongly that improved networking would help to develop the links between the knowledge base, companies and economic support for this sector and in doing so promote the essential role of knowledge exchange in facilitating continuous professional development.

Consultees reported that the relative lack of networks and engagement by industry in existing generic business networks is a major limitation to growth. This is of growing importance given that so many of the economic opportunities in the sector will require more than one organisation to collaborate and/or the development of cross sectoral links as highlighted in the East of England Science and Innovation Audit (2017).

A very strong message was that any action taken to develop sector co-ordination should build on the work of existing regional and local networks which cover some or all of the bio-economy. AgriTech East, One Nucleus and Hethel Innovation are all currently working on aspects of the sector. Supporting these existing groups is seen as the best way to address this shortcoming. This avoids the delays of creating new networks, builds on existing infrastructure and helps give companies who participate access many more contacts from the start of their engagement. These networks should be encouraged and supported were appropriate to help lead the actions on skills and knowledge exchange highlighted in the subsequent indicative action plan.

New Anglia should also explore the potential to use its local networks, to link to national initiatives on skills for the sector such as the Science Industry Partnership, co-ordinated by Cogent on behalf of the industry. This programme aims to support recruitment to the science industry nationally, with an aim by 2020 to deliver 20,000 apprentices and £3m of new investment into regional skills initiatives[6].

c) Proposed Skills Interventions

The need to develop an industry led Development Plan for the sector is agreed as the first stage in developing the Life Sciences and Biotechnology sector and is a key commitment in the Economic Strategy. In developing this plan, the following six indicative skills actions are proposed as ideas which this planning process should consider based on the skills challenges and opportunities raised by consultees.

Given the current perceived lack of co-ordination within the sector, most consultees felt that many of these actions could be delivered largely within existing resources through better co-ordination, collaborative working and by aligning actions on skills with other interventions in the sector. The indicative actions are divided into:

Short term (2018-'19):

- Intervention 1 – Promote the Need for International Recruitment and Training
- Intervention 2 – Increase Commercial Experience Opportunities in Education and Training Courses

Short to medium term (2019-'20):

- Intervention 3 – Develop Higher & Degree Apprenticeship Routes into the Sector
- Intervention 4 – Create Projects Focused on Increasing ICT, Data and Maths Skills linked to the Life Sciences and Bio-economy

Medium to longer term (2020-onwards):

- Intervention 5 – Develop Increased Training in sectors Using Life Sciences to Develop 'Informed Clients' to Create a Market Pull for Life Science Innovation
- Intervention 6 - Develop a New Anglia network of Education & Training Centres for Life Sciences and the Bio-economy

[6] Cogent Skills (2016), Science Industry Partnership: Operational Plan 2016

Intervention 1 – Promote the Need for International Recruitment and Training

Rationale: The life sciences and bio-economy are an international sector, whether at in health, food and agriculture at NRP, in the marine sector at CEFAS or equine cluster in Newmarket. All of these are internationally recognised centres with a strong history of attracting overseas residents to study or work in their centres.

Maintaining these international links are critical to sustaining the international standing of all these centres. Increasing restrictions on overseas students, potential consequences from Brexit and stricter rules on the movement of international staff, represents a real threat to the future growth of the life sciences and bio-economy sector in the region.

Action to be Taken:

The sector has to ensure that it presents a clear argument to explain why international recruitment of students and staff is good for the industry and the challenges that restrictions on movement would create both in the short and longer term. Staff recruitment and challenges with obtaining study visas for students (from short courses to post graduate level) are already impacting across the sector at levels from stud farm staff to international research centres. There is a need to make the economic case for maintaining migration both to supply the staff and skills needed in the short to medium term in the region, but more importantly to ensure that the region's international economic links are maintained and developed. For example training the next generation of international leaders in this sector has long term commercial benefits through trade.

Specifically this action needs to focus on making the case for:

- Positioning New Anglia as a great career location for globally-recognised scientists
- International staff to work in training, research and industry to bring global skills to the industry and the required workforce.
- International students on accredited courses including postgraduates and post docs who are essential to the future position of the research sector in the region;
- International students on non-accredited, but industry sponsored courses e.g. the courses offered by the National Stud at Newmarket;
- International investors and entrepreneurs in the life sciences and bio-economy, including former graduates who wish to develop businesses or programmes in the UK.

Leadership: the action needs to be led by the sector group once established and work with local education providers and research centres for whom international connectivity is critical to their position and future growth.

When: given the impending changes to movement of people due to Brexit, it is essential that this issue is addressed in 2018.

Resources and support: this action is primarily about making the case for an outward facing, internationally engaged approach to education and research. As such the main resource requirement is for partners in the region to share their experience and agree a common lobbying position to ensure that international connectivity is enhanced and not constrained by changes in the UK's future external relationship.

Intervention 2 – Increase Commercial Experience Opportunities in Education and Training Courses

Rationale: Whilst a number of programmes already exist which allow for work experience and internships for science students, most do not currently have credits attached to them and are thus voluntary, meaning that many learners and graduates choose not to access them and are thus not as well prepared for commercial roles as they could be. There is a need to support bio-economy growth by equipping students with the skills needed to commercialise research and support the delivery of innovation in the sector.

Action to be Taken:

A challenge with this action is that anecdotal evidence suggest that whilst most employers want staff with practical experience or a mix of scientific, data and business skills, many students do not choose to study these options particularly at undergraduate level. The action therefore needs to combine direct action by skills providers with a focus on engaging student interest in and commitment to changing the course choices they make.

The action that is needed is therefore to:

- Scope out the potential for an explicit cross-life sciences knowledge transfer strategy
- Start earlier during the student journey and improve the careers advice so that students recognise as soon as possible the skills they need for their careers. The aim must be to encourage them to select courses and work experience opportunities which broaden their career options;
- Encourage providers to work with employers to develop case studies of successful career paths which have been followed students to show how skills in subjects such as business, commercialisation and data can lead to a good career;
- Develop credit systems which reward students for work experience placements, whether whole years in industry, shorter placements over the summer or integrated into the course, to provide a real incentive to participate in these programmes;
- Develop specific programmes to support students who wish to develop commercial skills by for example partnering with business schools on modules in commerce;
- Recruit additional employers who can offer commercial work placements, including potentially offering Case studentships in the Doctoral Training Partnership.

Leadership: the action needs to be led by the main providers of student education e.g. science departments in Colleges, UEA, UoS and NRP, but should be developed with industry and other providers who can provide the business courses needed by students. The opportunity to link more postgraduates to business courses of the type run by Hethel in the Go BIO programme should also be taken.

When: given the range of existing initiatives there is already a good base to build on, but further action should start immediately given the imperative to address this challenge.

Resources and support: the resources to deliver this intervention are already largely in place, but require some changes to course structures, more engagement with life science employers and a commitment to promote commercial skills with students.

Intervention 3 – Develop Higher & Degree Apprenticeship Routes into the Sector

Rationale: recruitment to the sector is almost universally via graduate level or above entry, despite some employers reporting that graduates can be over-qualified, can lack the practical skills needed and can block entry to the sector for those with other qualifications. In parallel the introduction of the apprenticeship levy will directly affect many of the larger employers e.g. the NHS, Universities, research centres and larger companies in the sector and create a financial incentive to increase apprenticeship provision.

Action to be Taken:

Employers and providers should create routes for more of the local workforce to obtain the skills needed to support the growth of the Life Sciences and Bioeconomy sector by combining study with work experience via apprenticeships and other courses. This also includes a need to promote the sector to non-traditional entrants who have not seen the life sciences sector as a career option (in equine, bio sciences etc.).

This action should focus on meeting the skills needed for scientific ancillary roles (including in the NHS), process engineering and manufacturing to support growth of manufacturing companies in the bio-economy.

Additional partnership working between FE Colleges and the research base to support alternative routes into Life Sciences should be supported, e.g. by growing the provision of science based Access to HE courses for older learners to build on existing provision e.g. at CCN, CoWA and others or by offering routes with lower 'A' level grade requirements. This will help a broader group of people access careers in the sector.

Similarly post graduate apprenticeships, as an alternative to MSc and PhD programmes, could meet the need for applied scientists, process engineers and business skills in the bio-economy. As L7 apprenticeships are developed, New Anglia should seek to lead on this development for the life sciences and bio-economy. To do this it is important for post graduate providers e.g. UEA and Norwich Research Park, to develop links with larger employers who could support post-graduate apprenticeships.

Leadership: providers including West Suffolk College, College of West Anglia (with ARU), City College Norwich and UEA/NRP amongst others are all looking at this type of provision and should work together to develop a regional offer.

When: the move to apprenticeships is taking place now as the apprenticeship levy begins to impact on employers (including large research bodies in this sector and the NHS) and the aim should be to develop and introduce new higher apprenticeship provision for the life sciences and bio-economy sector by 2018/19.

Resources and support: no specific resources are needed to deliver the majority of this action as employers are already seeking new provision and providers are responding to this demand. Some facilitation of connections between providers and major would help to accelerate the process, promote this approach to additional employers and help to secure a regional focus on this area of activity.

Intervention 4 – Create Projects Focused on Increasing ICT, Data and Maths Skills linked to the Life Sciences and Bio-economy

Rationale: the life sciences and bio-economy are increasingly using data and ICT tools to conduct research, develop innovation and provide new tools for end users. Across all consultees there was a recognition that the demand for digitalisation, ICT and data management would grow strongly, but that the supply of these skills was already under pressure and is not responding fast enough to meet employer needs. It is recognised that this is not unique to life sciences and therefore to address this challenge further work to link life sciences employers and centres with bodies such as Connect EB which promotes education business partnerships and runs STEM ambassador programmes is needed.

Action to be Taken:

To address this challenge fundamental changes which increase the supply of STEM skills are needed if the local workforce are to benefit from the high quality jobs available in science and linked informatics and data processing. Action is needed across all age groups, but consultation stressed the need to include schools and alternative training programmes for those under the age of 18 to ensure that the enthusiasm which many young people have digital skills is channelled and developed. Suggested actions include:

- Developing challenge led tasks on coding, data analysis and data enabled technologies (such as automation), which can be used with young people based on life sciences problems, but which require ICT or data skills to address them. These challenges should be promoted with schools, Colleges and youth organisations;
- A programme of Hackathons for young people should be developed alongside Tech East, Stepintotech, Innovation Martlesham and life sciences centres e.g. NRP, CEFAS to help young people exploit their ICT skills whilst solving life science challenges;
- Working with UTCs, Colleges and other providers to create technical education centres to bridge schools, UTCs, FE and HE provision to create a clear progression pathway for young people who want to apply technology skills. Consultees also supported the creation of new applied HE centres which focus on vocational HE.

In addition to the practical actions taken, New Anglia should seek to promote changes to structural funds (post Brexit) which allows them to support short courses for any age group (including school age) which target commercial applications of new technology.

Leadership: this action needs to link end user demand from employers in industry and research to the ICT/Digital sector (via TechEast), STEM promotion via Connect EB, British Science Association programmes and specialist local providers such as Stepintotech.

When: this action is medium term, but should start by 2018 with an aim to make a substantial impact by 2020.

Resources and support: funding interventions will be needed to increase the supply of ICT skills, but the exact nature of these will be determined by developing a business plan to increase ICT skills for the science sector. The initial stage is to work with the New Anglia Digital and ICT cluster to understand how to deliver a programme for this.

Intervention 5 – Develop Increased Training in sectors Using Life Sciences to Develop 'Informed Clients' to Create a Market Pull for Life Science Innovation

Rationale: the region has a serious and growing shortfall in health care staff (partly due to current reliance on migration). One solution is to invest in technology, but to do this end user training has to ensure that staff have the skills to adopt new technology. If the local health service can accomplish this it will create a pull for new medical technology from the research and innovation base, which in turn would support a stronger local med tech economy by providing the testbed for new life sciences innovations.

Similar arguments were also made for equipping private sector end users of life science technology with the skills to exploit innovative life science and biotechnology. Major sectors in which this is relevant include AgriFood Tech, Energy, Water and Advanced Manufacturing, where life sciences have the potential to have a transformative effect.

Action to be Taken:

The key actions needed to deliver this are to bring a range of training and education providers together to link those offering end user courses with specialist life science provision. The new provision could be offered as specific modules or pathways within existing courses.

The main focus should be on:

- Courses in nursing and clinical training which allow those entering the medical profession to gain an understanding of how new technology from life sciences, ICT and data could be applied so that they become 'expert clients' able to use technology to drive efficiency gains in the NHS and other health and care settings whilst increasing the local demand for medtech. There is seen to be a particular need for this amongst senior nursing staff given the potential for technology in this area;
- Similarly creating additional life science and bio-economy routes and modules for students in agriculture, food, energy and manufacturing courses would help to ensure that the industry has the skills needed to take up new bio-economy opportunities.

Leadership: this action requires collaboration between the NHS, other end users of life science innovations e.g. Anglian Water, food companies and training providers in both the health and bio-economy sectors with the life science innovation base, to collaborate on the delivery of courses on life science and biotechnology innovation.

When: it is recognised that this is a more challenging issue to address and will require development as education and training providers in other sectors will need to be engaged. It is therefore proposed to seek to start to action this by 2019/20 and develop it further in the years thereafter.

Resources and support: the resources to deliver courses are in place as the existing life science education centres have the expertise to deliver appropriate content, but modest resources will need to be utilised by all partners to collaborate on designing and implementing this new provision.

Intervention 6 – Develop a New Anglia network of Education & Training Centres for Life Sciences and the Bio-economy

Rationale: current provision of education and training for Life Sciences and the Bio-economy in New Anglia lacks co-ordination. New providers are also emerging and others are re-developing or expanding their provision. Greater co-ordination of provision would promote an easier to navigate system for employers and strengthen progression pathways for young people and those already in the sector.

Action to be Taken:

There is a need to bring providers together to:

- Promote career and progression opportunities, particularly for students who have not considered this sector, don't have a clear understanding of the breadth of opportunities provided or who don't have the grades to access traditional degree provision;
- Create targeted progression routes between providers to help students fulfil their potential and via Access to HE courses in science for older workers;
- Help employers understand what provision is available locally with a particular focus on helping potential inward investors recognise the breadth of training and education in the sector in New Anglia so that they are attracted to the area.

New or expanded life science provision is also being developed by a range of providers:

- West Suffolk College is currently developing a new science centre which will link life science, ICT and engineering expertise in new purpose built facilities to serve primarily the New Anglia and Cambridge markets;
- College of West Anglia developing new life science provision to serve both West Norfolk and Cambridgeshire from its base in Kings Lynn. It is looking at potential models from elsewhere to develop a centre supported by industry with industry standard provision.

Linking this new or expanded provision with established provision at UEA, University of Suffolk and other centres including CEFAS and Newmarket, would create a strong partnership approach with good geographic coverage across New Anglia.

Leadership: the proposed sector leadership group should lead this action.

When: the timescale for developing additional provision to meet employer needs will vary between the proposed centres, but New Anglia should seek to develop better co-ordination between centres on marketing and promotion by the beginning of 2019 and to have a network and linked progression routes in place by 2020.

Resources and support: the new centres proposed are substantial investments which will require public sector and/or industry investment. Routes exist to secure funding for these developments although funding is heavily competed for; a clear economic and skills rationale would need to be developed by partners. The wider need to bring a network of providers together has a much more modest cost and could become a key focus for the sector group proposed above, to help the area co-ordinate investment in skills.

Appendix A – Method and Consultees

Sector Skills Plan Development Process

The development process for the Life sciences and bio-economy Sector Skills Plan was overseen by a task and finish group, which met in February and June 2017.

The development of the plan was also informed by a meeting held by Norfolk County Council in March 2017 to help shape its response to the Industrial Strategy focused on the bio-economy and a meeting with New Anglia LEP, Norfolk and Suffolk County Council representatives in July 2017.

In addition to this sector skills plan, a supporting datapack has been developed which outlines the current workforce in the sector, trends in its skills levels and how the local Life sciences and bio-economy sector in New Anglia compares with other areas.

This datapack also reports on the underlying socio-economic context for the industry locally and reports on projected changes in future skills needs and current student numbers.

The datapack is presented as a separate document and provides the data to underpin many of the comments made in the sector plan and should be used as a reference source which is read in conjunction with the plan.

Consultees

A series of key informant interviews were conducted with a mix of employers, sector skills providers and representative bodies. In total over 30 consultees were interviewed in depth and/or attended the meetings held or provided other direct input (several of whom attended more than one meeting). These consultees included:

1. Aaron Hunter, Hethel Innovation and project manager of Go BIO ERDF programme to commercialise biosciences at Norwich Research Park
2. Dr Alastair Forbes, Norfolk and Norwich University Hospital (NNUH)
3. Claire Riseborough, stepintotech
4. Colin MacEwan, British Beet Research Organisation (BBRO)
5. Dr Belinda Clark, AgriTech East
6. Dr Ben Miller, UEA (Bio) and Eastern ARC
7. Dr David Compton, Prosynth Ltd.
8. Dr Jonathan Clarke, John Innes Centre
9. Dr Liliya Serazetdinova, Knowledge Transfer Network (KTN)
10. Dr Sally Ann Forsyth, Norwich Research Park
11. Dr Steve Dorling, Weatherquest Ltd and UEA
12. Dr Steve Feast, Eastern Academic Health Science Network
13. David Carlin, CEFAS
14. Tabitha Smith, The National Stud
15. Tim Robinson, TechEast
16. Vitty Danino, Anglian Water
17. Sheila Childerhouse, NHS Chairman and farmer
18. Dr Nigel Davies, Muntons

19. Marie Francis OBE, Adapt Group Ltd.
20. Simon Coward, Hethel Innovation
21. Duncan Gregory, British Racing School
22. Caroline Turnbull, the Thoroughbred Breeders Association
23. Eve Cronin, Norfolk County Council
24. Jasmine Joolia, Suffolk County Council
25. Karen Smith (UEA)
26. Lindsey Johnson, West Suffolk College
27. Michael Gray, New Anglia Local Enterprise Partnership
28. Nic Bury, University of Suffolk
29. Nicola Currie, Easton and Otley College
30. Nikos Savvas, New Anglia Colleges Group
31. Professor Brendon Noble, Plymouth Marjon University
32. Richard Stittle, West Suffolk College
33. Shaun Hindle, College of West Anglia
34. Vince Muspratt, Norfolk County Council
35. David Henley, Easton and Otley College
36. Chris Starkie, New Anglia Local Enterprise Partnership

Task and Finish Groups were held on:

- 27th February 2017 at Norwich Research Park
- 21st June 2017 at Norwich Research Park

In addition a further six people attended a meeting run by Norfolk County Council on the Bioeconomy on 3rd March 2017 attended by the SkillsReach team to feed into the national Industrial Strategy consultation:

- David Henley, Easton& Otley College
- Dr Ruth Welters, UEA
- Norfolk County Council: Eliska Cheeseman, David Dukes, Jan Feeney, Jo Middleton

The SkillsReach team also attended a meeting on the New Anglia Strategic Economic Plan review on 19th June in King's Lynn, which discussed the need for skills with partners in industry, the education sector and public sector in West Norfolk.

Appendix B – Summary of the DataPack and Additional Sector Intelligence

Sector Definition

Defining the Sector focus

The official Life Sciences definition as set out in the UK Life Sciences Strategy[7] is seen by consultees locally as too narrow as it only focuses on human health and does not include many other areas which draw on biology, related life sciences and new emerging areas.

Consultations have shown that in New Anglia the life sciences sector needs to be linked with the bio-economy as this encompasses all the major areas which are important locally, both to the innovation base and commercial sector.

Furthermore, the consultation process stressed the need to link to end users across the bio-economy. Not only will this respond to local needs, it will also align developments in this sector with major funding bodies such as BBSRC, national policy and EU policy, all of which are increasingly focused on inter-disciplinary science which supports the bio-economy.

In the EU the Bio-based Industries public private partnership is using Horizon 2020 to invest €3.7billion in the industry from 2012-'20[8], focused on bio-refining Further afield in America, a national blueprint for the bio-economy[9] was published in 2012.

Consultees also reported that life sciences companies which have traditionally focused only on human health are also now working in other sectors where the same technology and science base can be exploited.

The agreed title is therefore the Life Science and Bio-economy Sector Skills Plan.

Sector Definition

The science economy in New Anglia is a diverse sector, from long established sub-sectors such as human health life sciences with steady but moderate growth as well as newer, much smaller, but faster growing sub-sectors such as industrial biotechnology.

Other processes at regional, national and international level are increasingly linking the health and medical sector to other sectors which utilise 'life sciences' or biological science expertise to support growth. This is the approach taken by the East of England Science and Innovation Audit, a Bioeconomy review for BIS in 2016, the EU's Bioeconomy programmes and locally in the project Hethel Innovation are co-ordinating at NRP utilising ERDF support.

Nationally the sector is dominated by human health companies and research, the traditional life sciences sector and, whilst New Anglia has a presence in this market, the critical mass of UK investment in core Life Sciences is in London and the Midlands, running up the spine of the UK, with only relatively few companies in Norfolk and Suffolk.

Notwithstanding this concern about ensuring a broader focus than only the human health aspects of life sciences, consultations with those in the health industry highlighted that Norfolk and Suffolk have one significant advantage in human health research, based on its

[7] BIS (2011), Strategy for UK Life Sciences
[8] Bio-based Industries Paprtnership, www.bbi-europe.eu
[9] The White House (2012), National Bioeconomy Blueprint

stable and relatively elderly population cohort. This makes it ideally suited to the long term study of conditions which are normally associated with ageing and, in turn, the development of solutions for these conditions and diseases which are increasingly rapidly in the UK and globally as the population ages.

This focus on health is reinforced by the presence locally of the Norfolk and Norwich University Hospital, the largest in the region, which is closely aligned with the research base.

New Anglia has significant and nationally/internationally important critical mass in the wider bioeconomy, the sector which draws on biology (and other science as well), with major markets in dietary health linked to food, marine sciences, equine health.

There are really exciting new developments from the life sciences research base in areas such as soil health and the diversity of organisms which can both affect agriculture as well as the environment and human health.

The New Anglia Life Sciences and BioTech economy sector is therefore defined as containing:

- Human health Life Sciences including pharmaceuticals, medical devices and medical technology;
- Agritech, food and the microbiome (gut, soil and rhizosphere);
- Bioinformatics;
- Equine cluster centred on Newmarket and Marine Sciences centred on CEFAS;
- Industrial bio-economy including bio-energy.

This broader definition is well aligned with BBSRC and their investment in the New Anglia science base.

The consultation has also shown a real demand for linking life and bio sciences ICT, data and engineering skills to support the growth of the commercial life science and biotech sectors. Indeed, the link to bio-informatics and the need for digitally enabled technologies is a major emerging theme in this sector where Innovation Martlesham and computing and data sciences at NRP/UEA have a major role to play. All consultees agreed that big data and its manipulation will drive future growth of the sector and creates significant skills challenges.

The Life sciences and Bio-economy Sector in the New Anglia LEP area

Scale of the UK and Global Life Sciences and Bio-economy Sector

A review of the bio-economy for BIS in 2016[10], reported that the total UK bio-economy industry is worth £56billion in GVA in 2014 and employed 981,000 people. Of this farming and the food chain generated £32.2billion, forestry £4.5billion, the water industry £12.1billion and industrial biotechnology and bioenergy £7.2billion.

The UK Life Sciences industry had a turnover of £50billlion in 2011 (BIS 2011), split between pharmaceuticals at £31billion and medical technology at £18billion. The sector was estimated to employ 165,000 people and spent £5billion per annum on R&D.

Cogent (2015)[11] found that some of the national Life Sciences and Bio-economy sub-sectors saw rapid changes in workforce size with industrial biotechnology increasing its workforce by 164% since 2010 (from a low base) and the more established medical technology sub-sector grew by +60%.

A 2016 report showed that the Med Tech sub-sector in the UK contained over 3,400 companies, generated sales of £22billion and employs 122,000 people (up 9.5% in 5 years)[12], with the earlier 2015 version of the same report estimating the Compound Annual Growth Rate (CAGR) for this sub-sector at 12% per annum. New Anglia has partnered with GCGP and Eastern Academic Health Science Network (EAHSN) to run the MedTech Accelerator to help fund innovations in this sector.

In contrast the pharmaceutical sector saw its workforce decline by 3% and that in chemicals by 25% (Cogent 2015). The East of England had the third largest science workforce at 50,000, beaten only by the South East at 78,000 and North West at 65,000. However, in the East of England analysis by PWC (2017)[13], shows that there were only a limited number of medium and larger companies in the Life Sciences industry in Norfolk and Suffolk, with most concentrated in Cambridgeshire, Bedfordshire, Hertfordshire and Essex.

The UK bio-renewables sector is growing strongly with a 2013 government report showing that the industrial biotechnology sector had a compound annual growth rate of 11% for turnover and 5% for employment over the period 2009-2013[14]. This report also found that:

- Utilising biomass as a chemical feedstock could bring potential benefits of £8billion by 2030 and was 'an essential focus for increasing the opportunity for innovation'.
- Improving current biotechnology by adopting smart industrial processes could add a further £4-12billion per annum to the economy by 2030.
- The global food retail sector was worth $4.3trillion in 2015 & is growing at 6% per annum[15]. Using the best estimates available for the food service sector suggests that

[10] Capital Economics, TBR and E4Tech (2016), Evidencing the Bioeconomy, for BBSRC and BIS
[11] Cogent (2015), Science Industry Partnership: Skills Strategy 2025
[12] HM Government (2016), Strength and Opportunity 2016: the landscape of the medical technology and biopharmaceutical sectors in the UK
[13] PWC (2017) The Economic Contribution of the UK Life Sciences Industry
[14] HM Government (2015), Building a high value bioeconomy: opportunities from waste
[15] US Department of Agriculture (USDA) Economic Research Service (2013), Global Food Industry

the total food market is worth approximately $7trillion, which is nearly five times the value of the global automotive market (circa $1.5trillion in 2015[16]).

- The reasons for increased demand have been well rehearsed by a large number of reports in the last decade, the most notable of which is the Foresight Report[17] which predicted that global food demand would rise by 50% by 2030 and 60-100% or more by 2050.
- Global agriculture was valued at $3.9trillion in 2013 of which crops contributed $2.64trillion and livestock $1.26trillion. Whilst the growth of non-food crop continues, on a global basis their farmgate value, $0.12trillion, is still much smaller than the market for food[18].
- Globally the bio-renewables sector is seeing rapid growth, with the House of Lords[19] reporting that the global renewable chemicals market was worth $57billion in 2013 and predicted to grow to $83billion by 2018. This report also stated that utilising biomass as a chemical feedstock could bring potential benefits of £8billion by 2030 and was 'an essential focus for increasing the opportunity for innovation' and that improving current biotechnology by adopting smart industrial processes could add a further £4-12billion per annum to the economy by 2030.
- In Europe, using a wider definition of the bioeconomy, the EU has reported that the industry is worth €2trillion and employs 22million people (9% of total employment)[20].

This suggests that within the overall sector, there are big changes happening with some sub-sectors growing strongly whilst others are seeing falls in employment and/or sales.

Whereas in the past much of the focus has been on growing crops specifically for the bio-economy, attention is now more focused on utilising co and by products, or 'waste', with the UK estimated to have 100million tonnes per annum of carbon containing waste including 14million tonnes per annum of crop and forestry residues.

Even converting 25million tonnes per annum of this to relatively low priced bio-ethanol would yield 5million tonnes per annum of biofuel worth circa £2.4billion (HM Government 2015).

The growth in the demand for biofuels, timber and other natural products is driven by both environmental policies and consumer demand. The recent global climate change deal in Paris in December 2015[21], with its more ambitious target to keep global temperature increases to 1.5oC is likely to reinforce the trend towards using plant based, biomass products to replace fossil fuels.

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[16] Statista (2015), Revenue of the leading automotive manufacturers worldwide in 2014
[17] Beddington, Professor Sir John, Government Office for Science (2011), Future of Food and Farming: final project report
[18] FAO (2015), Macro Statistics
[19] House of Lords Science and Technology Select Committee, 3rd Report of Session 2013–14 (2014), Waste or resource? Stimulating a bioeconomy
[20] Europa (2012), Commission proposes strategy for sustainable bioeconomy in Europe
[21] UN Framework Convention on Climate Change (12th December 2015), newsroom, Historic Paris Agreement on Climate Change: *195 Nations Set Path to Keep Temperature Rise Well Below 2 Degrees Celsius*

Food waste is a major challenge and improvements are clearly possible with recent reports[22] suggesting that nearly 1/3rd of food is wasted globally and programmes around the World showing that improvements can be made.

There have been attempts over many years to tackle this area, but they have tended to be policy led e.g. the government backed Waste and Resources Action Plan (WRAP). However, the rising cost of ingredients, concerns over margins and growing consumer interest is now encouraging the food chain to look seriously at waste reduction. Waste reduction is also a sensible option if wishing to reduce carbon footprints.

The waste agenda is also supported by the push across Europe to develop the bio-economy, with significant research funds now focused on this area e.g. Horizon 2020[23]. The Horizon 2020 programme has grouped the bioeconomy together with agriculture under the title 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy'.

United Kingdom households waste an estimated 6.7 million tonnes of food every year, around one third of the 21.7 million tonnes purchased. This means that approximately 32% of all food purchased per year is not eaten. Most of this (5.9 million tonnes or 88%) is currently collected by local authorities. Most of the food waste (4.1 million tonnes or 61%) is avoidable and could have been eaten had it been better managed (WRAP, 2008; Knight and Davis, 2007)[24].

The EU has also identified a series of 'Societal Challenges'[25], which are long term, strategic areas the EU needs to address, including (of 7 challenges):

- Number 1: Health, demographic change and wellbeing;
- Number 2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy.

The New Anglia Life Sciences and Bio-economy Sector

In addition to consultation the review process has collated data on sector employment and how this compares to other LEP areas.

The headlines from this work show that (see datapack for more details):

- Life sciences and biotech represents 3.7% of employment and 5.6% of the businesses in New Anglia;
- The sector employs 25,100 people (using the broad bio-economy definition as well as core life sciences), compared to 44,330 in GCGP, 31,300 in the Herts LEP area and 74,900 in the SELEP area;

[22] FAO (2014), Food losses and waste in the context of sustainable food systems: A report by The High Level Panel of Experts on Food Security and Nutrition
[23] EU Commission: Bio-economy, http://ec.europa.eu/research/bioeconomy/index.cfm?pg=home
[24] United Nations Environment Programme (UNEP): Food Waste Facts
[25] EU Horizon 2020: The EU Framework Programme for Research and Innovation: Societal Challenges, http://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges

- The 3.7% of local employment at LEP level is virtually identical in Norfolk (3.7%) and Suffolk (3.8%), but well behind the 6.6% seen in GCGP, the 7.4% seen in the Herts LEP and 4.7% seen in SELEP. Regionally the figure is 4.8% and 4.4% for England;
- However, the growth seen in this sector over the period 2010-'15 at 37% for employment in the sector in New Anglia (Norfolk 33%, Suffolk 42%), is much faster than the national +18%, regional +16%, GCGP +20%, Herts LEP +9% and SELEP +29%. This suggests that the sector is more mature in other areas and that whilst starting from a lower base, the sector is now gathering pace in the New Anglia area;
- At district level over half the districts have seen growth of +43-58% or more in employment in this sector over the period 2010-'15: Broadland, Forest Heath, Ipswich, Mid Suffolk, Norwich, St Edmundsbury and Waveney, with Kings Lynn and West Norfolk recording growth of +92% (from a low base);
- In contrast Babergh, Breckland, Great Yarmouth, North Norfolk, South Norfolk and Suffolk Coastal have all seen more modest employment growth in the range +10-27%;
- Most of the growth in employment has been in manufacturing and services with no net increase in the workforce focused on R&D;
- The Location Quotient at 0.9 in 2015 shows that New Anglia still has a smaller sector relative to its total employment base than the national average (figures above 1 show a higher proportionate share than the national average), whereas GCGP with an LQ of 1.5 is still very strongly represented in this sector. Locally 3 districts have a LQ of more than 1: Mid Suffolk (1.2); South Norfolk (1.3); and, Waveney (1.2);
- The under-performance in employment in New Anglia compared to GCGP, Herts LEP and SELEP areas, is partly explained by fewer business units in the sector, with only 21 per 10,000 population in New Anglia compared to 32 in GCGP, 38 in Herts LEP and 28 in SELEP. This suggests that average business unit size is broadly comparable to these other LEP areas and the smaller sector locally is thus driven mainly by fewer companies in this sector across Norfolk and Suffolk.

Skills provision data shows that:

- New Anglia had just over 3,100 apprenticeship starts in the 2014/15 year in the health, life science and biotechnology sector, but only 60 of these were outside the health sector, with the health and social care framework alone having nearly 2,700 starts;
- UEA is a major provider of UG provision for this sector with over 200 graduates per annum in Biological Sciences, as well as large but declining numbers in Environmental Sciences and Chemistry;
- The 11 colleges in the New Anglia Colleges Group[26] educate 32,000 students and nearly 8,000 apprentices per year, with half of all their apprentices in manufacturing and engineering. In 'A' Level provision at the Colleges 61% of students are studying STEM subjects.

The New Anglia Life Sciences and Bio-economy Research Base

[26] City College Norwich, College of West Anglia, East Norfolk VIth Form College, Easton and Otley College, Great Yarmouth College, Lowestoft College, Lowestoft VIth Form College, Paton VIth Form College, Suffolk New College, Suffolk One, West Suffolk College

Hethel Innovation, is facilitating the ERDF supported Go Bio programme run from Norwich Research Park to support the bio-economy. Its early work shows that[27]:

- Norfolk and Suffolk have about 30 companies with 1,600 staff locally in the core life sciences and biotech sector out of an English total of 1,320 companies. However, this does not include the scientists and support staff employed at Norwich Research Park, the equine sector or marine sciences (see below). Relative to population share, this suggests that the LQ for this sector commercially (in terms of business count) is less than 0.75, which given the strength of the local research base suggests a challenge in commercialising the science base locally;
- New Anglia only came 15th out of 29 LEPs in the share of Innovate UK funding received for sustainable agri-food projects, despite having the largest research base of any LEP supporting this sector.

The ERDF supported Go Bio programme run from Norwich Research Park to support the bio-economy is focused on three sub-sectors:

- Industrial biotech: food fermentation; waste processing; chemical manufacturing; bioengineering; synthetic biology;
- Med tech and med biotech: sensors, tests and imaging; surgical and therapeutic; medical devices; assistive technology; digital health; small molecule drugs; biologics; medical 'omics; synthetic biology;
- Agribio: precision agriculture; breeding and transgenic organisms; genomic cataloguing; molecular diagnostics and disease control.

The research base is also a significant provider of post graduate training with a global reputation and therefore attracts leading scientists from across the World.

Norwich Research Park (NRP) includes 3 of the national 8 BBSRC strategic institutes (JIC, IFR and Earlham Institute):

- The John Innes Centre (JIC) - is the number 1 ranked plant science centre in the World;
- The Earlham Institute (formerly The Genome Analysis Centre – TGAC) - has in the last decade been established as a leading centre for genomic analysis;
- The Sainsbury Laboratory - is privately funded and linked to JIC working on plant sciences;
- Institute of Food Research (IFR) - is the only nationally funded food research institute in the UK;
- British Beet Research Organisation (BBRO) - is funded by industry and based at NRP;
- The UEA and Norfolk & Norwich University Hospital both work on dietary health and will merge their dietary teams with IFR in 2018 to form the new Quadram Institute, a £81m investment to create a national centre for dietary health.

NRP has five strategic areas of focus:

- AgriTech

[27] Hethel/Go Bio (2017), Sector Intelligence reports for agribio, med tech and med biotech, industrial biotech

- Industrial biotech
- Food, health and microbiome
- Medbio
- Bio-informatics

Norfolk County Council held a bio-economy discussion March 2017 to feed into its response to the Industrial Strategy and reported that:

- Norwich Research Park is acknowledged as having the fourth greatest concentration of 'most highly-cited researchers' in the UK, after London, Oxford and Cambridge. Home to around 40 science and IT based businesses. With over 12,000 employees, 3,000 scientists, 14,000 students and an annual research spend of over £100 million, the Norwich Research Park is Europe's leading centre for research in Food, Health and the Environment:
  - 6 major research institutions;
  - 74 companies (many of which are knowledge led spinouts and start-ups working in the Life sciences and bio-economy sector)
  - World class assets in plant, microbial and environmental science;
  - Research excellence relevant to global 21st century challenges on Food and energy security, Healthy ageing, Living with environmental change.
- Norwich University Hospital has an annual turnover of c. £550m with 7,300 staff and c. 1,100 beds making it the 6th biggest stand-alone hospital in the UK. It is the regional host for the clinical research network and the Norwich Clinical Trial Unit has phase 2/3 capability with research themes in cardiovascular, diabetes, dementia, musculo-skeletal, nutrition, psychology, respiratory and stroke. Within these themes they are investigating medical and nutritional interventions, screening, rehabilitation, lifestyle modifications and health service delivery. There is experience in designing and running a wide variety of trials including trials of complex interventions. The NNUH is the largest hospital in the region and supports other hospitals, thus ensuring that it is well placed to test developments. The stability of the Norfolk population (compared to other areas) also facilitates the delivery of cohort studies
- UEA itself is 10th in the UK for the quality of its research output with 82% per cent of the research classified as 'world-leading' or internationally excellent in the Research Excellence Framework (2014).
- Norfolk is home to 3 out of the 8 UK Biotechnology and Biological Sciences Research Council (BBSRC) strategically funded institutions

The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) is based in Lowestoft and employs 450 people, of whom approximately 350 are based in Lowestoft and 100 in Weymouth.

Over 1/4 of its staff are PhD qualified and it has c80 PhD studentships and c12 Apprentices. 23% of its workforce is international (EU and non EU). CEFAS in a strategic alliance with UEA and uses their courses to help meet its demand for graduates.

CEFAS offers 7 service areas:

- Research advice and consultancy with a history of over 100 years work for government and other clients
- Emergency response
- Laboratory services and analysis
- Modelling
- Programme management and training (bespoke training courses for clients in the UK and overseas)
- Surveys
- Technology

Newmarket Equine Cluster

Newmarket is acknowledged as the centre of global equine science and has a number of key strategic assets including:

- The Animal Health Trust (AHT) is a 75 year old charity which works with dogs, cats and horses. The Trust now employs 285 people including vets, nurses, scientists and support staff and has a turnover of £15m. AHT offers a range of work experience for local school children and researchers, and formal training for residents, interns and student nurses. Its work covers four areas:
  - Veterinary services providing care for very sick (and injured) dogs, cats and horses
  - Scientific research into cures and treatments from lab to clinic
  - Expertise in preventing disease, from providing specialist advice to developing new vaccines that stop diseases and conditions from occurring in the first place
  - Education and training programmes developing and supporting the next generation of veterinary and scientific specialists
- The National Stud provides Apprenticeships, QCF and non QCF qualifications to assist young people wishing to join equine sector, with a focus on equine breeding. With circa 20 apprentices per year it has also recently started an industry led diploma in stud management and works with the Thoroughbred Breeders Association. The racing industry uses apprenticeships but is concerned at their complexity and many employers prefer to use non-accredited courses. Non-accredited courses have, however, caused challenges with overseas students obtaining study visas.
- British Racing School is a specialist provider of training in racing and associated management skills. With 70 horses and 50 staff the school turnovers £3m per annum training future jockeys and those who want to take up management roles in the industry with a range of courses from tasters and L2/L3 apprenticeships to foundation degrees (with Warwickshire College) and a graduate development programme. It is the largest provider of training to the racing industry in the UK.
- Rossdales Newmarket is a specialist veterinary practice with 40 veterinary surgeons and 100 support staff with bases at. Beaufort Cottage Stables in the centre of Newmarket is the headquarters. This also hosts Rossdales Laboratories, an established market leader delivering comprehensive diagnostic laboratory referral services specifically for equine veterinary practitioners from across the UK and EU.

- Newmarket Equine Hospital is the largest equine hospital in Europe with 45 veterinary professionals. It provides 2 or 4 week placements for veterinary students and hosts CPD events for the equine medicine sector.

A 2017 update to the 2014 report on Newmarket's Equine Cluster[28] reports that the cluster has continued to grow with the cluster now estimated to support 3,597 direct jobs in 2016 (9.5% more than in 2012). The 213 Veterinary Surgeons or researchers, represent a 24% increase over the period 2012-'16 and are estimated to contribute £7.7m to the economy in GVA. This report also says that: 'the main qualitative finding is the continuing and probably increasing international orientation of the cluster … and several of the interviewees for this updating exercise felt that the cluster's standing has improved'.

AgriTech links to Life Sciences and the Bio-economy

In addition to links to NRP there are a number of experimental farms in the region including Morley run by NIAB TAG, which also operates the STAR project in Suffolk. There are also trial sites for many companies including, for example, those run by Europe's largest seed company Limagrain, at Woolpit in Suffolk and Docking in Norfolk.

Other companies such as Muntons and British Sugar in the food sector have their own R&D programmes.

Anglian Water is increasing its investment in research and innovation and has established the Anglian Centre for Water Studies with UEA, which will work on water quality and other issues, drawing on life sciences expertise at UEA.

AgriTech East is a major cluster organisation specifically focused on the industry and the Eastern Agritech Initiative run alongside it provides locally responsive grants for applied research and development.

The strength and breadth of the research base is built on a highly skilled workforce drawn from across the World and attracted to Norfolk and Suffolk by the global reputation in agritechof centres such as the John Innes Centre. International recruitment has therefore been a longstanding feature of this sector.

[28] SQW (2017), Newmarket's Equine Cluster: the economic impact of the horse racing industry centred upon Newmarket – a short update to the 2014 report

Links to Other Sector Skills Plans

The consultation for the life sciences and bio-economy sector has identified that links to other key sectors in the economy are essential for future growth, both through:

- Linking to sectors which provide the skills needed to deliver growth in the life sciences and bio-economy e.g. ICT and digital, advanced manufacturing;
- Providing the end user markets for life science and bio-economy innovations e.g. AgriFood Tech, Energy.

In addressing the skills needs of life sciences and the bio-economy, these linkages with other sectors are critical.

ICT and Digital

The use of data analysis and big data platforms is at the heart of the life sciences and bio-economy research and commercial deployment. Consultees reported that staff with skills in both biological sciences and ICT/data were in particular demand and commanded much higher salaries than staff who only had one of these two skill sets.

Big data analytics and digital sensors are leading to the Internet of Things (IoT), which is being taken up in the NHS (to monitor health); in bio-processing to monitor production and in the agrifood sector to monitor agriculture and food production. Consultees reported that the uptake of these types of technology was being hampered by a shortage of staff who could apply ICT and digital skills in practical contexts in industry.

Advanced Manufacturing

Consultees reported that a big limitation in growing the life sciences and bio-economy sector in New Anglia was the need for process engineering skills which they considered to be weak in Norfolk and Suffolk. As sectors such as bio-refining, bio-materials and medtech grow engineering and advanced manufacturing skills are essential to take innovative products to market in a cost effective way.

Consultees saw the need to develop process engineers with specific skills in designing, scaling up and running plants which process biological raw materials.

AgriFood Tech

The link to life sciences has two main dimensions: the use of life sciences to develop more productive farming and food systems; and, the development of food which has enhanced health benefits to respond to consumer trends and thus open up new markets for the food chain. UK agricultural policy has promoted the need for sustainable intensification with reports including Food 2030 (2010), the Foresight Report (2011)[29] and the UK Strategy for Agricultural Technology (2013)[30] , promoting the need to increase production whist addressing the sector's environmental footprint.

[29] Foresight report (2011), Global Food and Farming Futures
[30] Her Majesty's Government (2013), A UK Strategy for Agricultural Technologies

In the Food 2030[31] paper the Government also highlighted that poor diet is estimated to account for a third of all cancer cases, and a further third of cases of cardiovascular disease. Obesity has more than doubled in the last 25 years and increases the risk of developing Type II Diabetes, cardiovascular disease and some cancers[32]. Healthy Lives, Healthy People published in 2011[33] reported that 23% of adults are obese; 61.3% are either overweight or obese. It estimated that the costs to society and the economy of being overweight or obese were almost £16bn in 2007, with a potential rise to just under £50bn in 2050 if the rise in obesity rates continued.

The relationship between health and food is a major concern to the NHS given the costs of poor dietary choices. It is also leading to new markets, with reports suggesting the global health food market could reach £220billion by 2017[34] and the nutraceuticals market will grow at 7% per annum to reach €35billion by 2020[35].

Energy

New Anglia has been developing biomass and biofuel production from agricultural, food chain waste and forestry. Anaerobic digestion in particular is a technology which requires the use of life sciences expertise. Work at NRP on fermentation, yeasts and bacteria are all very relevant to this sector. They should be seen alongside work to fractionate biomass into a range of components, bio-refining, with the more valuable components extracted for use in many different process industries with the remaining by-product used in AD or similar technologies.

[31] Her Majesty's Government (2010), Food 2030
[32] Foresight (2007) Tackling Obesities: Future Choices
[33] HMG (2011), Healthy Lives, Healthy People: a call to action on obesity in England
[34] Metro.co.uk (30th January 2014), Companies grow fat as you slim: the growth of the weight loss market
[35] Food & Drink Europe (10th August 2015), In 2020: Global nutraceuticals market to be worth €35billion

Current Skills and Training Provision

Centres and courses

The provision of New Anglia skills and training for the Life sciences and bio-economy sector is broad and includes:

- Schools, College and VIth form provision of apprenticeships, science A levels and equivalent;
- UEA and University of Suffolk degree and post graduate courses;
- Specialist programmes run by research centres including the centres at Norwich Research Park and CEFAS;
- A large range of commercial companies and partnerships who offer courses and training events directly to industry.

Cogent (2015)[36] found that the science workforce is out of line with most other sectors, with 75% of the biotechnology workforce qualified to degree level or above. Consultees felt both that this focus on higher level skills is likely to continue, but also that the type of higher education provision needs to change and that there was a need to support the development of more applied training and new apprenticeship routes into the industry.

Whilst there were 3,100 apprenticeship starts in the 2014/15 year in the health, life science and biotechnology sector, only 60 of these were outside the health sector, with the health and social care framework alone having nearly 2,700 starts.

Apprenticeships are currently focused on end users of life science technologies and not on the life sciences and bio-economy itself. Consultees feel that the introduction of the Apprenticeship Levy from April 2017 is potentially very significant for parts of the industry and will create a real incentive for change. There is demand for more applied forms of higher education and development of higher, degree and post graduate apprenticeships.

The 11 colleges in the New Anglia Colleges Group[37] educate 32,000 students and 8,000 apprentices per year, with half of their apprentices in manufacturing and engineering. In 'A' Level provision at the Colleges, 61% of students are studying STEM subjects.

Access to HE course provision also includes courses specifically focused on life sciences such as those offered at City College Norwich which runs an Access to HE course targeted at the use of sciences in the health sector[38]. College of West Anglia offers Access to HE provision in both Dentistry and Medicine and Science and Nursing and Veterinary Nursing at its Cambridge campus. West Suffolk College offers Access to HE in both Nursing and Science.

These Access to HE courses are aimed at those over the age of 19 who did not progress to HE previously and most local provision is linked to the Cambridge Access Validating Agency

[36] Cogent (2015), Science Industry Partnership: Skills Strategy 2025
[37] City College Norwich, College of West Anglia, East Norfolk VIth Form College, Easton and Otley College, Great Yarmouth College, Lowestoft College, Lowestoft VIth Form College, Paton VIth Form College, Suffolk New College, Suffolk One, West Suffolk College
[38] City College Norwich, Access to Higher Education: Science for Health Practitioners

(CAVA) which supports provision at College of West Anglia, City College Norwich, Easton and Otley College, Suffolk New College and West Suffolk College.

UEA is a major provider of UG provision for this sector with over 200 graduates per annum in Biological Sciences, as well Environmental Sciences and Chemistry.

The Norwich Research Park Bioscience Doctoral Training Partnership is a PhD programme run by the John Innes Centre, UEA, the Quadram Institute, The Sainsbury Laboratory and The Earlham Institute. It is focused on: food security; bioscience for health; bioenergy and industrial biotechnology; World class fundamental bioscience. Launched in 2014 this £12.5m programme aims to support 125 PhD students over 5 years.

The Earlham Institute at NRP provides training in how to extract DNA, profile and analyse the results for the workforce. It also trains PhD students and other researchers and is one of a very small number of centres globally with this expertise or provision. Course attendance is 75% from the UK with 30% drawn from BBSRC supported research centres, but also draws on students from all continents. The Earlham Institute is, however, known to be concerned that potential course applicants are disproportionately male.

JIC has created an online learning tool www.wheat-training.com to help wheat researchers and companies globally access information on how to breed wheat varieties and step by step guides for research crops and genomics.

CEFAS has 85 PhD studentships in marine and environmental sciences and runs knowledge transfer and CPD courses for those in the industry. CEFAS works closely with UEA. It offers a range of training courses utilising the skills of its scientific and technical staff, which it offers to clients in the UK and overseas.

Also in Suffolk the University of Suffolk is developing a growing portfolio of undergraduate provision in life sciences with a specialism in stem cells with a new MSc starting in 2017 as well as undergraduate courses in environmental sciences and health.

The Newmarket equine cluster is a major employer and generator of international business, with an international training role in racing, stud and horseracing practice, science and management and is the acknowledged global leader in this sector. Training is provided at the British Racing School, National Stud and in conjunction with the Thoroughbred Breeders Association and via specialist vets practices in the cluster (which host many students for both short and long term placements).

Training in the Equine Sector includes:

- The British Racing School (BRS) in total trains over 1,000 people per year with 220 young people entering the UK industry, 50-60 overseas students per year and a wide range of CPD provision for those in the industry or who are progressing in their career. There is strong training at entry level, although the industry needs to reach out more to attract entrants from non traditional backgrounds and, strong career progression at the higher technical and managerial levels (including an MBA focused on the racing sector). The main challenge is to retain more of those trained initially as they start to progress their career and to provide the training and linked career progression to help them

progress in the industry. The BRS has a Tier 4 licence (for L3+) and also for example runs international courses for jockeys;

- The National Stud trains 20 apprentices per year and runs a range of short and CPD courses for the industry. It is just starting a diploma course focused on older recruits new to the industry, which is receiving every good support from employers.

The British Beet Research Organisation (BBRO) at NRP runs training days for thousands of farm and ancillary industry members each year, with further courses run by NIAB TAG and commercial companies covering the application of life sciences in the agri-food sector.

The 11 colleges in the New Anglia Colleges Group[39] educate 32,000 students and nearly 8,000 apprentices per year of with half of all apprentices in manufacturing and engineering. In 'A' Level provision 61% of students are studying STEM subjects. Particular interest in life sciences and the bio-economy is focused on:

- West Suffolk College – which is in the process of developing a new Science Centre which links science, engineering and data skills to meet the needs of employers in the New Anglia are and Cambridge
- College of West Anglia (CoWA) – CoWA also have aspirations to offer a degree in biosciences in conjunction with Anglia Ruskin University and to develop expanded bioscence facilities

[39] City College Norwich, College of West Anglia, East Norfolk VIth Form College, Easton and Otley College, Great Yarmouth College, Lowestoft College, Lowestoft VIth Form College, Paton VIth Form College, Suffolk New College, Suffolk One, West Suffolk College

Skills Supply Challenges and Future Skills Needs

National research from Cogent[40], the sector skills body for the science industries, has been actively working on identifying skills gaps in the industry. It defines the science based economy as having three major divisions:

- Life science & healthcare: pharmaceuticals; med biotech; medical tech;
- Industrial sciences: food and drink; energy; chemicals and materials;
- Primary production: livestock; marine; agriculture.

The Cogent (2015) Skills Strategy for 2025 is linked to its Science Industry Partnership. This identified headline skills needs in five key enabling technologies

- Informatics and big data, where it reported a tenfold increase in demand in the past 5 years with advertised salaries now averaging £55k, 24% higher than other IT sectors. Other research shows that 90% of respondents reported a medium or high concern about being able to recruit staff with informatics, computational and statistical skills. Furthermore, evidence also shows that over 60% of existing staff in the sciences recognised that they needed to improve their statistical skills;
- Synthetic biology and biotechnology is a developing sector and whilst still relatively small is growing quickly. Employers report needing more practical skills to grow their businesses and feeling that graduates often lack the skills needed to manage production processes;
- Advanced manufacturing is growing in importance with the advent of continuous flow processes, which is accelerating the need for IT, CADCAM and process engineering skills. Employers also reported wanting more production managers with the business skills to assess new production processes and access new sources of funding;
- Formulation technology is being hampered by the lack of technicians who can take new formulations and scale them up to industrial scale. This sub-sector is also critically dependent on ICT skills as processes are increasingly automated;
- Materials science is being used in a wider range of fields and enabling new medical technologies. Staff who can bridge the gap between materials science and medical technology are in particular demand.

Cogent (2015) also identified the following cross cutting skills as essential to the delivery of these enabling technologies:

- Inter-personal skills: leadership; team working; communication skills;
- Commercial: business skills; international business awareness; commercial and intellectual property awareness; translational skills (science to practice); regulatory awareness; quality management; problem solving; project management; interdisciplinary skills;
- Quantitative skills: computational skills; mathematics and statistical skills;
- Knowledge transfer and capture.

[40] Cogent (2015), Science Industry Partnership: Skills Strategy 2025

The KTN has recently consulted with its Plant Sciences Board and reported that[41] the board members (many with an agri-food sector background) made the following comments on skills needs in the sector:

- Need to improve the educational pipeline. Need to teach / train the right skills (including practical skills).
- Need to incentivise new students to go to the agri-food sector. Reduce tuition fees / increase quota.
- Support the vocational education system.
- Improve school curriculum to deepen the knowledge about agri-food systems (including an understanding of agriculture and food manufacturing).
- Increase the number of practical (hands-on) courses in colleges and Universities for agri-food knowledge and skills. Increase the amount of "practical" work at HEIs.
- Preserve and support FE colleges in agriculture.
- Encourage more apprenticeships, and funding for apprenticeships.
- Invest in "trainers" by developing their expertise about business needs.
- Fund and encourage more practical experience in agriculture and biology. Support more outreach from businesses and HEIs to schools.

Future Skill Needs

Anticipated Trends in the Key Determinants of Future Skills Demand

Cogent (2015) estimates that between 2015-'25 the science industries needed to recruit:

- 180,000-260,000 new staff, most for replacement demand, but with an estimated 77,000 new jobs created over the decade
- Up to 142,000 professional level jobs (broadly degree level and above) and up to 73,000 technical level jobs (primarily via apprenticeships)

Of the sub-sectors relevant to Life Sciences and Bio-technology, the following national anticipated skills needs are foreseen:

Sub-sector	Sector workforce 2014	Forecast demand for staff 2015-'25	Replacement demand	New jobs – sector growth
Medical technology	88,000	46-63,000	34,000	12-29,000
Pharmaceutical	70,000	21-32,000	21-31,000	0-1,000
Medical biotechnology	23,000	21-36,000	12,000	9-24,000
Industrial biotechnology	2,600	1,200-1,500	800	400-700

Estimating New Anglia Sector Employment Demand to 2025

[41] Dr Liliya Serezdetinova, KTN personal communication

National demand based on the Cogent 2015 report:

National from Cogent Report 2015	Sector Workforce 2014	2015 - 2025					
		Demand Forecast		Replacement Demand		Jobs Growth	
		Low	High	Low	High	Low	High
UK SIP Employment	459,000	177,200	260,500	155,800	184,800	21,400	75,700
England SIP Employment (85%)	392,150	151,392	222,560	133,109	157,885	18,283	64,675

Clearly the national demand estimate from Cogent shows a large range particularly for jobs growth. The data from which this report was developed was also collated before the vote to leave the EU and, given the additional uncertainty this has created, anecdotal feedback from the industry suggests that there is even more uncertainty now over the growth prospects for the industry over the next decade.

National demand based on BRES Data (2015) which includes demand in the broader sector is projected to be:

Using BRES 2015 figures	Sector Workforce 2015	2015 -2025					
		Demand Forecast		Replacement Demand		Jobs Growth	
		Low	High	Low	High	Low	High
England	1,120,800	432,692	636,097	380,437	451,250	52,255	184,847
Sector multiplier	2.9						
		Demand Forecast		Replacement Demand		Jobs Growth	
		Low	High	Low	High	Low	High
England		39%	57%	34%	40%	5%	16%

This national data has then been translated into New Anglia demand based on the share of national workforce locally. What is clear in the national data and thus carried forward locally, is the large uncertainty in terms of some of the projected future demand, most notably in relation to jobs growth with a national range of 5-16% change projected over the decade to 2025.

New Anglia Estimates:

New Anglia	Sector Workforce 2015	2015 - 2025					
		Demand Forecast		Replacement Demand		Jobs Growth	
		Low	High	Low	High	Low	High
Life Sciences	25,100	9,690	14,245	8,520	10,106	1,170	4,140
		Average	11,968	Average	9,313	Average	2,655

Of the estimated 2,655 jobs growth (average value) projected for New Anglia there is estimated to be:

- 1,779 Professional level jobs (broadly degree level and above)
- 876 Technical level jobs (via apprenticeships)

Consultee Feedback

Consultees reported that the growth of the Life Sciences and Bio-economy would be focused in their view primarily within the commercial sector. Clearly if New Anglia could take a larger share of this growth, it would be expected that its workforce and skills demand in the sector would be higher than the current East of England Forecasting Model suggests.

Consultees however, highlighted that New Anglia is not alone in targeting this sector and that to attract growth in the sector it will be essential to focus on areas in which Norfolk and Suffolk have class leading expertise and to support this with investment. This creates real uncertainty in relation to future skills needs because the magnitude and type of skills required will depend markedly on New Anglia's relative success in attracting investment in this sector.

The industry also has major concerns about increasing restrictions on migration and the potential erosion of free movement after Brexit. As international sectors they attract a global workforce and students whether in health, the bio-economy, equine or marine sciences. This global base is seen as being essential to the future of the sector.

Consultees stated that the life sciences is a 'global game' and that new Anglia has to attract the best from across the World and have a churn to refresh the talent pool. To do this the UK market must remain open to migrants who bring expertise, ideas and the number of staff needed for the workload in the region – the fear is that unless this is achieved the UK will not remain World class and other global centres will be happy to step into the gap this creates.

Another overarching issue raised by consultees was that UEA is a real powerhouse for science graduates and so there is no shortage of potential graduate scientists. If anything there are too many for the current local jobs market to absorb and there is therefore a need to focus on growing the life science industry to keep home grown talent in the region post-graduation. Anecdotal feedback also suggests that 50% of UEA science undergraduates think they will end up in R&D, but only 10% ultimately go into research, so the rest need to gain the business and/or process engineering skills for jobs in the commercial sector.

In contrast the racing industry in Newmarket is reporting a major recruitment challenge, particularly for entry level jobs. With 2,500 staff employed in racing stables in Newmarket, the industry already has a 15% shortfall in staff (this is also true nationally) with a further 15% of the workforce being from overseas. Overseas recruitment is becoming much more restricted due to tightening of rules on migration and the anticipation is that this will continue.

The key skills issues which consultees think will ultimately influence the future scale of the sector and thus its skills needs in New Anglia are:

- **Sector cohesion** – this is currently perceived to be very weak, with a lack of business groups, networks and infrastructure to support collaborative action. Most of those consulted do not see the Norfolk and Suffolk area as one in which the support for this sector is strong, with many consultees contrasting this with the business networks focused on Cambridge or London (health clusters and emerging clusters in the Midlands and Leeds) and Yorkshire (bio-economy).

The presence of strong local clusters for this sector in neighbouring areas, especially Cambridge, was seen as a challenge as the success of these other clusters draw in companies and staff, for whom the cluster effect is seen as important in helping them to progress their growth or careers. Whilst staff who live in New Anglia can work in these neighbouring clusters, this does not optimise the economic potential in the local economy of this sector. West Suffolk College also reported that many of the students they train in life sciences are then employed in Cambridgeshire. There is also anecdotal evidence of companies relocating to Cambridge from New Anglia to access the skills base available there.

The consultees said that entrepreneurs clubs and business networks including venture capitalists, specialist accountants and advisors were needed. In New Anglia it would also be important to link to engineers to help fuel commercialisation.

However, there were mixed views on whether and how they believed this should be addressed, with several consultees questioning if the LEP was the right level to do this at, given that the sector is international, diverse and highly technical. Some consultees thus argued that they gain more value by linking to regional, national or international business groups and networks focused on their specific sub sector. The preferred option was in the main to seek the expansion and extension of existing networks so that they ran more events in New Anglia.

- **Commercialisation** - is seen as a significant local challenge given that the sector in Norfolk and Suffolk has a World class R&D base in several significant and growing sub-sectors of life sciences and the bio-economy, but as shown by the data, has a relatively small commercial sector to exploit this research strength. Economic development policies and programmes which addressed this successfully would lead to a much larger increase in the demand for skills in the sector.

  A significant number of consultees also reported that UEA was so successful in attracting undergraduates to life sciences disciplines, that local employers had no shortage of highly qualified applicants and that in fact the problem was the lack of a large enough commercial sector to absorb the numbers produced each year.

  Whilst consultees recognised that the UEA is a national/international provider, the view was expressed that given the local supply of graduates, regional growth could be enhanced in this sector if more were retained locally after graduation.

  There is a concern that existing support programmes for the commercial sector nationally (and with EU funding) often don't engage global companies as they tend to focus on SMEs. Large companies are the route to market and thus need to be actively supported to engage sector growth. It was felt that New Anglia place marketing needs investment to support this sector as a go to location for training, commercialisation etc.

  Globally in some sub-sectors e.g. the use of life sciences in the food chain, consultees said that companies are forging ahead of the research base as they both horizon scan globally and seek to protect their own IP. To ensure that local graduates are ready for this there is a need to help more undergraduates go into industry or pursue FE/Higher

Apprenticeship routes to prepare them for work in industry. At post graduate level more use of KTPs and mini KTPs or professional internships in PhD programmes, would help drive commercialisation.

Similarly linking to Business Schools was seen as important. Commercial business skills, team working and skills in delivering innovation were seen as growing in importance. This focus on linking life sciences skills to other disciplines was a repeated theme of the feedback and was supported by all types of stakeholders given the rapid changes taking place in the industry.

There was also a view that we need to encourage more young people into science and to see the linked manufacturing sectors as attractive careers. It was felt that apprenticeships are a good way to equip young people with the skills needed for this, especially if they were higher apprenticeships which combined the study of life sciences with engineering and management skills.

However, apprenticeships were not universally supported with some sub-sectors, e.g. equine, saying that many employers were concerned that there was too much focus on apprenticeships which they found to be too bureaucratic and not well aligned with their needs. Other sub-sectors, e.g. in research centres, said that apprentices would not meet most of their staff needs and did not have the support of some employers. Even where these reservations were raised, this was mainly targeted at FE apprenticeships, with most consultees supporting an expansion of higher (degree level) and post graduate apprenticeship routes.

- **End User Pull** – similarly in the health sector, problems with recruitment are acute, with recent reports (13th June 2017) suggesting EU nurse recruitment has fallen by 90% since Brexit, with this supporting anecdotal evidence from the NHS locally. Unless this can be addressed consultees suggested that the health service will be short staffed and thus less able to absorb new technologies emerging from the local science base. The presence of an end user 'pull' was seen as an important factor in supporting local growth of companies in the medical sector.

  Consultees also said that apprentices can help drive the end user pull in related sectors, for example in the agri-food sector, it was reported that John Deere has been integrating a lot of new technology into its tractors so that life science driven research on delivering enhanced efficiency in areas such as soils, fertilisers, plant protection products can be applied. However, it is finding that only 30% of the fleet is being used to its potential as the drivers are not sufficiently skilled to apply this technology.

  In the water industry it was reported that life sciences have the potential to transform many aspects of the industry including water quality management, pollution, the use of 'waste' products e.g. bio-solids by optimising AD plants etc. The challenge is that currently the water industry staff don't have an understanding of what maybe possible and most life science graduates have little understanding of the needs of the industry. Bridging this gap would both help industry utilise life sciences by becoming an expert client at the same time as delivering new career options for life science graduates.

- **Research base** – the region is perceived to have a World class research base in some life science and bio-economy topics (but not all), with well-developed post graduate training provision which has drawn some of the best brains in the World to New Anglia.

  The ability to recruit internationally is seen as critical in sustaining the knowledge base and thus Brexit and, any potential or perceived, migration controls, present a real challenge to the global standing of the local sector. Similarly, the commercial sector in sectors such as equine which leads the World stressed this need to retain international workforce links to support the sector's pre-eminence globally in the scientific and commercial application of science.

  Whilst some future staffing needs could be met locally, most consultees stressed that to attract some of the best researchers in the World, as the region has in the past, an outward looking international recruitment programme for research leaders and post doc researchers will continue to be essential to sustain and build on this research excellence.

- **Life Sciences and STEM education** - consultees were involved in a multitude of different initiatives to promote science and technology, but in most cases these were local initiatives with little or no connectivity to national or regional programmes.

  Co-ordination of STEM engagement across Norfolk, Suffolk, Cambridge and Bedfordshire by Connect EB (Connecting Education and Business[42]) for example was mentioned by any consultees.

  Similarly consultees did not report being involved in national programmes such as those run by the British Association for Science[43] which offers a wide range of provision to help students understand science including, for example, the CREST programme which provides STEM enrichment activities for 5-19 year olds.

  Most consultees recognised this weakness, but some who had previously been engaged in STEM ambassador programmes reported that they had stopped participating as they did not feel that they had been supported. In some cases they had continued to deliver engagement with schools, but were now doing this in house on their own as this was easier to manage and allowed them to align their activity with the needs of the business.

If these issues can be addressed consultees felt that future skills needs were likely to be focused on:

- **Commercialisation skills** - feedback from employers, the research base itself and other stakeholders all stressed that more commercial skills were needed in future graduates.

  It is seen as a strategic challenge which needs both clear support from economic development agencies (LEP, County Councils, District Councils and others) as well as more focus on business skills in the education system to ensure that graduates have the skills to support commercial business growth in the sector.

[42] Connect EB, http://www.connecteb.co.uk/
[43] British Association for Science, https://www.britishscienceassociation.org/Pages/Category/our-work

Consultees in many cases were concerned that science graduates lacked the commercial awareness to make them employable, given that most will ultimately go into business rather than research.

- **Skills levels and routes** – qualification levels in the sector are high with most staff qualified to undergraduate level and above. Some employers reported having no demand for staff without degrees, whereas others reported that they were interested in apprentices at levels 3+ and specifically several suggested that some of the commercialisation challenges (e.g. skills in production and process management) would be addressed more easily with a programme to develop higher apprenticeships at degree and postgraduate level, which combined study with work placements and experience.
- **ICT, data and maths** – many consultees reported that the skills needed in industry or research are being transformed by the rapid growth in data and the consequential need for data scientists as well as a need for other scientific staff and researchers to have data and ICT skills. Consultees felt strongly that the education system at every level, from schools, via Colleges to Universities have yet to grasp the magnitude of this change. Consultees stated that potential employees with science skills who lacked ICT and data skills would increasingly struggle to find high quality employment.

  Others described the lack of focus on coding, ICT and data skills in school as the Achilles Heel of the education system, which unless addressed would have significant negative consequences for future growth. For example, there is concern that hacking skills peak at age 13-14 and that it is important to support children at this age both so that their interest is retained and to stop them using hacking skills for unwanted disruption. Developing hackathons and other ways to engage them in productive ways would help to develop their skills positively.

  Industry 4.0/ Internet of Things is now becoming ubiquitous in health care, the food chain, environmental and the resource sectors and requires a step change in young people's skills. The demand for staff who combine science with data management and technology skills is growing at every level.

  There is an argument to develop new types of provision which bridge the FE/HE provision to meet this need. Technical education routes, via new centres or by integrating existing centres to provide seamless progression routes, would help to address this challenge.

Annex 1 – New Anglia LEP Life Sciences & Biotechnology

(website text)[44]

Life sciences and biotechnology have emerged as world-class clusters for Suffolk and Norfolk. New Anglia is home to leading edge research facilities and expertise within these areas, our region is seen as a true centre of excellence.

In terms of employment it is estimated that there are around 3,000 people working within life sciences and biotechnology in New Anglia, with more than 40 specialist businesses operating in the region. The GVA per employee in 2010 was recorded as £122,388 – significantly higher than for other key sectors. For the same period the business turnover was £277 million.

There are clear clusters of life sciences and biotechnology businesses across New Anglia. In Norfolk, a cluster is located around the Norwich Research Park (NRP), one of Europe's largest single site concentrations of food, health and environmental scientists. NRP is home to a number of world-class research educational and training institutions including the John Innes Centre, University of East Anglia and Institute of Food Research.

Of the eight strategic research institutes that make up the Biotechnology and Biological Science Research Council, three are located on the Norwich Research Park. Funding has been secured for a £26 million expansion of Norwich Research Park; building new infrastructure and securing around 5,000 new jobs in the next 15 years.

Suffolk has developed a reputation for excellence in biotechnology and in particular stem cell research and regenerative medicine at University Campus Suffolk. Two new degree courses in regenerative medicine have been created and the university has forged strong links with Ipswich hospital to build specialist capabilities.

This has happened relatively quickly; some aspects of cluster cohesion are at an early stage of development, but already offer significant growth opportunities. In between the 'Life Sciences Triangle' of Norwich, Ipswich and Cambridge there are also important hubs of life sciences excellence including those in Newmarket (equine/bloodstock), and Mildenhall and Haverhill (high value bio manufacturing).

New Anglia Local Enterprise Partnership is working closely with the life sciences and biotechnology sector to ensure that our region attracts further investment and continues to capitalise on economic growth and reputational opportunities.

FACT
Norwich Research Park, located on the border between South Norfolk and Norwich, is Europe's largest single-site concentration of research into Health, Food and Environmental Sciences.

[44] www.newanglia.co.uk

The New Anglia Economic Strategy published in autumn 2017[45], identifies Life Sciences and Biotechnology as a 'competitive cluster close to global centres'. This commits to developing a commercially led plan for the sector - extract adapted from the Economic Strategy:

COMPETITIVE CLUSTERS CLOSE TO GLOBAL CENTRES

Within our business sectors, Norfolk and Suffolk have a number of recognised national and global clusters of business, with excellent access to national and global markets and to London and Cambridge.

"Each of our identified clusters has substantial further growth potential and supports high value jobs."

We will support these clusters and their specialisations, working with each to ensure that the commercial opportunity they represent is fully developed and well communicated to Government and investors. Evidence suggests businesses identify with and benefit from locating in these clusters.

TOGETHER WE WILL:

Develop a commercially led plan for each cluster that will:

- Encourages new companies and commercial investment.
- Establishes global and national links.
- Maximises local supply chain benefits.
- Markets the commercial opportunity.
- Develop the ecosystem that enables the cluster to thrive.

Focussing on our specific sectoral opportunities will deliver real value in sector specific interventions. This will drive economic benefits across our indicators and themes.

LIFE SCIENCES AND BIOTECH

At Norwich Research Park, home to the Earlham Institute, John Innes Centre and the Quadram Institute and UEA, and in Lowestoft at The Centre for Environment, Fisheries and Aquaculture Science (CEFAS), we have two major UK life science centres.

The research base provides a concentrated focus to the cluster and can provide a magnet to attract new businesses as well as act as a catalyst to grow existing firms. Hargreaves Plants and Germains Technology are two examples of local businesses who are global leaders in plant and seed research and technology who benefit from proximity to the NRP and to Cambridge.

There is an opportunity through bodies such as Agri-tech East to strengthen the links further between our research centres and the local economy. We will ensure the infrastructure is in place to sustain growth and benefit local businesses and supply chains. Another priority is the microbiome hub at NRP, which will further encourage convergence and translation of the centres assets into commercialised businesses. Newmarket is also a global centre for equine health and science.

The process to develop the sector skills plan identified a number of consultees who indicated that they are willing to help develop the economic growth plan for the sector envisaged in the new Economic Strategy, including:

[45] New Anglia, (2017), The East: Norfolk and Suffolk Economic Strategy – a strategy for growth and opportunity

- Hethel Innovation - Simon Coward and Aaron Hunter
- Norfolk and Norwich University Hospital (and UEA) - Dr Alastair Forbes, NNUH
- Stepintotech - Claire Riseborough
- British Beet Research Organisation (BBRO) - Colin MacEwan
- Eastern Academic Health Sciences Network – Dr Steve Feast
- CEFAS – David Carlin
- AgriTech East – Dr Belinda Clarke
- UEA (Bio) and Eastern ARC - Dr Ben Miller
- Norwich Research Park - Dr Sally Ann Forsyth
- John Inness Centre – Dr Jonathan Clarke
- New Anglia Colleges Group – Nikos Savvas
- West Suffolk College - Lindsey Johnson, Richard Stittle
- University of Suffolk - Nic Bury
- College of West Anglia - Shaun Hindle
- The Thoroughbred Breeders Association – Caroline Turnbull

Others who are specifically interested in the skills agenda include: The National Stud – Tabitha Smith. Whilst no longer based in New Anglia for his work, Professor Brendon Noble is interested in continuing to support the group and sector vision work.

Annex 2 – East of England Science and Innovation Audit (SIA)[46] - Life Sciences Theme

The East of England SIA focuses on four themes: Life Sciences; AgriTech; Advanced Manufacturing and Materials; ICT.

Each theme is described in the main text of the SIA, supported with a separate volume specifically on the Life Sciences sector.

The Chapter Summary for Life Sciences states that:

- The East of England's Life Sciences sector is already world class, with outstanding research in universities, research institutions and businesses (both major corporates and spin-outs/start-ups); it is also seeing substantial investment (from national and international sources).
- It has huge assets – in the context of fast-growing markets – for personalised medicine (including drug discovery, development and diagnostics); regenerative medicine; genomics; medtech; and food, health and microbiome.
- Innovation models are changing, accelerating the process of open innovation – and the innovation ecosystem is evolving in response.
- The cluster around Cambridge is exceptional. Substantial further investment is underway and planned, and this is creating opportunities which are being realised as translational pathways evolve.
- The region is well positioned to capitalise on emerging opportunities in medtech – which are best understood as "clinical data plus hardware". Life Sciences firms in Cambridge, the A1(M) Corridor in Hertfordshire, and south/mid Essex are connecting with the region's ICT and data analytics resources – and working with healthcare providers – to create products and services that could transform healthcare delivery.
- In relation to food, health and microbiome, the Quadram Institute on Norwich Research Park will open in 2018, and it is already generating much interest from the business community, this will incorporate and build upon the longestablished research excellence of the Institute for Food Research.
- Convergence is driving innovation. It is also creating some challenges. Investors can find "convergence" difficult, particularly when it does not translate into patentable intellectual property. A proliferation of 'build to buy' models is a barrier to growing talent and scaling-up world class businesses. There is a need for skills in "deep computer science" to allow key elements of the industry to grow.

[46] HMG (2017), East of England Science and Innovation Audit: A Science and Innovation Audit Report sponsored by the Department for Business, Energy and Industrial Strategy, 21st September 2017