**New Anglia Emerging Technology Skills Plan**

**2019**

**February 2019**

**New Anglia Skills Board version**

**‘We are stuck with technology when what we really want is stuff that works’**

In *The Salmon of Doubt* (2002 posthumous collection) by Douglas Adams (author of the Hitchhikers Guide to the Galaxy and the Answer to Life, the Universe and Everything)

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# **Executive Summary**

The development of emerging technology or Industry 4.0, based on digital and engineering technologies, is leading to major changes in large sectors of the economy. The obvious example is retail and distribution, where online sales now represents £1 in every £5 of the sector. Not surprisingly we are seeing jobs displaced from the traditional retail sector and many established retail companies failing whilst new online only companies emerge.

Reports suggest that 30% of current job roles in New Anglia, could be lost or change fundamentally and many more will need new skills as digitalisation and automation impactson both public and private sectors. Allaying fears, the rebalancing of jobs towards higher skills presents a real opportunity for upskilling and lifelong learning.

However, the Industry 4.0 revolution is occurring at a time of historically low unemployment, with the dependency ratio rising and most employers struggling to secure the workforce needed. The local economy will also be able to expand if it is nationally and internationally competitive. If New Anglia is World class in its adoption of Industry 4.0, the productivity benefits this brings will lead to economic growth, more higher paid, higher skilled jobs and enough jobs for everyone.

The technology supply sector is anticipated to grow as the demand for Industry 4.0 solutions grow offsetting some of the jobs displaced in other sectors. Job creation will though not be limited to the technology sector, with new jobs and job roles created right across the economy as Industry 4.0 facilitates the creation of new products and services, improves competitiveness and enables new job roles.

Skills is an essential enabler of this transition. Whilst new skills will be needed in the companies supplying Industry 4.0 solutions, in terms of scale, the bigger opportunity is in ensuring that the 90%+ of the economy which is an end user of Industry 4.0 technologies has the skills to be expert in using Industry 4.0 to increase productivity.

The scale and speed with which job roles will change means that the transition to Industry 4.0 will require a substantial increase in retraining for the existing workforce.

Given the focus in the New Anglia Local Industrial Strategy on digitalisation, addressing the implications of Industry 4.0 should be a strategic priority for the LEP. Action is needed in 4 main areas to deliver on the potential of Industry 4.0:

* Increasing student supply into the technology sector with Industry 4.0 skills;
* Upskilling the technology workforce to spearhead adoption of Industry 4.0;
* Ensuring all students, regardless of sector, have Industry 4.0 in their courses;
* Upskilling and retraining the existing workforce in end user sectors for new or changed job roles enabled by Industry 4.0.

# **The Emerging Technology Sector Skills Plan**

The Emerging Technology Sector Skills Plan has been developed by Norfolk and Suffolk, working alongside the New Anglia Local Enterprise Partnership, the New Anglia Skills Board and supported by SkillsReach.

SkillsReach was contracted to facilitate and prepare sector skills plans for the New Anglia LEP priority sectors. The project was commissioned by the Education and Skills Funding Agency, in partnership with New Anglia LEP, and funded through the European Social Fund. Each Sector Skills plan and supporting Data Pack has been developed in collaboration with local employers and other stakeholders.

The New Anglia Skills Board places employers at the centre of decision making on skills in Norfolk and Suffolk to ensure the skills system becomes more responsive to the needs of employers, and the future economy.

Whilst there is currently not a formal industry led sector group for Emerging Technologies which covers the whole of New Anglia, there are a range of bodies such as the Institute of Productivity (IoP) and proposed Eastern Institute of Technology (EIoT), which focus on and represent the stakeholder community.

SkillsReach is an established East of England-based strategic skills consultancy with an associate project team with extensive experience of developing skills plans.

**Acknowledgements**

The New Anglia LEP wish to thank the employers, training providers and stakeholders who contributed to the plan by attending events, being interviewed or by making referrals to employers and organisations in the sector. This sector skills plan was developed in 2018 by SkillsReach.

# **Context for Emerging Technology**

The World Economic Forum report in 2018 on the Future of Jobs[[1]](#footnote-1) states that:

*The Fourth Industrial Revolution is interacting with other socio-economic and demographic factors to create a perfect storm of business model change in all industries, resulting in major disruptions to labour markets. New categories of jobs will emerge, partly or wholly displacing others. The skill sets required in both old and new occupations will change in most industries and transform how and where people work. It may also affect female and male workers differently and transform the dynamics of the industry gender gap.*

The Fourth Industrial Revolution is being driven by Emerging Technology and in its breadth and speed is creating a rapid change in the skills needed right across the economy.

This skills plan is therefore different to the other Sector Skills Plans developed by New Anglia during 2016-’19, because it has to cover the whole economy. This need to focus on emerging technology and Industry 4.0 was clearly evident in the New Anglia Cross Cutting report (summer 2018) which reviewed the common themes which were emerging from the individual New Anglia sector skills reports.

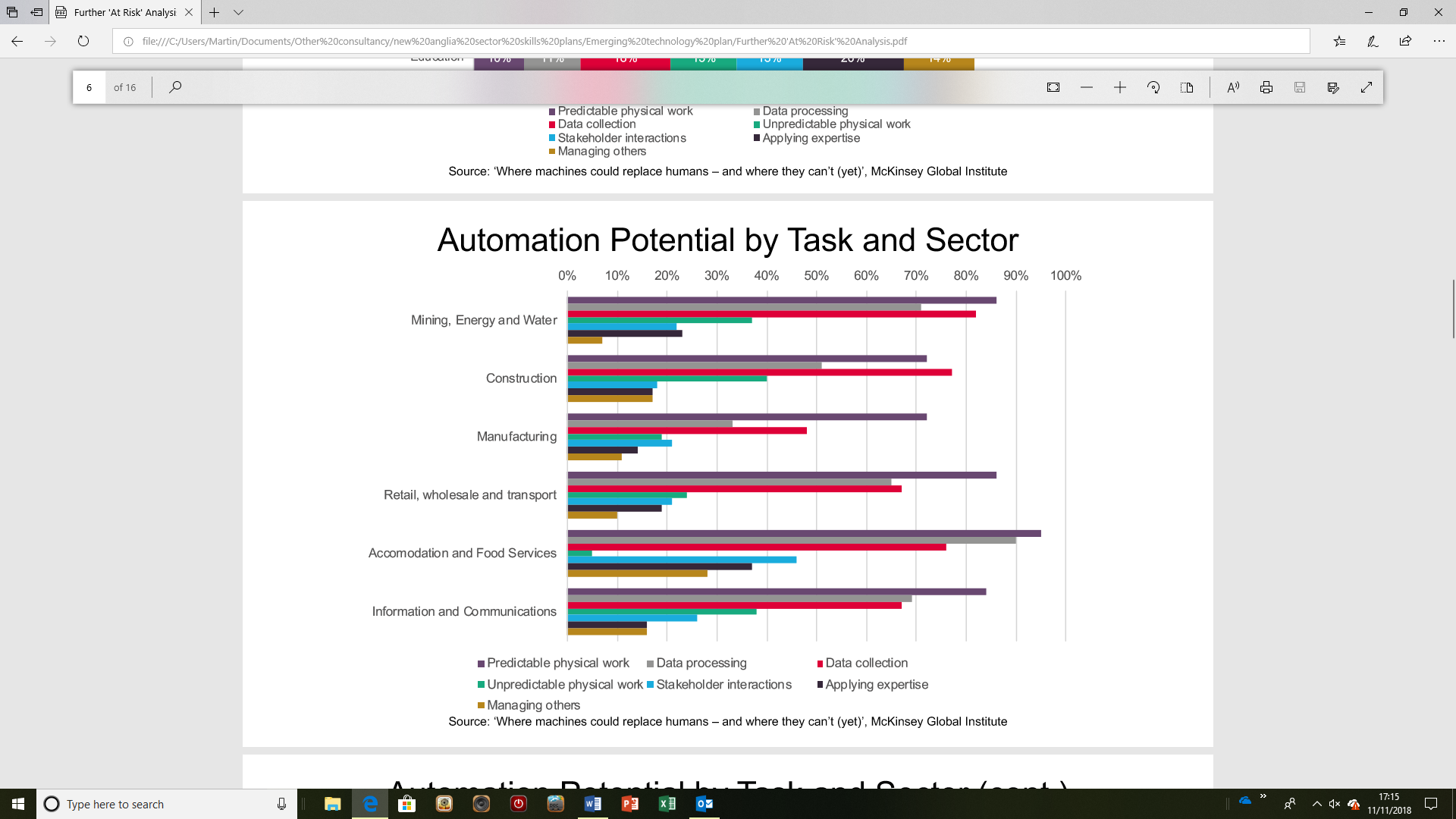
The Fourth Industrial Revolution is also called Industry 4.0 and many descriptions also uses terms such as the Internet of Things or the Internets of Data, Systems and People - in practice it is all of these and is the transition in the economy facilitated by the merging of the physical and digital environments.

The results are potentially very large for the economy with reports suggesting that:

* 15-30% of jobs could be displaced completely within the next decade;
* And, the nature of the roles in a further 30-40% of jobs may change substantially;
* New roles will also be created as all employers (public and private) utilise emerging technology to offer new or enhanced products and services.

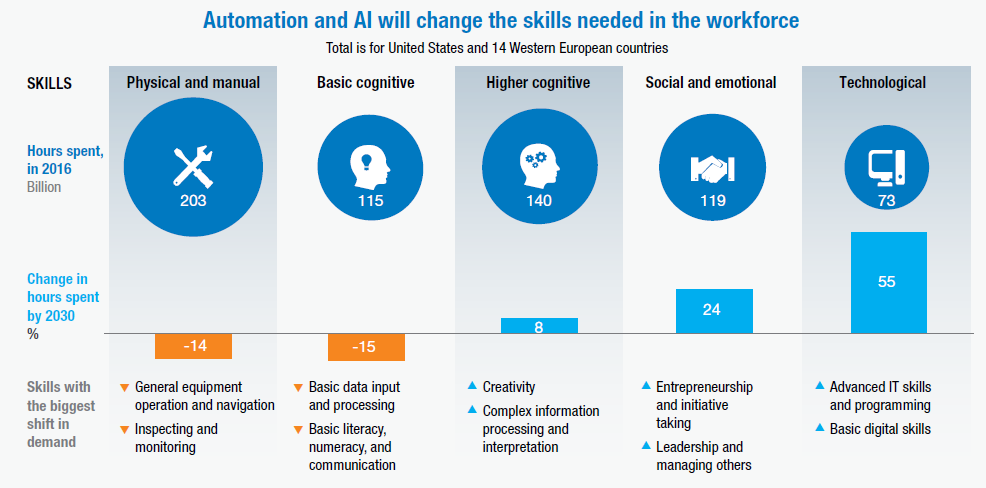
Applying analysis by PWC (2017) to assess which jobs are at risk due to Industry 4.0 suggests that over 303,000 jobs in New Anglia could be displaced, with similar analysis by McKinsey (2016) on jobs which have potential for automation suggesting that 287,000 jobs in New Anglia could be affected by automation (see figure 1). The magnitude of this change, by 2030, clearly shows the scale of potential impact.

**Figure 1 - Automation Potential by Task & Sector of the New Anglia Economy**



The difference in the impact on different types of skills is also illustrated by other work[[2]](#footnote-2) which shows big anticipate changes in the balance of skills needed:

**Figure 2: Changes in the balance of skills needed**



In responding to Industry 4.0 the region will obviously require new skills in technology supply companies, but the larger effect in terms of the numbers of people impacted will be in those sectors which use technology (in both the public and private sectors).

This is because these end user sectors are physically much larger and have more job roles which are at risk or will change due to automation and Industry 4.0. Whilst this is a challenge for initial training, the larger need will be for new skills amongst the existing workforce if we are to help the established workforce adapt to these changes.

**Process to Develop the Plan**

The process to develop the Emerging Technology Sector Skills Plan has involved:

* Drawing on other New Anglia Sector Skills plans;
* Reviewing reports on emerging technology from local to global level;
* Developing data to explore the impact of emerging technology on job roles and the workforce at aggregate and sectoral levels;
* Attendance at and running meetings and events to consult with stakeholders on the way in which emerging technology will impact workforce and skills issues.

**New Anglia Sector Skills plans**

Over the last 2 years New Anglia has developed 10 sector skills plans:

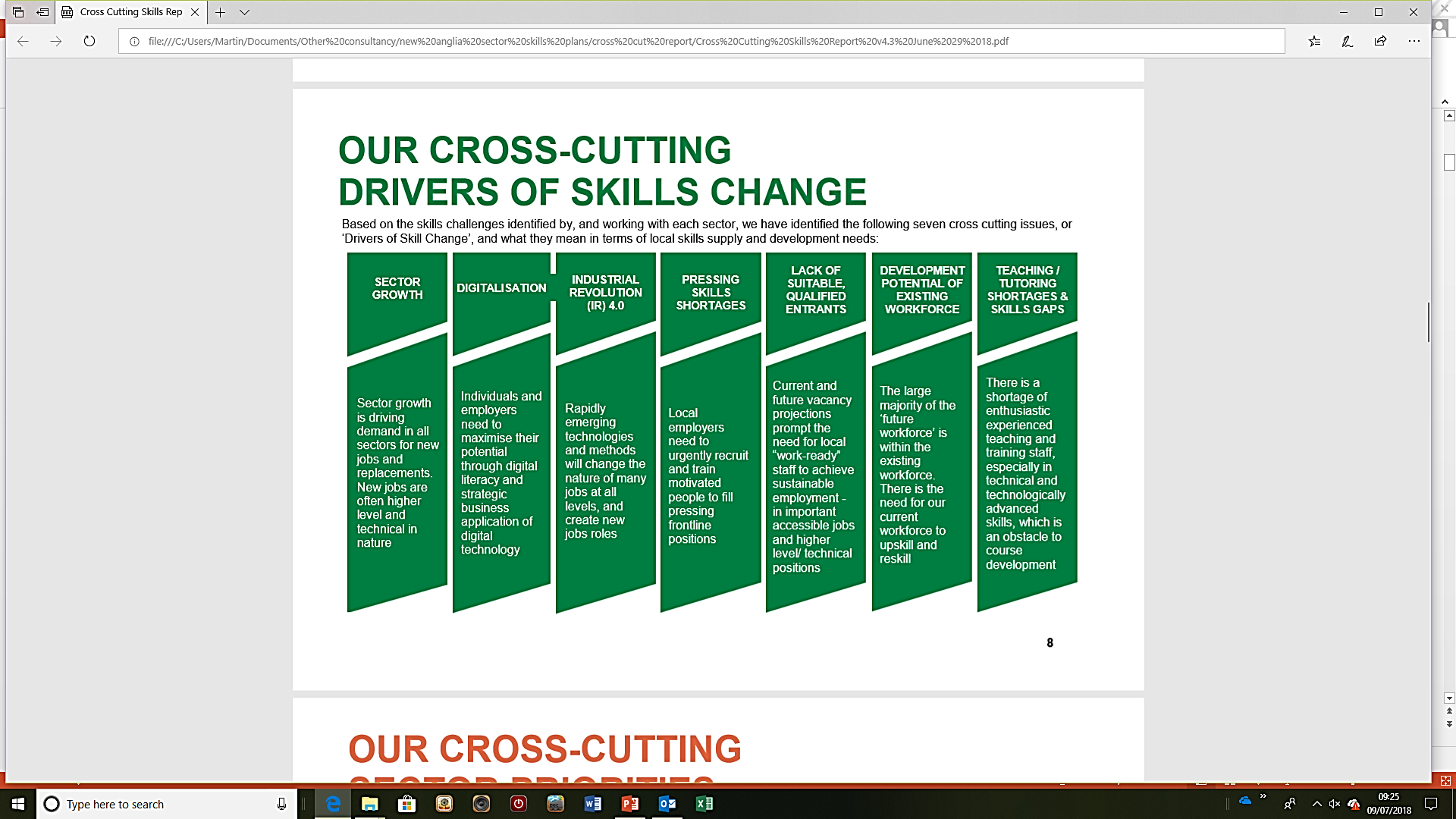
* 2 in 2016 (in house) which looked at: Construction; Health and Social Care.
* 8 during 2017-18, led by SkillsReach, which looked at: AgriFood Tech; Digital Tech; Advanced Manufacturing & Engineering; Financial & Insurance Services; Energy; Life Sciences & the Bio-economy; Ports & Logistics; Cultural Sector.
* A further 2 (in addition to this plan) are currently in development.

Details of the way in which each of these plans approached emerging technology and the key conclusions in each plan in relation to this challenge are set out in Annex 2.

In addition to the individual sector skills plans, in summer 2018, SkillsReach also developed a cross cutting report which brought together common issues from across all the individual sector skills plans. This process clearly identified emerging technology as a cross cutting theme (figure 3):

* Both as a challenge in its own right - Industrial Revolution 4.0;
* And also through the pervasive nature of digitalisation of the economy and thus workforce skills, which is a key enabler and driver of the fourth Industrial Revolution, or Industry 4.0.

**Figure 3 - Drivers of Skills Change, New Anglia Cross Cutting Report 2018**



(Source: New Anglia Sector Skills Plans Cross Cutting Report, 2018)

This same approach, with Industrial Revolution 4.0 (or Industry 4.0) as both a challenge in its own right and as a driver of change across the economy, was also recognised in the Made Smarter Review (originally known as the Industrial Digitalisation Review or IDR) published by the UK government in November 2017.

Accenture led this national work which concluded that investing in digitalisation could be worth £455bn to the UK economy over a decade[[3]](#footnote-3).

**Reports on emerging technology from local to global level**

This plan also reviews a wide range of reports from regional to global level which have looked at how new, digitally enabled, technologies and Industry 4.0 will impact on job roles and the workforce. Annex 1 includes highlights from these reports.

# **Impact of Emerging Technology in New Anglia**

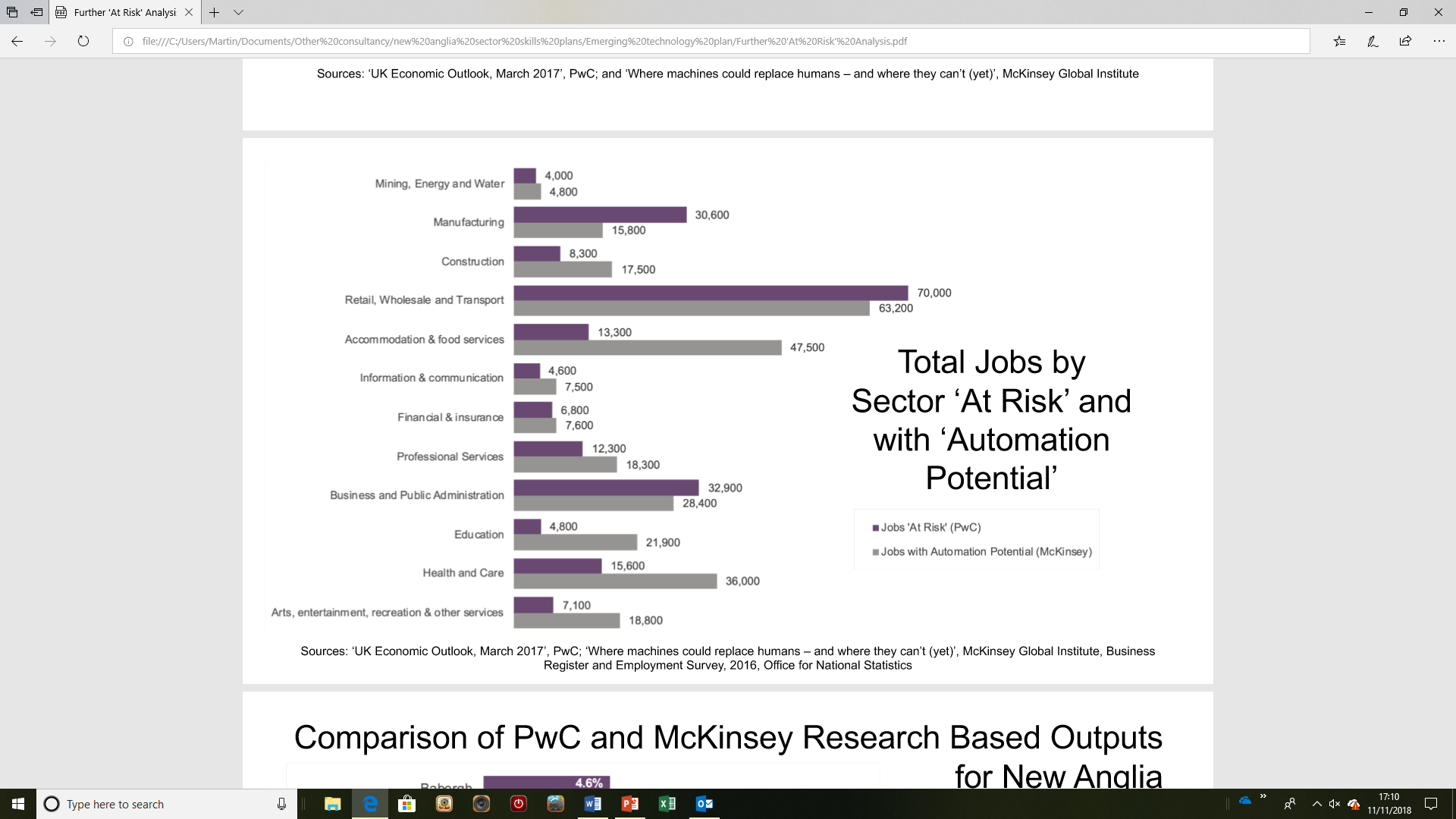
**Data on job roles and potential impacts**

In parallel to the consultations and review of reports undertaken, SkillsReach have mapped the impact that the expected change in job roles created by Emerging Technology will have on the workforce at aggregate and sectoral levels in Norfolk and Suffolk (at both district and LEP levels).

The data is presented in full in a separate datapack, which supports this sector skills plan.

The key conclusions drawn from these assessments, which draw on global and UK research by McKinsey Global Institute (2016)[[4]](#footnote-4) and PWC (2017)[[5]](#footnote-5), suggests that the New Anglia economy is as exposed as any region to the changes which Industry 4.0 and Emerging Technology will mean for the economy, employers and workers themselves (see figure 4)

**Figure 4 - Total Jobs by Sector ‘At Risk’ (PWC) or with ‘Automation Potential’ (McKinsey)**



The main impacts are likely to be:

* Employees with lower levels of qualifications are more at risk of seeing their job automated - 46% of those with only GCSE or below levels qualification are at risk, compared to only 12% of those with degree level qualifications (see table 1);

**Table 1 - New Anglia workforce ‘At Risk’ of Automation by Qualification Level (see datapack for full details and referencing)**

|  |  |  |
| --- | --- | --- |
| Higher Education  (12% at Risk) | % with degree or equivalent & above - aged 16-64 | 221,300 |
| Number at Risk | 26,600 |
| Medium Education (36% at Risk) | % with higher education below degree level - 16-64 | 73,800 |
| % with GCE A level or equivalent - 16-64 | 247,600 |
| % with GCSE grades A-C or equivalent - 16-64 | 222,100 |
| Total | 543,500 |
| Number at Risk | 195,700 |
| Low Education (46% at Risk) | % with other qualifications (GCSE) - 16-64 | 99,500 |
| % with no qualifications (GCSE) - 16-64 | 77,400 |
| Total | 176,900 |
| Number at Risk | 81,400 |
| Totals | Total at Risk | 303,600 |
| Population Aged 16-64 | 941,700 |
| % at Risk | 32% |

* 15-30% of jobs could be displaced completely within the next decade by new technology which automates a role entirely making it redundant, but with large variation between sectors (see table 2);
* The nature of the job roles which need to be undertaken in a further 30-40% of jobs may change substantially, necessitating these staff to develop new skills (see table 3);

**Table 2 - Analysis of Key Determinants of Job Numbers at risk by sector** (see datapack for full details and referencing)

|  |  |  |
| --- | --- | --- |
|  | Highest impact | Lowest impact |
| Number of job roles at risk by sector | 70,000 jobs have automation potential (McKinsey) & 63,200 (PWC) are at risk in retail, wholesale & transport  The sector with the highest proportion of automation potential (McKinsey) is accommodation & food service with 75% | 4,800 jobs have automation potential (McKinsey) & 4,000 (PWC) are at risk in mining, energy & water  The sectors with the lowest proportion of automation potential (McKinsey) are manufacturing with 30% and business & public administration with 31% |

**Table 3 - Analysis of Key Determinants of % of Job at risk by sector** (see datapack for full details and referencing)

|  |  |  |
| --- | --- | --- |
|  | Highest impact | Lowest impact |
| Sector | 46% jobs in manufacturing at risk (McKinsey 2016) | 8.5% jobs in education sector at risk (PWC 2017) |

The impact on sectors varies due to:

* Substantial difference in terms of the numbers of job roles at risk, based on both the proportion of job roles in the sector at risk and large variations in employment by sector. The largest impacts are likely in sectors with a large workforce, many of whom do repetitive roles.
* Using PWC analysis 3 sectors account for 63.5% of all jobs at risk:
  + Retail, wholesale & transport at 70,000 jobs;
  + Business & public administration at 32,900 jobs;
  + Manufacturing at 30,600 jobs.
* In contrast other sectors are likely to see many fewer staff displaced as they are smaller employment sectors with a smaller % of job roles at risk of automation.
* In some sectors there is a big gap between jobs at risk (PWC analysis) and those where the job role may change due to automation of some roles which are currently performed by people (McKinsey analysis) e.g. health and social care, accommodation and food service.

The conclusion is that there is a large degree of variation between sectors of the economy in terms of what proportion of jobs are at risk. As a generalisation sectors which have more jobs roles which require problem solving, creativity & inter-personal skills have less potential for automation than those where repetitive, manual tasks & routine data recording or input are required.

Furthermore:

* New job roles will be created as all employers (public and private) utilise emerging technology to offer new or enhanced products and services, but many of these new roles are not yet apparent and so are hard to plan for;
* Industry 4.0 will require new skills in technology supply companies, whose market is likely to grow necessitating the recruitment of extra staff as well as the development of new skills;
* Overall, the changes expected will have a larger effect in terms of the numbers of people impacted in those sectors which use technology (in both the public and private sectors), with most sectors seeing half or more of their current job roles either displaced completely or substantially changed by technology;
* The speed of change also means that we cannot be focused just on young people entering the workforce for the first time. To respond positively to Industry 4.0 will require a significant increase in upskilling of the existing workforce.

The data analysis therefore shows that the impact of Emerging Technology will be felt right across the economy and across all districts in New Anglia.

Every sector will be affected, with some sectors which have not been seen as priorities by New Anglia e.g. retail and public and business administration, seeing some of the biggest anticipated changes in terms of the number of job roles which are at risk.

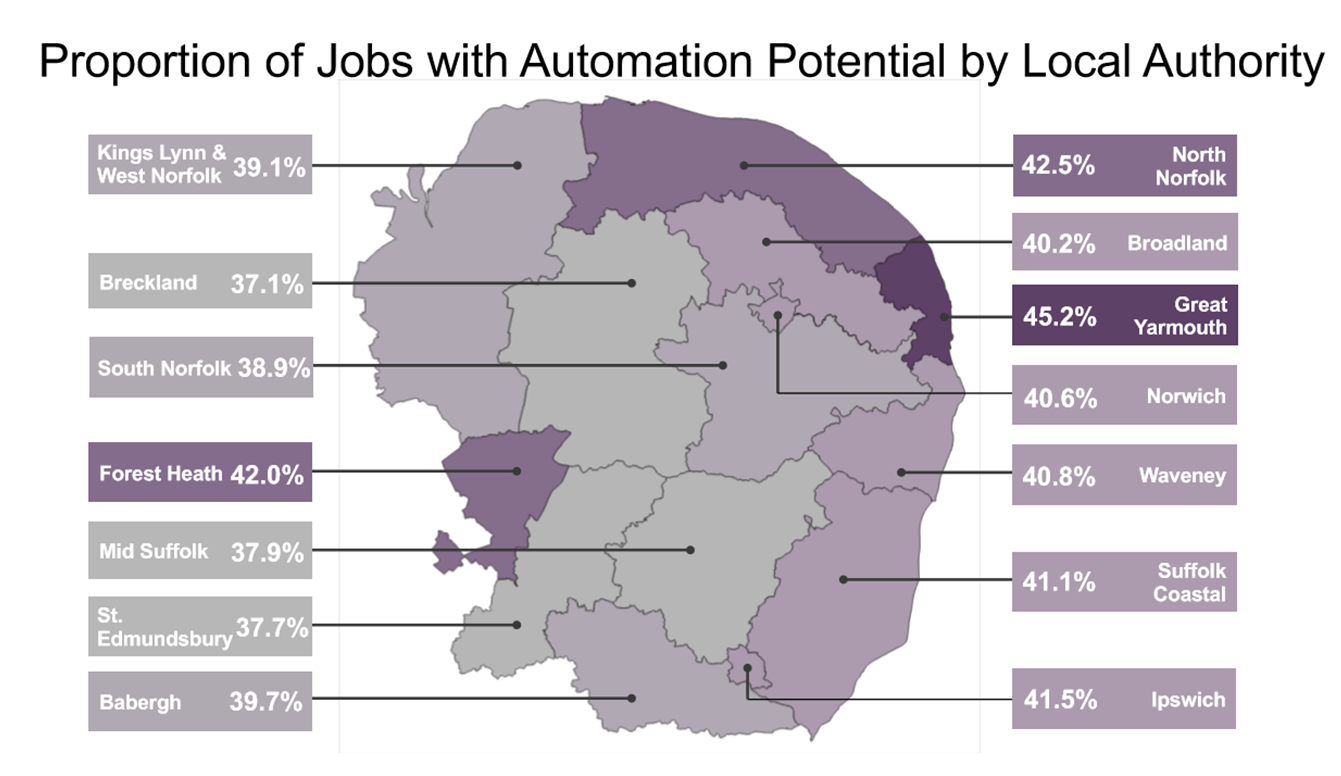
In the case of retail, the development of online retailing and the displacement of high street stores means that the largest private sector employer in New Anglia, the retail, wholesale and transport sector, is likely to see a rapid displacement of workers (see annex 2 for further analysis of this).

**Spatial Impact**

The variation between districts in terms of the % of jobs with automation potential is relatively low, suggesting that all districts will be impacted to a medium to large extent (figure 5).

The district level variation is primarily driven by variations in the sectors which predominate in the local economy at district level (table 4).

**Figure 5 - Proportion of Jobs with Automation Potential by Norfolk and Suffolk Local Authority**



**Table 4 - Districts level impact** (see datapack for full details and referencing)

|  |  |  |
| --- | --- | --- |
|  | Highest impact | Lowest impact |
| District | Proportion of jobs roles with automation potential is highest at 45.2% in Great Yarmouth | Proportion of jobs with automation potential is lowest at 37.1% in Breckland |

**The potential for economic gain**

However, reports also suggest that, in common with previous Industrial Revolutions the changes we are likely to see due to Industry 4.0 will also:

* Increase growth;
* Create new industries and job roles, many of which don’t currently exist.

The Made Smarter Review (2017), as noted above, projects that embracing Industry 4.0 will unlock growth across the economy, worth £455billion in the first decade.

Other reports make similar projections with a recent report from BEIS (2019) on Artificial Intelligence (AI)[[6]](#footnote-6) reporting on work by Accenture which suggests that AI could add £630billion to the UK economy by 2035 and increase GVA growth from 2.5% to 3.9% (much higher than has been seen in the last 20 years).

Furthermore, wider changes in the economy and demographics mean that young people entering the jobs market and those displaced from existing roles are likely to find jobs, because:

* In New Anglia and the UK, over the long term birth rates have fallen meaning that there are fewer young people entering the workforce;
* Average age in the workforce is increasing and many industries are struggling to find enough young entrants to replace those who retire;
* Unemployment rates have fallen and are now at the lowest rates since the early 1970s meaning that there is very little slack in the jobs market.

The real economic challenges are therefore that:

* The economy needs to address wage growth which lagged inflation for nearly a decade after the economic crash in 2007-’08, with a squeeze on family incomes and growing political impacts as workers saw the value of their earnings eroded by inflation for the longest period in at least 70 years;
* The dependency ratio is rising (i.e. how many people each worker supports), meaning that the economy needs to increase the productivity generated by each worker so they can support more of those who are not working (whether as children, students or the retired);
* Workforce supply is the growing challenge for most employers.

Productivity growth is therefore needed to increase wealth and real wages through creating higher paid, higher skilled jobs which are more productive.

This analysis suggests that even if 30% or more of current job roles are lost to digitalisation & automation (as some suggest), we will not be short of jobs.

Those displaced will find new jobs, in new industries or by undertaking new roles in their current industry or for their current employer. However, Industry 4.0 is, like other industrial revolutions, likely to change the structure of the economy across the country and indeed the World.

No LEP area is immune from this change and whether this change allows an area to improve its position will primarily depend on the speed with which it is able to respond.

A critical determinant of whether an employer, sector, LEP area or the whole of the UK is able to benefit from the potential productivity gains created by Industry 4.0 will be its ability to ensure that it has the skills and knowledge to embrace this change.

This must encompass both ensuring the young have the skills needed to prosper in the new working environment and that the existing workforce is supported to gain the skills needed for new or changed job roles.

In a new paper McKinsey[[7]](#footnote-7) argues that we have to embrace lifelong employability by changing the way that we train workers for new roles. The key need they identify is to support existing workers to gain the new skills needed through tailored, bite sized, regular, participatory and social learning, which becomes a standard part of organisational culture, rather than formal, standardised and occasional courses. They argue that unless this change is embraced workers will find it increasingly difficult to keep up to date with the skills needed in the workplace as it embraces technology, with artificial intelligence (AI) being particularly disruptive to job roles.

# **Consultation Feedback**

**Meetings and Events**

In developing the Emerging Technology Skills Plan a number of local, regional, national and international meetings were attended to provide feedback on how different sectors, stakeholders and regions see this challenge. This included:

* Liaising with providers and stakeholders in the Institute of Technology (IoT) (meetings in July and September 2018) & Institute of Productivity (IoP) development group (meeting October 2018) to understand how these initiatives can support New Anglia in responding to the Emerging Technology challenge;
* Engaging with employer stakeholders to understand how the challenge paper conclusions relate to their experience through consultations at:
  + The 17th September 2018 productivity challenge event run by Hethel Innovation at UEA;
  + The 16th November 2018 employers engagement event run to support the Eastern Institute of Technology (EIoT) proposal.

The plan was also be informed by feedback gained by Martin Collison (SkillsReach team) from engaging with a range of regional, national and international events focused on Industry 4.0 and digital technology adoption, including (all funded separately to the skills plan):

* Speaking to the Lincolnshire Industry 4.0 skills working group 30th August 2018;
* Speaking at the Agricultural Economics in Transition conference XV in Budapest on how technology will change the food chain 11th September 2018;
* Attending the Greater Lincolnshire Innovation Council meeting on Industry 4.0 on 19th September 2018;
* Speaking at the EU SKIN Project technology event in Hungary on 25th September 2018;
* Speaking at the EFFAT EU Trade Union’s events: Budapest on 25th October 2018; Copenhagen on 5th February 2019, on technology impacts on job roles;
* Speaking at the West Sussex Growers Association in Chichester on 26th October 2018 on how technology will affect the agricultural and horticultural industry;
* Presenting the draft plan to the New Anglia Innovation Board on 19th February 2019 to debate how best the region can rise to the challenge of Industry 4.0.

**Employer Consultee Feedback**

Employer representatives at the EIoT meeting reported that many people and organisations are still not clear what is meant by Industry 4.0, or how this will impact their workplace and thus are uncertain how skills needs are likely to change.

It was reported that some major sectors, e.g. construction, know that Industry 4.0 will impact them, but very few in this sector have begun to address this challenge to date, largely due to more pressing short term issues and a lack of certainty about how it may impact them.

A straw poll of 12 employers at the consultation exercise for the Eastern Institute of Technology (EIoT) showed that on a scale of 1-5 (where 1 = not ready and 5 = ready):

* For employers who were primarily technology end users (7 companies): the average score for their organisation’s preparedness for Industry 4.0 was 2.7 compared to 2.4 for their sector as a whole;
* For purely technology provider companies (1 company) they rated their own company at 5, but their sector still only at 1;
* For companies which both provide and buy technology (4 companies), the rating was 3.8 for their own readiness but only 2.0 for their sector as a whole.

This is broadly consistent with other reports and surveys, which show that many companies and employees rate their own preparedness for Industry 4.0 more highly than the sector in which they work.

In August 2018 the Fabian Society and Trade Unions launched a 2 year commission into Workers and Technology[[8]](#footnote-8), with the publication of new evidence on British workers hopes and fears for automation in the next decade. Their initial evidence shows that (based on an online survey of over 1,000 workers):

* Overwhelmingly, workers are positive about their own ability to navigate change: 73% are confident they will be able to change and update their skills if new technology affects their job. After learning about how technological changes will affect the workplace, over half (53%) were optimistic about their future working life and job prospects.
* However, a significant minority were anxious about the impact of automation over the next 10 years: 37% of workers (i.e. circa 10 million people nationally) are worried their job will change for the worse; and 23% of workers (i.e. 6 million people) are worried that their current job may no longer be needed.

Whilst the balance of those consulted were optimistic about their own chances of coping with the changes brought about by Industry 4.0, this contrasted sharply with their views about the help on offer to them to help them embrace Industry 4.0:

* 9% of workers think that the UK government is taking steps to prepare them for new workplace technologies;
* 16% (with a trade union in their workplace) think their union is taking steps to help ensure new technologies improve working life;
* And, only 27% think their employer is taking action to prepare them for change.

Caution is needed in interpreting this data, because those who are more likely to respond to these surveys are usually those who have already engaged with the issues and are thus likely to be more prepared.

However, the local evidence and national reports consistently suggest that, at sectoral or economy level, many employers have yet to understand the impact that Emerging Technology may have on their organisation.

**What Action is Needed**

Key areas which local employer and stakeholder consultees considered the region needs to focus on to provide the skills needed for emerging technology were:

* Apprenticeships - there was concern that the levy and reforms have disrupted established successful models in the technology sector. There is a need for apprenticeships to have more status and for greater flexibility in how apprenticeships are managed. Employers felt that the frameworks and standards were too rigid and not flexible enough to meet the rapidly changing employer needs which Industry 4.0 implies;
* Applied courses - degrees need to be more applied e.g. including placements, so that students are prepared for the way in which emerging technologies can be applied. Employers also favour ‘HNC’[[9]](#footnote-9) type provision and think this should be used to address the emerging technology skills need;
* Work experience - it was felt strongly that current work experience is failing young people and that children, from age 14, should be supported to use their holiday time to gain experience of work (employers stressed that the excuse that this is stopped by H&S can be overcome with the correct risk assessments even in very physical environments such as construction). This work experience should be accredited;
* Vocational pathways - there is a need for a vocational pathway at GCSE. It was felt that ‘T’ Levels are too late as by this stage most students are fixed on an academic route even if this does not suit them;
* Young workers as trainers - employers reported that many young staff in their organisation had a much better understanding of the potential of emerging technology and could be used to train older staff in how to optimise the use of new technology;
* Local delivery - employers stressed that local delivery is essential because many students and workers will not/cannot travel easily across the region. To deliver new skills for Emerging Technology it will therefore be important to include virtual outreach, blended learning (so that learners get a social experience as well) and similar models (e.g. video conferencing), so that the whole workforce can participate at a time and pace which suits them and their other commitments;
* Bite size delivery is also needed for industry 4.0 using videos, practical applications and test centres, with this particularly important for the established workforce who need to fit training in around their other commitments;
* Culture change - it was felt that the biggest challenges to adopting Industry 4.0 relate to culture change and thus a focus on soft skills is needed alongside technical education and training to support business uptake.

Delivery also needs to recognise that:

* Working through established business groups can be very effective - many business groups have HR manager forums/groups which can be used as an effective conduit to promote training and to ensure that regional programmes align with employers’ internal programmes;
* Need to reduce the bureaucracy - if businesses are expected to manage the process this is likely to fail, because the administration of publicly supported training is simply too complex (including apprenticeships) and, if businesses are expected to do this themselves, many will not take part.

It was felt that the most important issue for employers is to get rid of educational jargon and produce a simple, clear 2 page explanation of the emerging technology training offer, which ends with a very clear set of next steps which they can take to engage in the process. It was felt that unless this is implemented most businesses will not choose to engage and will continue to try to meet their needs through recruitment rather than training their own staff.

**Strategic Alignment**

Consultees at the New Anglia Innovation Board suggested that:

* There is a need to co-ordinate local action being taken on Industry 4.0 related provision by the Institute of Productivity (IoP) at UEA with the Institute of Technology (subject to approval);
* The review of Post-18 Education[[10]](#footnote-10) led by Philip Augar is important in reviewing both FE and HE provision and how this can provide seamless progression, which is important in the context of Industry 4.0;
* It is important for the work on Industry 4.0 to focus on how to support productivity growth by working with employers to co-create programmes which meet their changing skills needs;
* It is important to recognise that many young people have excellent digital skills as ‘digital natives’, but don’t have the formal qualifications to prove these skills. It is important for employers to utilise these skills even if they are unaccredited;
* Meeting the training needs of the established workforce in relation to Industry 4.0 is a larger challenge than training young people and it is important that educational policy and local delivery embraces this so that the benefits of Industry 4.0 can be captured across the economy;
* It is important for Industry 4.0 transition support to integrate training provision with business support, as is proposed in the New Anglia Strength in Places Fund application (subject to approval);
* Employers engaged in existing business support programmes have very mixed views on digitalisation, but most don’t know what possibilities digital technologies offer to them. This means they are unable to identify their needs unless they are supported to understand what might be possible. This is a key role for the Growth Hub and local business support programmes so that employers can be signposted to the most appropriate provision;
* The needs of technology adoption in end user sectors of the economy is more important than the needs of the technology sector itself, due to the scale of the wider economy and the need to ensure that the breadth of the economy (public and private sector) is World class in technology adoption;
* It would be useful to use LEP sector groups to help undertake and regularly update foresight exercises to identify how Industry 4.0 may impact their sectors and to identify the training needs which arise from this;
* This foresight activity must link to the LEP economic strategy and be clear on both the opportunities and challenges facing the area in adopting Industry 4.0. This also needs to be clear why it maybe more challenging in areas such as New Anglia, e.g. the rural and sparse nature of much of the geography, or the absence of a Mayoral Authority with greater delegated powers;
* The magnitude of the change which Industry 4.0 will lead to means that a strategic approach is needed. To deliver this it is important to establish an Industry 4.0 task force or similar structure to co-ordinate the actions taken both to support the technology industry, e.g. by the Digital Skills Taskforce, IoP and IoT, with wider support for the adoption of technology across the economy by the Skills Board, Innovation Board and Local Industrial Strategy. Alignment with the ICT and digital strand of the Local Industry Strategy is important.

**Summary of Findings on Training Provision for Emerging Technology**

In developing a skills plan for how to support the adoption of emerging technology, there are a series of key questions which need to be addressed about whether the current skills system is equipped to respond to this challenge, as set out in table 5.

**Table 5 - Headline Questions and Evidence on Industry 4.0**

|  |  |
| --- | --- |
| **Key questions and challenges** | **Evidence** |
| Starting points – are school, college and university leavers gaining the right skills (hard and soft) to embrace current and future technologies? | Evidence from the earlier skills plans and the consultations for this plan suggests the answer is no.  Too few students study the skills which are needed and the curriculum is poorly aligned with employer needs.  There are big gaps in the supply of students with the skills needed despite those with the right skills to power the adoption of emerging technology commanding higher salaries. |
| Do the trainers have the right skills to facilitate the take up of emerging technology in education?  And, is there an adequate supply of trainers? | There are reports showing this is a major problem nationally and the skills plans developed in 2016-18 for New Anglia showed this is a challenge locally across multiple sectors.  The earlier sector skills plan identified challenges in recruiting staff with digital/ICT skills, as well as related areas such as engineering. The main challenge is that staff in these areas can earn far more in industry than they can in education and it is therefore very hard to retain them in the education system.  Technology is a major driver of change in the economy and it is vital that the educational workforce itself has the skills to develop students abilities in the skills needed to adopt Industry 4.0. |
| Is there appropriate curriculum available or will it have to be adapted or made bespoke?  What levels and delivery styles will be needed?  Will accredited or non-accredited training be needed?  How can funding be aligned with employer needs? | Evidence from the New Anglia skills plan consultations show that there is a problem with the curriculum failing to keep up with the speed of technological change.  There is also clearly a link to the point above on teachers and trainers lacking the skills needed and providers struggling to recruit staff in many technology focused disciplines.  Some data has also shown that the number of students studying ICT has been falling despite increased demand for these skills. |
| Are there cultural barriers which restrict the willingness to embrace technological change amongst both employers and employees?  If so, how can these be tackled? | National and EU level reports suggests that in many cases culture change and skills challenges are more significant than the availability of technology itself and our local consultations reached the same conclusions.  Employers recognise that adopting new technology normally requires new systems to be designed, management structures to change and companies to change working practices.  Globally the availability of technology will continue to develop rapidly, but whether local economies, such as New Anglia, benefit will be more to do with whether their economies embrace the possibilities it provides, with culture change and skills at the heart of the economy’s ability to respond.  To respond to these challenges there is a need to provide leadership, both technical and management, whilst helping employers to recognise the potential that emerging technology may have in their organisation. |

# **Emerging Technology Skills Plan**

Many commentators argue that we are truly on the cusp of the next Industrial Revolution, Industry 4.0, which will, like previous revolutions, affect the whole economy. However, this time the transition is likely to be faster (as we are already seeing in retailing) and in the process we are likely to see many business failures whilst new ones emerge.

There is growing awareness that whether employers survive this process will, as with Darwin’s Theory of Natural Selection, be more dependent on the ability to adapt rather than their fitness for purpose at any particular time.

It is this ability to adapt rapidly which is at the heart of the skills challenge which Industry 4.0 (and the Emerging Technology which is driving it) is creating across the New Anglia economy.

Evidence shows that there is a generic shortfall of workforce supply across the economy (not only in New Anglia, but across much of Northern Europe) as birth rates have fallen, average age is increasing and unemployment rates have fallen. The challenge is therefore that:

* The dependency ratio is rising (i.e. the number of people who are dependent on each worker) and this means that society needs to focus on increasing the productivity of those in the workforce;
* Workforce supply is the growing challenge for most employers with vacancies across the economy and historically very low unemployment (lowest for 2 generations);
* Productivity growth is needed to increase wealth & real wages following a decade, since the global slowdown, of falling real wages.

This suggest that even if 30% or more of current jobs are lost or changed substantially by Industry 4.0 digitalisation & automation (as some suggest), we will not be short of jobs. Those displaced will find new jobs or new job roes with their current employer, assuming that they are assisted to transition to new job roles by investing more in skills & retraining & doing this fast enough.

Whilst the adoption of technology can increase productivity it will also lead to many jobs roles being completely or partially automated and this process needs to be managed. Evidence also suggests that new job roles will need to be undertaken to support the adoption of emerging technology.

These new job roles could be to design, build, install and manage the new systems which are created, but are equally likely to be created by allowing end user sectors of the economy to develop new or enhanced services.

For example, in health and social care, telemedicine, automated diagnosis or robotic care assistants may well render many current roles redundant, but could free clinicians and care assistants to interact more directly with those in their care focusing on the person and their psychological as well as their physical care needs.

In the logistics industry automated cranes, forklifts and trucks are likely to reduce the demand for drivers, whilst at the same time increasing the demand for engineers, ICT specialists and logistics planners.

In other sector, such as retail, the transition is likely to mean completely different business models reduce workforce size and release staff to join other sectirs.

For New Anglia it is important to consider how Emerging Technology will enable the Industry 4.0 transition and to provide leadership to this process, so that the region gains from the opportunities Industry 4.0 provides.

The transition in the economy, will, as is shown in the evidence base for this plan, have different impacts in different sectors, impact those with higher qualifications less than those with lower qualifications and affect some job roles far more than others. However, no sector is immune from the change and as shown all districts in New Anglia currently have between 37-45% of their job roles at risk from automation.

The impacts will thus be region wide and affect every sector, with most areas seeing both positive and negative changes which they need to respond to.

The result is likely to be that:

* Some sectors grow their workforce whilst that in other sectors fall substantially (even if the GVA or economic value of the sector does not change given the different potential for automation);
* The aggregate demand for some skills will fall whilst for others it will rise. For example every report suggests the demand for digital skills is rising, but this is not being reflected in more course enrolments. If the region wants to successfully manage the transition to Industry 4.0, this needs to change;
* The need for different skills should impact the choices made by young people to help prepare them for the new job roles which will be available in the economy, but in terms of numbers the bigger challenge is how to help existing workers develop the skills needed to remain relevant in the workforce;
* The demand for hours spent across the economy on physical, manual and basic cognitive skills will fall by 14-15% by 2030[[11]](#footnote-11), whilst the demand for hours spend on higher cognitive skills will rise by 8%, those on social and emotional skills by 24% and technology skills by 55%;
* Furthermore, the impact of new technology on new skills requirements will disproportionately impact those with lower qualifications. More jobs roles will also demand higher levels of qualification and thus reduce the jobs market potential for those with skills at lower levels;
* Most employees are likely to have multiple job roles during their career and as a result rather than seeing education as a single major event followed by a career, we need to see education and training as a continuous process throughout life. This is a major challenge to established educational and funding models. In the consultation for this plan the need for change in educational structures was clearly identified by employers.

However, the challenge created by emerging technology and Industry 4.0 is not simply a skills one and in addressing this proactively New Anglia needs to understand, plan for and proactively support economic change by using all the levers it and its partners have, including planning, business support, incentives and grants, thought leadership and skills.

Consultees were clear that the transition to Industry 4.0 needs to be a strategic, cross sectoral challenge which the LEP seeks to address both through its economic strategy as well as through skills policy.

Existing New Anglia skills plans, notably the ones for DigitalTech and Advanced Manufacturing and Engineering (AME), already deal with the skills challenges of the technology sector itself. Therefore in addressing the supply of emerging technology skills for those companies in New Anglia who provide Industry 4.0 technologies and solutions, these two existing skills plans should be used.

As noted by consultees the larger challenge, in terms of numbers of students or the existing workforce, who will need new skills due to Industry 4.0, arises in those sectors which will use Industry 4.0 solutions (supplied to them in most cases by companies in the DigitalTech and AME sectors) to improve productivity. It is these end users of Industry 4.0 on which the skills actions identified in this plan should primarily focus.

# **Skills Actions to be Taken**

Based on the evidence collected it is recommended that embracing Industry 4.0 is adopted as a cross cutting need which pervades all aspects of the New Anglia economy and linked to the ICT and Digital strand of the Local Industrial Strategy.

To address this successfully New Anglia will need to provide leadership on the economic changes which this will lead to across the economy and consider how:

* The region ensures that it can grow sectors to the economy which will benefit from Industry 4.0;
* Manage the decline or reinvention of sectors where Industry 4.0 may eliminate many of the existing jobs, job roles and/or companies/organisations;
* Facilitate the movement of the existing workforce between sectors or job roles as some existing jobs are displaced and new ones created;
* A co-ordinated effort by skills providers, working collectively given the magnitude of the impacts which are likely to be seen, can proactively facilitate the resultant economic transition.

If this transition is successfully managed it could:

* Allow New Anglia to embrace the new economy Industry 4.0 will lead to more rapidly than other areas, increasing its growth rate and economic success;
* Support the move to a knowledge led economy;
* Help workers to have more rewarding, higher skilled and better paid jobs, with less physical stress and a reduced need to undertake boring repetitive roles.

The all-encompassing nature of Industry 4.0 means that the region will need to address:

**Two key challenges:**

* Ensuring that the technology industry itself can scale up to provide the solutions needed across the economy;
* Supporting adoption of industry 4.0 by end user sectors so that they remain competitive (commercial sector) or can deliver enhanced public services within constrained budgets (public sector).

**Each of which in turn have two dimensions:**

* Initial training and education so that those entering the workforce for the first time bring with them the skills needed to embrace the opportunities, offered by Industry 4.0;
* And workforce development so that the existing workforce is equipped with the skills needed to enhance their career prospects as Industry 4.0 pervades the economy.

# **Action 1 - ICT and Digital in the Local Industrial Strategy**

To successfully deliver a response to the challenges created by Emerging Technology a commitment is needed to put in place a robust leadership model, supported by both the public and private sector, to proactively drive this change in the New Anglia economy.

The challenge requires leadership in terms of both thought leadership as well as proposing, developing, resourcing and leading practical actions to position New Anglia to benefit from the 4th Industrial Revolution.

This could be best delivered through a public/private Industry 4.0 led theme in the ICT and digital strand of the Local Industrial Strategy (LIS), to develop and implement practical policies to support positive economic change.

This must embrace both the opportunities provided by Industry 4.0 at the same time as addressing the socio-economic challenges created by rapid changes in how and where people work. In doing this it is important to address:

For major sectors of the economy:

* How industry 4.0 will affect the sector (public and private sectors) by working with established New Anglia sector groups to continually update foresight exercises for their sector relating to the technology that they will adopt;
* Clarify the skills and knowledge challenges the sector has to address to adopt Industry 4.0;
* Identify how skills and knowledge interventions can be aligned with other support for technology adoption (e.g.: business support; innovation support and grants; commercial investment and grants for investments in new technology).

For the education and skills response:

* The changes needed to education and skills provision to meet future economic needs due to Industry 4.0;
* How education and training provision and economic development support can work together to support the transition to a new economy through packages of training and education, business support and investment.

New Anglia is fortunate that local partners have already begun to develop work in this area and should seek, in developing the ICT and digital strand of the LIS, to build on the initiatives already being taken.

Consultees stressed that the breadth of the challenge means that this should seek to unite those who focus on technology development with representatives of those who need to adopt Industry 4.0 solutions. They stressed the need to support technology adoption as the prime focus.

This work will initially focus on four additional skills actions:

* **Action 2 Train Young People to be Industry 4.0 Professionals** - to increase recruitment and training of young people for Industry 4.0 technology supply companies;
* **Action 3 Upskill existing Industry 4.0 workforce** - workforce development for the Industry 4.0 supply industry;
* **Action 4 Integrate Industry 4.0 awareness into all courses at school/FE/HE** - to ensure they understand how Industry 4.0 will impact their chosen career;
* **Action 5 Upskill existing sectors workforce to adopt Industry 4.0** - to develop awareness of Industry 4.0 amongst the existing workforce across all sectors**.**

Actions 2 and 3 will be delivered primarily by building on and uniting the interventions identified in the New Anglia DigitalTech and Advanced Manufacturing and Engineering Sector Skills Plans and be led by the groups already charged with delivering these plans.

Actions 4 and 5 are new and will be the core delivery focus for this Emerging Technology Sector Skills Plan, aligned with the LIS theme on ICT and digital. They will be delivered by working with the sector skills plans sub groups for each of the existing plans to support their work on emerging technology adoption.

The Industry 4.0 theme in the LIS will also need to advocate with employers on the need to adopt Industry 4.0 and produce a simple employer guide on Industry 4.0 and where they can seek help with skills for technology adoption.

The Industry 4.0 deployment agenda in the Local Industrial Strategy needs to draw on local existing expertise and activities linked to Industry 4.0, including:

* New Anglia Innovation Board
* Institute of Productivity (IoP including NAAME)
* Eastern Institute of Technology (EIoT)
* Digital Skills Task Force

The suggested Industry 4.0 delivery structure brings together a range of existing initiatives aligned with the ICT and Digital strand of the LIS, including:

New Anglia LEP Board

New Anglia Skills Board

Industry 4.0 theme under ICT and Digital strand of the Local Industrial Strategy (LIS), drawing on expertise from:

New Anglia Innovation Board

Institute of Productivity (IoP including NAAME)

Eastern Institute of Technology (EIoT)

Digital Skills Task Force

Action 2: Train Young People to be Industry 4.0 professionals

Digital Skills Task Force, IoP & EIoT

Action 5: Upskill existing sectors workforce to adopt Industry 4.0

LIS ICT & digital theme

Action 3: Upskill existing Industry 4.0 workforce

Digital Skills Task Force, IoP & EIoT

Action 4: Integrate Industry 4.0 awareness into all courses at school/FE/HE

LIS ICT & digital theme

Sector skills plan sub groups for:

Digital Tech;

Advanced Manufacturing & Engineering (AME)

Link to & support sector skills plans sub groups for:

AgriFood Tech;

Construction;

Energy;

Financial & Insurance Services

Health & Social Care;

Life Sciences & the Bioeconomy

Ports & Logistics

Tourism & Culture

# **Action 2 – Train Young People to be Industry 4.0 Professionals**

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| **Rationale:** the technology suppliers (e.g. ICT, engineering companies) who support the adoption of Industry 4.0 can expect to see their market grow as the uptake of Industry 4.0 grows. It is essential that the industry promotes the opportunities in the sector and works with education and training providers to ensure that the technology suppliers can expand their workforce. |
| **Action to be Taken:** the supply of young people with the right school and post compulsory training and education to support the development and deployment of Industry 4.0 has to be increased. This action has to start in school and ensure that more children study the STEM subjects which underpin Industry 4.0 adoption.  This requires:   * More students to leave school with formal STEM and particularly digital qualifications & training and to progress to College and University courses which equip them for careers in the supply of Industry 4.0 solutions; * Careers information and guidance has to be reinforced to promote the growing importance of Industry 4.0 and the skills needed to enter the sectors which will support adoption of emerging technology across the economy; * Work placements which include Industry 4.0 applications; * A focus on apprenticeships, including higher apprenticeships, focused on the technology supply industry; * Colleges and Universities need to provide more courses which combine digital and Industry 4.0 themes with other disciplines to drive applications of the technology across the economy (e.g. digital with management, arts, design, sectoral/vocational etc.). |
| **Leadership:** this action will be led by the Digital Skills Task Force and Institutes of Technology and Productivity to help Universities and Colleges increase their focus on courses which provide Industry 4.0 skills. The sector skills plan groups for Digital Tech and AME will align their work to provide employer input to guide this action. |
| **When:** the need to increase the supply of young people in the Industry 4.0 sector is current and work has already begun through initiatives such as the EIoT, IoP and new facilities at Colleges and Universities. |
| **Resources and support:** this action requires constant updating of the curriculum for technology courses and investment in the technology available to deliver courses. |

# **Action 3 - Upskill existing Industry 4.0 workforce**

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| **Rationale:** the speed of technological change in Industry 4.0 means that there is a need for constant updating and expansion of the existing workforce in technology supply companies to ensure they have the skills needed to help their customer base adopt the latest technology |
| **Action to be Taken:** the key action to be taken is to ensure that the New Anglia emerging technology supply industry is embracing the latest technology from across the World and developing the skills to help implementation of these technologies across the economy. This action should also encourage those with strong sectoral backgrounds and understanding of how technology can support organisational performance to join Industry 4.0 technology suppliers to help facilitate adoption of emerging technology across the economy.  This requires:   * Bite size, blended local delivery of training and education to communicate the latest technology effectively to those already in the technology sector; * A focus on additional training to help technical experts in Industry 4.0 acquire the skills to support their customer base in adopting Industry 4.0. This needs to include training in both technology and how it can be implemented (e.g. the business case and soft skills required in the end user company etc.); * More focus on the development of multi-skilled professionals to deliver applications across the economy (e.g. emerging technology for health care), by ensuring that staff with a range of technical backgrounds can work together to deploy Industry 4.0. This can include recruiting and training workers from other sectors with sectoral specialism and understanding to work alongside technical experts to deploy Industry 4.0 solutions.   Most programmes will include a range of these skills and attention will also focus on ensuring that clear progression pathways for the industry are established. |
| **Leadership:** this action will be led by employers with the support of the Digital Skills Task Force and NAAME. |
| **When:** the need for updating is ongoing and needs to build on existing in house and sector based programmes of professional development, training and demonstration. |
| **Resources and support:** the resources needed for this action will primarily come from employers, but will be supported with specialist input and advice from the Digital Skills Task Force, NAAME, IoP and EIoT. |

# **Action 4 - Integrate Industry 4.0 awareness into all courses at school/FE/HE**

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| **Rationale:** the future workforce will be entering jobs in which the use of technology based on Industry 4.0 is a standard feature of their working life. Whichever part of the public or private sector students will ultimately work in, it is therefore vital for them to gain experience in how Industry 4.0 based technologies will support the job roles they will undertake and to ensure that they have the skills to apply these technologies effectively. If students acquire these skills they will be able to secure good jobs, not least because they will be able to bring new skills to their employers and potentially fulfil a role in helping existing employees understand how these technologies can be applied effectively. |
| **Action to be Taken:** the key action which is needed is to ensure that all young people, regardless of the disciplines they study, learn the skills to successful adopt emerging technologies which drive productivity and effectiveness. This requires:   * The integration of Industry 4.0 adoption skills (technical, management of change and culture) into all programmes at all levels; * Digital and Industry 4.0 skills to be treated like Maths & English as foundational skills which are central to employability in every sector.   Most programmes will include a range of these skills and attention will also focus on ensuring that clear progression pathways for the industry are established. |
| **Leadership:** this action needs to be taken forward by Universities and Colleges in New Anglia with the Enterprise Advisor Network (EAN) and initiatives such as the Institute for Technology and Institute of Productivity, which can provide specialist expertise to help lecturers and academics identify areas to apply Industry 4.0 within the curriculum. |
| **When:** there is a need to start the redesign of courses during 2020 and to maintain this action for at least the next 5 years as Industry 4.0 continues to change the skills needed right across the economy. |
| **Resources and support:** the main resources needed initially are for curriculum redesign to ensure that Industry 4.0 is integrated into courses. This will lead to a need for continued investment in facilities (potentially with technology suppliers) to provide examples of technology. Given that many lecturers and academics are not technology experts, a project to assist them to review their curriculum and identify areas in which Industry 4.0 can be applied should be supported by the LEP in conjunction with the Institute of Productivity and Institute of Technology. Training for lecturers is also needed to equip them with the skills to deliver Industry 4.0. |

# **Action 5 - Upskill existing sectors workforce to adopt Industry 4.0**

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| **Rationale:** the majority of the workforce in New Anglia work in ‘end user’ parts of the public and private sector, where the challenge is how to adopt Industry 4.0 so that it improves productivity and effectiveness. Evidence suggests that over a third of the current New Anglia workforce will be impacted by either the need to develop a new career if their job is displaced by technology, or to obtain new skills to secure their job role as technology changes how work is performed. |
| **Action to be Taken:** the scale of the long term challenge and lack of established provision at the scale or with the focus needed, means that action needs to be developed in at least two phases:   * A pilot phase during 2020-’21 to work with at least two end user sectors to undertake a foresight exercise to understand how Industry 4.0 will change the skills needed in their sector and to pilot ways of supporting members of the existing workforce to either gain the skills needed in the future in their sector, or to retrain for other sectors where demand in increasing; * Rollout of the successful models for workforce upskilling developed in phase 1 to the rest of the New Anglia economy.   This action is central to the ability of the New Anglia economy to respond to the opportunities and challenges resulting from Industry 4.0 and must therefore be aligned with the Economic Plan and the Local Industrial Strategy.  This action can be supported by the Mid Life MOT support linked to the government Pension Service and National Careers Service. This also needs to build on Adult Education and Skills Support for the Workforce programmes. |
| **Leadership:** this will be led by the LIS ICT & digital team in conjunction with the sub groups of the Skills Board working on each sector skills plan. |
| **When:** there is a need for a major programme over at least the next decade to develop models of support which work for this challenge. Pilot projects should be run in the next 2 years to identify how best to support employers and training providers to deliver the training needed. |
| **Resources and support:** the scale of the upskilling challenge will continue to grow as emerging technology impacts on more areas of the economy and as new technology is developed. The replacement for structural funds, the UK Shared Prosperity Fund, should be used to support upskilling of the existing workforce alongside employer investment. Consideration should be given to whether for larger employers the apprenticeship levy can also be aligned with this challenge. |

# **Annex 1 - Background to the Emerging Technology Challenge**

It is widely accepted that the economy is seeing a period of rapid change as technology pervades virtually every aspect of the economy. Whilst clearly technology has been with us for hundreds of years, starting with the industrial revolution, most commentators suggest that we are now witnessing the start of the 4th Industrial Revolution, or Industry 4.0.

The World Economic Forum (2016)[[12]](#footnote-12) has defined the position as:

*‘The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.*

*There are three reasons why today’s transformations represent not merely a prolongation of the Third Industrial Revolution but rather the arrival of a Fourth and distinct one: velocity, scope, and systems impact. The speed of current breakthroughs has no historical precedent. When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance.’*

The World Economic Forum (2016) goes on to state that:

*Like the revolutions that preceded it, the Fourth Industrial Revolution has the potential to raise global income levels and improve the quality of life for populations around the world. To date, those who have gained the most from it have been consumers able to afford and access the digital world; technology has made possible new products and services that increase the efficiency and pleasure of our personal lives….*

*In the future, technological innovation will also lead to a supply-side miracle, with long-term gains in efficiency and productivity. Transportation and communication costs will drop, logistics and global supply chains will become more effective, and the cost of trade will diminish, all of which will open new markets and drive economic growth.*

*At the same time, as the economists Erik Brynjolfsson and Andrew McAfee have pointed out, the revolution could yield greater inequality, particularly in its potential to disrupt labor markets. As automation substitutes for labor across the entire economy, the net displacement of workers by machines might exacerbate the gap between returns to capital and returns to labor. On the other hand, it is also possible that the displacement of workers by technology will, in aggregate, result in a net increase in safe and rewarding jobs.*

*We cannot foresee at this point which scenario is likely to emerge, and history suggests that the outcome is likely to be some combination of the two….. This will give rise to a job market increasingly segregated into “low-skill/low-pay” and “high-skill/high-pay” segments, which in turn will lead to an increase in social tensions.*

*….. Technology is therefore one of the main reasons why incomes have stagnated, or even decreased, for a majority of the population in high-income countries: the demand for highly skilled workers has increased while the demand for workers with less education and lower skills has decreased. The result is a job market with a strong demand at the high and low ends, but a hollowing out of the middle.*

This section of the World Economic Forum report neatly summarises the challenges which many others have discussed in relation to Industry 4.0 or the 4th industrial revolution:

1. Will Industry 4.0 displace so many employees that it is impossible for the creation of new, as yet unimagined, jobs or growth of new industries to replace the jobs lost?
2. Or will the wave of productivity growth created drive an economic renaissance by increasing the quantity, quality and value of jobs benefitting everyone?

History suggests that the second scenario is more likely, but others argue that this time is different, not least because of the speed with which whole industries are being transformed and the fact that this is happening across so many industries at the same time.

Building on this earlier work the World Economic Forum published a report in 2018 on the Future of Jobs[[13]](#footnote-13). This states that:

*The Fourth Industrial Revolution is interacting with other socio-economic and demographic factors to create a perfect storm of business model change in all industries, resulting in major disruptions to labour markets. New categories of jobs will emerge, partly or wholly displacing others. The skill sets required in both old and new occupations will change in most industries and transform how and where people work. It may also affect female and male workers differently and transform the dynamics of the industry gender gap.*

A key issue for New Anglia (and all other economic agencies to address is):

* Whether to focus on meeting the demand for digital technology skills in the digital and AME sectors with the aim of being World class at developing digital technologies?
* Or, whether to focus on being World class at adopting digital technologies, whoever developed them, so you can apply them across your whole economy through equipping the workforce in every sector with the skills needed to be digital pioneers?

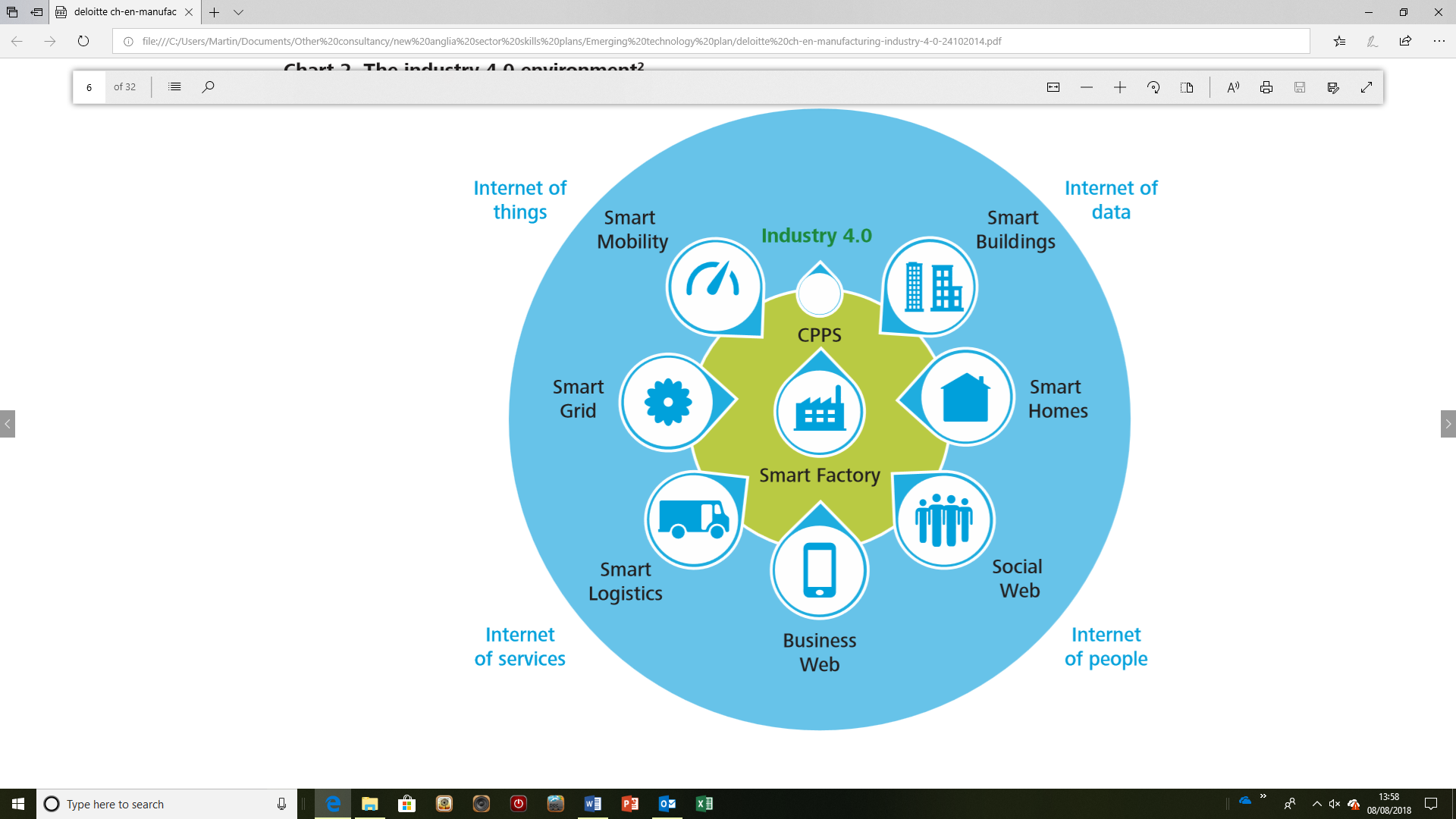
There is no easy answer to this conundrum and as the World Economic Forum suggests in relation to the impact of Industry 4.0, probably a combination of both approaches is needed.

# **What is Industry 4.0?**

PWC (2018)[[14]](#footnote-14) defines it as: ‘Industry 4.0 encompasses end-to-end digitization and data integration of the value chain: offering digital products and services, operating connected physical and virtual assets, transforming and integrating all operations and internal activities, building partnerships, and optimizing customer-facing activities.’

Deloitte in The Industry 4.0 Environment[[15]](#footnote-15) stresses the point that Industry 4.0 brings together multiple ‘smart systems’ which collectively are supported by internets of: things; data; people; and, services (see figure 6). This provides a useful graphical representation which shows the inter-dependency between sectors and participants, which create some of the non-technical skills challenges which Industry 4.0 leads to, including: the need for cross functional teams and working; integration skills; and, innovation in working methods and organisational structures.

**Figure 6 - Industry 4.0**



# **Impact across the Economy**

Whilst technology comes in many forms, many of the most disruptive changes arising from the 4th Industrial Revolution are focused on what has become known as Industry 4.0, which brings together digital technologies with engineering to develop autonomous systems with the potential to lead to rapid changes in job roles.

Most reports expect Industry 4.0 to impact across the economy with, potentially substantial, impacts on how many people work and the types of skills employers will need.

The development of Industry 4.0 will therefore increase demand for new skills and a larger workforce in the sectors which supply the technology (e.g. through increased demand for computer control, mechanised system suppliers etc.). The sectors supplying these services are likely to grow their share of the economy as end user companies and consumers buy products and services which allow them to adopt Industry 4.0 solutions.

In end user sectors, industry 4.0 is likely to displace many existing job roles (as is being seen in traditional retail as sales move online in the so called ‘retail armageddon’[[16]](#footnote-16)), but at the same time it will create new roles demanding new skills in technology adoption and optimisation. This will create a big increase in the need for workforce retraining and upskilling in end user companies.

A recent report on BBC News[[17]](#footnote-17) suggests that ‘The popularity of online shopping has contributed to a near doubling in demand for warehouse space over the past 10 years’, citing figures from property research firm CBRE, which went on to state that: ’About 235 million square feet of warehouse space was leased or purchased between 2007 and March 2018. That figure is up from about 130 million square feet in the previous decade. About 60% of the space is now used by retailers, according to CBRE.’

This clearly shows the impact that online sales is having right across the economy and its potential, over time to change the high street, business parks and the jobs roles that people fill in the economy.

Current end user sectors are likely to see a static or smaller workforce after adopting industry 4.0, even whilst growing their economic output, but will need higher skill levels and potentially new areas of in house skills to remain competitive. In end user companies the key challenges will include needing the skills to:

* Adopt a ‘technology watch’ mentality so that the company understands what new technologies may be appropriate to its processes;
* Redesign processes or change the organisation to allow new technologies to be used;
* Specify areas in which new technology can be applied, so that they are ‘expert clients’ when working with technology suppliers to design the most appropriate solutions;
* Manage the technology adoption process including: adopting new business models; financing capital investment (in lieu of revenue staff costs); supporting process changes; supporting workforce development.

The combined affect across the economy is likely to be a period of rapid change with potentially major economic and social challenges unless the skills system responds proactively to these changes.

New Anglia has to embrace and invest in the future jobs which will fuel its economy and has to do this at least as fast as other areas of the UK or wider World so that the local economy remains competitive.

To address this challenge the emerging technology plan focuses on two parallel strands to deal with this expected rapid increase in the use of digitally enabled technologies across multiple sectors, by focusing on:

1. **Meeting the demand for emerging technology skills in technology supplying industries**: this will focus primarily on how to ensure that New Anglia’s Digital Tech, Advanced Engineering and Manufacturing and Digital Creative sectors can work together to ensure they have the workforce and skills to design, build, supply and maintain products and services which deliver productivity growth in the wider economy. This will include focusing on areas in which New Anglia can develop products and services which can be sold into national and international markets;
2. **Meeting the demand for skills to optimise the use of emerging technology in end user sectors**: this will focus on how to equip sectors which need to adopt emerging technologies with the skills to remain competitive. To do this they will need to acquire the skills to be ‘expert clients’ and to get the productivity gains from the technologies which will be available to them. Major sectors where this is needed include: AgriFood Tech, Ports and Logistics, Life Sciences and the Bio-economy, Energy, Construction and Health and Social Care.

Arguably for an economy such as New Anglia’s, the first focus on developing the emerging technology sector itself, i.e. ‘suppling the picks and shovels’ for the technology (gold) rush, is an important goal and can lead to economic growth, particularly in areas where the region has globally significant R&D and innovation capabilities (e.g. NRP for the life sciences and the bio-economy and Innovation Martlesham for ICT and communications technology).

However, the second focus on ensuring that the wider economy has the skills to embrace emerging technology, is also important as this will ensure that the whole economy is able to make progress in delivering higher productivity, leading to growth and competitiveness in New Anglia’s other key sectors.

The balance of the economy is clearly focused on end user companies and employment (the second focus) and thus if the area only concentrated on the first focus, the impact is likely to be modest and could indeed lead to major disruption across swathes of the wider economy even if the region managed to develop and market World class emerging technologies.

# **The Evidence Base**

The impact of emerging technology and Industry 4.0 on employment, productivity, the workforce and the skills needed has received a lot of attention in the last 3-4 years and the number of reviews, reports and foresight exercises continues to rise as more policymakers, business and employee groups become involved.

The review below brings together the evidence and conclusions from many of these reports at the international, national and more local levels and then cross references these with the evidence from the New Anglia sector skills plans developed during 2016-’18.

**International Reports**

The OECD (2018) report[[18]](#footnote-18) on automation, skills use and training found that:

* Across the 32 countries [studied], close to one in two jobs are likely to be significantly affected by automation, based on the tasks they involve. But the degree of risk varies. About 14% of jobs in OECD countries participating in PIAAC are highly automatable (i.e., probability of automation of over 70%)…. In addition, another 32% of jobs have a risk of between 50 and 70% pointing to the possibility of significant change in the way these jobs are carried out as a result of automation – i.e. a significant share of tasks, but not all, could be automated, changing the skill requirements for these jobs.

In 2015 McKinsey Global Institute[[19]](#footnote-19) reported that: ‘for the applications that we size, we estimate that the Internet of Things has a total potential economic impact of $3.9 trillion to $11.1 trillion per year in 2025. On the top end, the value of this impact—including consumer surplus—would be equivalent to about 11 percent of the world economy in 2025’. It predicted that interoperability could enable gains of 40% in system efficiency, reduce the costs of human disease treatment by as much as 50% and using real time data to predict maintenance needs could reduce downtime by 50%.

In 2018, McKinsey reported[[20]](#footnote-20) that: ‘we expect productivity growth to recover and see the potential for at least 2 percent growth a year over the next ten years, with 60 percent coming from digital opportunities’.

World Robotics reported[[21]](#footnote-21) that in 2016:

* Robot sales increased by 16% to 294,312 units, a new peak for the fourth year in a row.
* There are five major markets representing 74% of the total sales volume in 2016: China, the Republic of Korea, Japan, the United States, and Germany. Since 2013 China has been the biggest robot market in the world with a continued dynamic growth.
* It predicted that in 2018 the UK will buy 2,000 industrial robots, against 21,500 in Germany (the most in Europe), with the US buying 38,000 and China installing an anticipated 140,000 robots.

World Robotics[[22]](#footnote-22) predicted that the largest markets for service robotics in 2018-2020 would be in four sectors:

* Medical: $7.8billion
* Logistics: $5.9billion
* Field use: $4.2billion
* Defence: $3.6billion

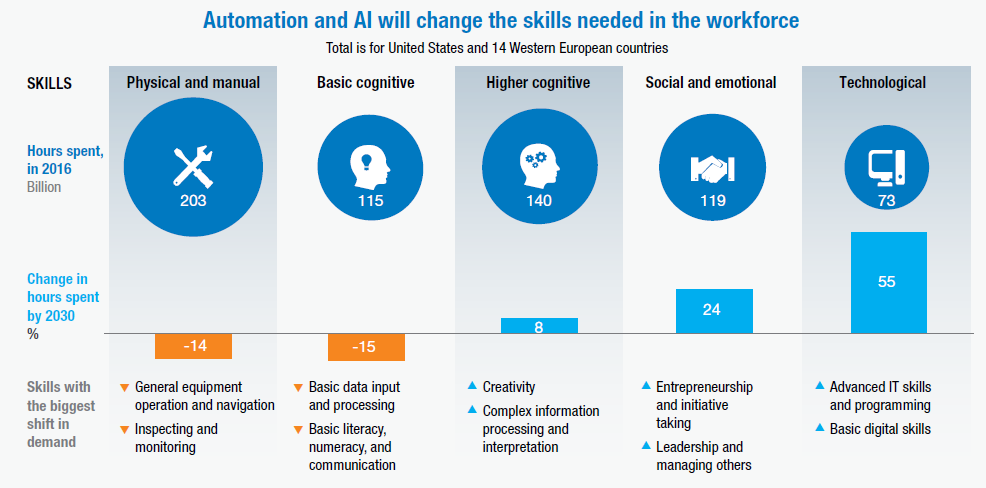
McKinsey Global Institute in a June 2018 paper[[23]](#footnote-23) for the French Presidency predicted that:

* ‘as AI and automation bring benefits to business and society, we will need to prepare for major disruptions to work. About half of the activities (not jobs) carried out by workers could be automated. Our analysis of more than 2000 work activities across more than 800 occupations shows that certain categories of activities are more easily automatable than others. They include physical activities in highly predictable and structured environments, as well as data collection and data processing. These account for roughly half of the activities that people do across all sectors. The least susceptible categories include managing others, providing expertise, and interfacing with stakeholders.’
* ‘about 30 percent of the activities in 60 percent of all occupations could be automated. This means that most workers—from welders to mortgage brokers to CEOs—will work alongside rapidly evolving machines’.
* ‘we have found that around 15 percent of the global workforce, or about 400 million workers, could be displaced by automation in the period 2016–30’, but said that ‘additional economic growth, including from business dynamism and rising productivity growth, will also continue to create jobs. Many other new occupations that we cannot currently imagine will also emerge’.
* ‘jobs changed: More jobs than those lost or gained will be changed as machines complement human labor in the workplace Partial automation will become more prevalent as machines complement human labor. For example, AI algorithms that can read diagnostic scans with a high degree of accuracy will help doctors diagnose patient cases and identify suitable treatment’.

This summary report built on more detailed work in other McKinsey reports including[[24]](#footnote-24):

* ‘Our research finds that the strongest growth in demand will be for technological skills, the smallest category today, which will rise by 55 percent and by 2030 will represent 17 percent of hours worked, up from 11 percent in 2016. This surge will affect demand for basic digital skills as well as advanced technological skills such as programming. Demand for social and emotional skills such as leadership and managing others will rise by 24 percent, to 22 percent of hours worked. Demand for higher cognitive skills will grow moderately overall, but will rise sharply for some of these skills, especially creativity.’
* ‘Some skill categories will be less in demand. Basic cognitive skills, which include basic data input and processing, will decline by 15 percent, falling to 14 percent of hours worked from 18 percent. Demand for physical and manual skills, which include general equipment operation, will also drop, by 14 percent, but will remain the largest category of workforce skills in 2030 in many countries, accounting for 25 percent of the total hours worked. Skill shifts will play out differently across sectors. Healthcare, for example, will see a rising need for physical skills, even as demand for them declines in manufacturing and other sectors.’
* ‘Companies will need to make significant organizational changes at the same time as addressing these skill shifts to stay competitive. A survey of more than 3,000 business leaders in seven countries highlights a new emphasis on continuous learning for workers and a shift to more cross-functional and team-based work.’
* ‘Competition for high-skill workers will increase, while displacement will be concentrated mainly on low-skill workers.’
* In 2014 PWC[[25]](#footnote-25) reported that based on a survey of 120 manufacturers in the US: 28% believe that replacement of workers will be the biggest impact of robots on the US manufacturing workforce in the next 3–5 years; but, 35% believe the biggest impact will be the creation of new job opportunities to engineer advanced robots and robotic operating systems.

**Figure 7 - source: McKinsey, Skill Shift Automation and the Future of the Workforce (2018)**



This dichotomy on the prospects for jobs was also found in **Jobs Lost, Jobs Gained** (2017)[[26]](#footnote-26), in which McKinsey & Company argues that: 15% (midpoint estimate) of current jobs will be lost to automation, but that the proportion varies widely between countries and industries, with on balance more jobs likely to be affected in countries and industries where industry is more developed and wages are higher (such as the UK). They expect the overall economy and the demand for workers to grow, due to economic growth, but as with other reports argue that these changes ‘will challenge current education and workforce training models, as well as business approaches to skill-building’. They suggest that the change seen in the economy could be faster and more profound than in previous industrial revolutions and will require major skills initiatives to enable the response to keep pace with the changes seen.

In **AI, Automation and the Future of Work**, McKinsey (2018)[[27]](#footnote-27) stated that a key area for change was: ‘Evolving educational systems and learning for a changed workplace. Policy makers working with education providers (traditional and non-traditional) and employers themselves could do more to improve basic STEM skills through the school systems and improved on-the-job training. A new emphasis is needed on creativity, critical and systems thinking, and adaptive and life-long learning. There will need to be solutions at scale.’

**World Skills Russia**[[28]](#footnote-28) identified three layers of nested (like Russian Dolls) skill sets needed to effectively deliver Industry 4.0:

* Inner layer - Hard skills: Design; Programming CPS (Cyber-physical systems) dispatching; CPS maintenance; Data management; Knowledge transfer and usage; Quality control
* Middle layer - Soft skills: Communcation; EQ (emotional intelligence); Safety skills; Collaboration (human-human and human-machine); Problem identification & solving
* Outer layer - Metaskills: Environmental intelligence (sustainability); Sustainability skills (Green including recycle); Continuous learning; Multidisciplinary transfer, creativity; Adaptivity.

The development of Industry 4.0 is being assessed across the World and a report for the BRICS[[29]](#footnote-29) economies in 2016, specifically focused on whether these economies have the skills so that they were ready to adopt the potential offered by Industry 4.0. It concluded that more work was needed to improve: the quality of course content and trainers; align with World Skills so that vocational education in the skills needed to drive Industry 4.0 was given more recognition.

**EU Report and Initiatives**

In a report for the European Parliament in 2015[[30]](#footnote-30), it was noted that: ‘the nature of manufacturing work has been shifting from largely manual labour to programming and control of high performance machines. Employees with low skill levels risk becoming replaceable unless they are retrained. On the other hand, workers able to make the transition to Industry 4.0 may find greater autonomy and more interesting or less arduous work.’

They also reported that more creativity and decision-making skills were required as well as technical and ICT expertise. They predicted that by 2020, labour markets in the EU could be short of as much as 825,000 ICT professionals, but reported concerns that young people may not necessarily be interested by the digitalisation of the workplace: in one survey only 13% of young adults in Germany would definitely consider a career in ICT despite the majority view that the sector offered the best job prospects.

The EU has also promoted eSkills to reduce shortages of workers with ICT skills, including a multi-stakeholder partnership called the Grand Coalition for Digital Jobs to make ICT education more attractive and better aligned to industry needs.

The partnership for robotics in Europe, [SPARC](http://www.sparc-robotics.net/), is the largest research and innovation programme in civilian robotics in the world. It was launched in 2014 by the joint public-private partnership between the European Commission, the robotics industry and academia. Investments are expected to reach €2.8 billion with €700 million in financial investments coming from the European Commission under Horizon 2020 over 7 years.

In a recent paper published by SPARC, the question of whether robots will reduce employment was addressed[[31]](#footnote-31) and it stated that ‘robots perform tasks, not jobs’. This distinction is interesting as the paper points out that most jobs require workers to have more than one skill and therefore argues that it ‘makes sense to think of robots as tools that can be used by people in their workplace, ideally helping with the dull, dirty, or dangerous tasks and boosting productivity. This has spurred a new area of collaborative robots, or cobots, that are easy to work with’.

**National Reports**

In September 2018 the Migration Advisory Committee (MAC)[[32]](#footnote-32) report on **EEA Migration in the UK** was published. This recommended that post Brexit the UK should focus on high skilled migration and not low skilled, with migrants from both Europe and other countries treated equally. It proposed that the salary level for migrants should be set at £30,000 and below this the only sector where it suggested some low paid migration maybe allowed was for seasonal agricultural work (it is worth noting that DEFRA have announced a pilot on low paid seasonal agricultural workers from April 2019, but will only issue 2,500 visas in the first season - widely reported as being only circa 2% of the total needed by the industry).

Given that the majority of migrants working in New Anglia (with the exception of those in R&D, Universities and offshore energy), and indeed the average local wage, are both below £30,000, this suggests that there is, if these proposals are adopted, unlikely to be access to future migration to fill most roles currently occupied by migrants.

The initial government response to this MAC report suggests that these proposals are likely to be adopted. The need for new labour saving technologies, particularly for lower paid roles is therefore likely to become even more important than some reports have suggested.

In the Future of Skills: Employment in 2030[[33]](#footnote-33), NESTA states that:

* ‘THE FUTURE DEMAND FOR OCCUPATIONS - We predict that around one-tenth of the workforce are in occupations that are likely to grow as a percentage of the workforce. Around one-fifth are in occupations that will likely shrink. This latter figure is much lower than recent studies of automation have suggested. This means that roughly seven in ten people are currently in jobs where we simply cannot know for certain what will happen. However, our findings about skills suggest that occupation redesign coupled with workforce retraining could promote growth in these occupations.’

NESTA also says:

* We find that many of the jobs likely to experience a fall in employment are, unsurprisingly, low- or medium-skilled in nature. However, in challenge to some other studies, not all low- and medium-skilled jobs are likely to face the same fate;
* In general, public sector occupations — with some exceptions — feature prominently and are predicted to see growth.
* We also expect buoyant demand for some — but not all — professional occupations, reflecting the continued growth of service industries.

NESTA’s conclusions on what this means for skills are:

* We find a strong emphasis on interpersonal skills, higher-order cognitive skills and systems skills in both the US and the UK;
* We show that the future workforce will need broad based knowledge in addition to the more specialised features that will be needed for specific occupations;
* Complementary skills that are most frequently associated with higher demand are customer and personal service, judgement and decision making, technology design, fluency of ideas, science and operations analysis.

This report is consistent with others, in showing that the future demand for skills is uncertain in magnitude and speed and will have different effects on different sectors and roles within each sector. However, the overall conclusions are reported as being clear, with a trend towards inter-disciplinary and higher level skills increasing in importance, whilst across the economy the demand for lower skill levels and single disciplines is likely to decline.

On 6th August 2018 the Fabian Society and Trade Union Community launched a 2 year commission into **Workers and Technology**[[34]](#footnote-34) chaired by Yvette Cooper MP (chair of the House of Commons Home Affairs Select Committee), with the publication of new evidence on British workers‘ hopes and fears for automation over the next decade. Their initial evidence shows that (online survey of over 1,000 workers):

* Overwhelmingly, workers are positive about their own ability to navigate change: 73% are confident they will be able to change and update their skills if new technology affects their job. After learning about how technological changes will affect the workplace, over half (53%) are optimistic about their future working life and job prospects.
* However, a significant minority are anxious about the impact of automation over the next 10 years: 37% of workers (i.e. 10 million people) are worried their job will change for the worse; and 23% of workers (i.e. 6 million people) are worried that their current job may no longer be needed.

Few workers think the government, employers or trade unions are taking action to support workers as technologies change: only 9% of workers think that the UK government is taking steps to prepare them for new workplace technologies; only 16% of employees with a trade union in their workplace think that their unions are taking steps to help ensure that new technologies improve their working life; and, only 27% of employees think their employer is taking action to prepare them for changes.

An RSA commission has recently been set up on the future of work in farming, food and sustainable rural economies[[35]](#footnote-35). This has yet to report any findings but is looking nationally at the challenges created by the all the structural and technology challenges in the sector.

The **Industrial Strategy** (2017)[[36]](#footnote-36) sets an overall government vision for the UK economy and outlines key ways in which the UK needs to prepare itself for the future. Published in 2018, it tackles the issues created by Brexit and aims to make the UK more competitive to drive exports and trade post Brexit. It promotes apprenticeships, investment in technical education and a major focus on STEM skills to address the shortages of technical skills in across a wider range of technology intensive sectors.

The **Technology and Innovation Futures** report[[37]](#footnote-37) (2017), published alongside the Industrial Strategy White Paper, noted that ‘The greatest future opportunities lie in enabling existing and emerging technologies to interact with each other’. Furthermore, it identified that Government should make early interventions in its role as ‘Skills planner - Prepare for growing demand for workers with multi-disciplinary technical skills, and mitigate the impact of robots and machine learning replacing unskilled and graduate-level roles’, and noted that: ‘other countries are similarly engaged, such as Singapore, which has gained a leading international position in information technology through ensuring a pipeline of highly skilled workers’.

The **Made Smarter Review**[[38]](#footnote-38) (formerly the Industrial Digitalisation Review) was published in autumn 2017 and considered how digital technologies in all forms will impact UK industry. It calculated that embracing the transformative power of digitalisation has the potential to increase UK GVA by £455bn (cumulative) over the next decade by improving productivity, reducing waste and developing new markets. The review included a cross cutting theme of skills, which was a recurrent theme in all the consultations held for the review.

The Centre for Economic Performance (supported by ESRC, the Economic and Social Research Council) produced a report on **Robots at Work** in 2015[[39]](#footnote-39) which looked at the potential for robots to delivery economic gains. They concluded that: the likely contribution of robots on future growth is substantial.

Localis **In the Place of Work** (2017)[[40]](#footnote-40), suggests that of 47 local authorities studied in England Suffolk was ranked 46th and Norfolk 33rd most exposed to the aggregate risk from four structural labour market risks: migrant labour supply, automation of manual jobs, skills base and demographics. Norfolk at 43rd and Suffolk at 45th (out of 46) on the skills base ranking is reported to have particular challenges in the availability of skills to respond to changes in the economy.

The **Impact of AI in UK Constituencies**[[41]](#footnote-41) (2017) looked at where in the UK would be most affected by automation, with the South West Norfolk and Suffolk Coastal constituencies predicted to be the most affected in New Anglia as they have more staff in likely to be automated low skill jobs. The study found that between 22-39% of the workforce of every constituency would be affected by automation and argued that: ‘UK government should: develop smart, targeted strategies to address future job displacement …. The importance of targeting these interventions to those at most risk cannot be overemphasised. Such interventions could include supporting businesses to retrain employees and providing financial and psychological support to people impacted.’

The same themes have been picked up by the Engineering Employers Federation (EEF) in a series of recent reports including:

* In **An Up-Skill Battle**[[42]](#footnote-42) EEF (2016) reported that ‘we will struggle to find a sufficient number of candidates to satisfy the demands of our sector, and too many candidates lack the skills that manufacturers need’. The report identifies that 49% of employers already think UK productivity is lagging competitors and recommends greater focus on management, technical and production skills to address this. This report argues for supporting more young people to take apprentices and for ‘an integrated approach to skills, both vocational and academic, which has so far eluded the UK’.
* In September 2017 the EEF[[43]](#footnote-43) predicted the development of an ‘hourglass’ economy with a growth in higher skilled jobs at expense of those in the ‘middle’, and predicted that 54% of all jobs in the engineering sector would need L4+ skills by 2024. They also highlighted that 76% of engineering employers employed at least one migrant, with the current workforce comprising 87% UK nationals, 11% from other EU states and 2% from outside the EU. It also noted that employers had already seen a reduction in job applications from EU nationals and an increase in EU nationals leaving their jobs.
* In **The 4th Industrial Revolution: a primer for manufacturers**[[44]](#footnote-44) the EEF reported that 80% of manufacturers thought that the 4th Industrial Revolution would be a reality for their business before 2025, but only11% thought that the UK manufacturing sector was currently geared up to respond. 50% of manufacturers surveyed thought that their need for IT and software skills would increase over the next 3 years, and the report also concluded that ‘great leaders are needed for this to be a revolution’.

**Regional Reports**

The **East of England Science and Innovation Audit** (SIA)[[45]](#footnote-45), identified four sectors as regional strengths: life sciences; agritech; ICT; advanced manufacturing & materials. However, it stated that the real potential for economic growth lay in the overlaps and called for investment in inter-disciplinary skills e.g. the chapter for advanced manufacturing and materials stated that: ‘The sector is in the process of being transformed – particularly through digitalisation’.

The SIA executive summary also identified digital & ICT skills as central to the delivery of all four themes & regional growth: ‘There is an overarching requirement to address major issues relating to skills – particularly … data science & computer science…. found shortages across all four Themes …. the scale of the problem is such that unless addressed, it will stymie business growth’. Under overarching technology trends, the SIA also notes that: ‘Intelligent manufacturing …. Industry 4.0 involves pervasive digitalisation’.

The **New Anglia Economic Strategy**[[46]](#footnote-46) (2018) targets a 2% average increase in annual GVA to 2036, with productivity growing by 1% per annum and 0.5% growth in jobs per annum, supported by increasing the workforce with NVQ L3+ to 66% by 2036. The strategy also recognises that ‘many of our growth opportunities involve collaboration and partnership between firms in different sectors’.

The New Anglia Advanced Manufacturing and Engineering Sector Growth Strategy[[47]](#footnote-47) (2017) focused on six areas to drive sector growth:

* Financially backing the sectors as drivers of economic growth;
* Embed supply chains and knowledge locally;
* Bring together businesses in special interest groups;
* Improve the infrastructure across Norfolk and Suffolk;
* Increase the engagement between schools and businesses;
* Focus on New Anglia’s emerging sub-sectors.

# **Annex 2 - New Anglia Sector Skills Plans & the Adoption of Emerging Technology**

During 2016-18 New Anglia LEP developed 10 sector skills plans to identify, at sectoral level, the way in which sector growth or changes in job roles may affect the demand for skills and the degree to which current provision will meet future workforce needs. A further three plans, including this Emerging Technology plan are in development.

Each plan concludes with a series of recommendations for the areas in which new initiatives or additional investment is required to ensure that future skills provision meets employers’ needs for workforce and skills.

These plans covered the following sectors:

* Primarily technology providing sectors which supply technology to other industries:
  + Digital Tech
  + Life Sciences and the Bio-economy
  + Advanced Manufacturing and Engineering
* Predominantly sectors which use technology, much of which comes from other sectors:
  + Construction
  + Health and Social Care
  + Agri Food Tech
  + Energy
  + Ports and Logistics
  + Financial and Insurance Services
  + Cultural sector
  + A plan for the Digital Creative sector is still in development

In addition a Cross Cutting Report[[48]](#footnote-48) was produced which brought together common themes from the individual sector skills plans. This concluded that:

‘Across Norfolk and Suffolk we will support individuals and businesses to maximise their potential through: digital literacy; strategic application of digital technology; investing in and realising the economic and human potential from Industry 4.0 technologies such as Artificial Intelligence and Robotics’

The section below highlights the key findings from the individual LEP sector skills plans which relate to the skills challenges arising from the development and adoption of emerging technologies:

## **Digital Tech**

The New Anglia Digital Tech plan[[49]](#footnote-49), not surprisingly, focuses almost exclusively on challenges which are relevant to the Emerging Technology skills plan. The key findings were:

* Nationally, the 2017 TechNation Report[[50]](#footnote-50) highlights that the Digital Economy is growing twice as fast as the wider economy, with an economic output of approximately £100 billion per year. The Digital Tech sector has been placed in the centre ground of driving UK competitiveness, with the emerging Industrial Strategy and the emerging UK Digital Strategy. It is recognised as a sector that is a driver for innovation and economic growth and an enabler for a digitally fluent, more resilient economy.
* New Anglia’s Digital Tech sector is diverse and productive, with a total employment base of 16,600, up nine per cent since 2010, and a GVA of around £1.3bn. Employment opportunities in the region are increasingly requiring higher skills, creating even greater demand for qualifications at degree level and above. As well as businesses that self-define as Digital Tech, this plan recognises Digital Tech professionals employed across all sectors in the area. There is an expanding digital economy across New Anglia, involving marketing, finance, public services and tourism, and recruitment opportunities for digital workers with transferable digital skills are set to accelerate according to replacement demand forecasts. Also, there is significant demand for competencies across marketing and sales within a Digital Tech environment and this is set to increase.

## **Life Sciences and the Bio-economy**

The New Anglia LEP Sector Skills Plan – Life Sciences & Bio-economy (2017)[[51]](#footnote-51) focused heavily on the need to commercialise the region’s strong life sciences R&D base and recognised that to achieve this the industry needed to embrace advanced manufacturing skills drawing on emerging technology. Specifically it identified that:

* 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

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.

## **Advanced Manufacturing and Engineering**

The New Anglia LEP Sector Skills Plan for Advanced Manufacturing & Engineering (2018)[[52]](#footnote-52), had digitalisation as a major cross cutting theme, which would both enable the sector itself to be more competitive and productive whilst delivering new services to other sectors. It specifically identified that:

* The sector is, however, facing significant challenges in meeting its future workforce and skills needs and expected changes in the industry are likely to exacerbate this challenge. Notably the engineering and manufacturing sectors are on the cusp of widespread adoption of new technology, often called Industry 4.0 or the 4th Industrial Revolution, through which traditional engineering is becoming intimately entwined with sensors, automation and ICT.
* These changes in the context for the industry are an enormous opportunity and one which we know will change the skills we need, probably ultimately in ways we have not yet even considered. As with earlier industrial revolutions the prize is economic growth, better and safer working conditions and enhanced life opportunities, but Norfolk and Suffolk are not alone in the race to adopt this new technology.
* The skills that our existing workforce have and continue to develop will help us lead this process of change, but we also need to attract many more young people by helping to describe clearly how a career in our industry is dynamic and has real prospects. If we are right about Industry 4.0 these prospects will not only be in the traditional AME sector, the skills we have in manufacturing and engineering will also be enablers of change right across the economy, from health care to transport to food production and science.

Throughout the consultation process it was clear that employers and providers shared a view that the demand for AME skills was likely to see a step change in three important ways:

* Total demand - the total demand for AME skills will increase as the use of automation and robotics, self-driving vehicles and other similar developments advance;
* New Skills and Combinations of Skills - the nature of the skills needed will change quickly as technology advances and boundaries between disciplines become blurred;
* Diversify into new sectors – as the demand for AME solutions moves into new sectors (e.g. health care) and affect the demand for skills and employees with AME skills across many other industries.

Consultees felt that incremental, organic growth of training and skills provision was likely to mean that the current shortage of AME skills becomes a crisis and constrains future growth of the sector.

## **Agri Food Tech**

The New Anglia LEP Sector Skills Plan - AgriFood Tech (2017)[[53]](#footnote-53) identified that emerging technology is a major driver of change in the food chain both locally and internationally as the sector tries to develop its productivity sustainable. It specifically identified:

**Labour Substitution Through Automation** - the industry is rapidly adopting new technology enabled by digital technology, sensors, data analysis, robotics and control systems. This may reduce the workforce needed for the same level of output and could thus be expected to cost jobs, but will also address key local weaknesses by raising labour productivity and creating higher skilled, higher paid jobs. If this development improves competitiveness of the New Anglia AgriFood Tech sector it may also lead to growth of the sector through import substitution and growth in exports. It could also help the industry address challenges created by a lack of supply of labour, rising wage costs and potential further restrictions on supply post Brexit. However, this will create skills challenges including:

* Skills for engineering, soft robotics, artificial intelligence (AI), data are growing in importance and more supply will be needed to meet industry needs;
* An agile workforce with higher level technical skills will be needed given the speed of change in the industry;
* There will be a need for applied research and skills in new disciplines such as acoustics and vibration sensors to identify problems early in mechanised systems to allow timely remedial action to be taken.

The skill set that unites all these areas is the need for skills in the collection, manipulation, presentation and use of data. Employers reported that current maths performance is poor for those entering the industry from school and, that even those with degrees in data focused disciplines, often struggled to apply their knowledge to business problems.

The need for data skills supports AgriFood Tech companies in assessing markets, driving production efficiency and managing their businesses.

The growth in demand for technical and data skills will also need to be underpinned by a supply of soft skills in leadership, management and project working, to enable new production systems or the use of data to support decisions to be integrated into the workplace.

## **Energy**

The New Anglia Energy Sector Skills Plan 2018[[54]](#footnote-54) highlighted that:

* There is a growing demand for intelligent sensoring solutions to regulate heat, lighting, power output/generation and consumption - linked to plugs, domestic sensor units with digital capture and transmission technologies
* Employers highlighted the need for the workforce to demonstrate greater transferability of skills between digital, surveying, engineering/manufacturing and maintenance services. Key examples include:
  + The transition from CAD to GIS cloud / thin client web based mapping systems for marine surveying, including an increasing use of drone technology. Surveying practice is becoming increasingly sophisticated through digital and automation technologies;
* The growing importance of aligning advanced manufacturing and engineering with energy in the context of Industry 4.0, particularly on the back of the increasing use of digital and cloud based technologies

## **Ports and Logistics**

The Ports and Logistics sector skills plan[[55]](#footnote-55) noted that:

* Change in the industry is being enabled by digital technologies to plan logistics (e.g. backloading, most efficient routes and rerouting, geofencing, load optimisation etc), energy efficiency (storage and transport) and, it is expected, that further major changes will occur in the next decade for example through the potential widespread adoption of autonomous and/or electric vehicles.
* Automation of vehicles and warehousing is already beginning to be seen in the sector. Whilst there are different views about how quickly the transition to automation will occur, there is a broad consensus that in some areas automation will have a large impact by 2023, whilst other areas may take longer. The cost and efficiency savings which automation can bring will ultimately drive adoption rates, but will be contingent on the availability of skills to design, develop, install and operate these new systems

Subsequent to the LEP Ports and Logistics Sector Skills Plan the Government Office for Science (2019) had released a report[[56]](#footnote-56) on how emerging technologies may affect the freight sector. This looked at 7 technologies including: cloud computing; Internet of Things (IoT); social media networks; Artificial intelligence (AI); big data analytics; immersive technologies; and, distributed ledger technology (DLT). This review concluded that:

‘These technologies were found to enable smart and digitalised applications and to support various practical, sector-specific activities, such as digital rail, smart motorways and smart port programmes. These and similar digital applications have great potential to enhance the sustainability of transport in respect of its physical, environmental, economic and social dimensions. However, with the exception of cloud computing and IoT, the review found limited empirical evidence to demonstrate the value created by these technologies for freight, mainly due to their early stage of deployment in this sector’

This need for further work to understand the impact of emerging technologies is common across all sectors.

## **Financial and Insurance Services**

The New Anglia sector skills plan for financial and insurance services (2018)[[57]](#footnote-57) noted that:

* Support digital tech capability, (which is increasingly important given digital automation across key parts of the sector).
* To this end there is a significant crossover skills ‘relationship’ to foster between the sector and digital technology, with the New Anglia ‘Digital Tech’ skills plan activity led by TechEast, aiming to better define and influence the supply of skills for the New Anglia area. This will be an important link to the Financial Services and Insurance sector skills plan.
* Overall employers highlighted the increasing impact that digital automation has had on consolidating and restructuring services into accounts (often by industrial sector for commercial banking) and area based roles, with general ‘digital literacy’ needed to provide appropriate advice and customer management. Technical capability for larger businesses is often retained within the employer through specialised IT contractor roles and through an increasing need to provide digital data analysis, using cloud based solutions.
* Digital AI (artificial intelligence) for the insurance industry means that claim handling and renewals will increasingly be issued automatically, including some initial underwriting considerations.
* Across the board concern for the mismatch between changing skills demands and ‘softer skills’ output- with digital automation impacting on the nature of business services being far more relationship management and account management focused for the client and less focused on compliance and administration.
* Financial technology- known as ‘FinTech’ describes a business that aims to provide a service financial service- directly to the end customer or to a business client, which makes use of digital modern technology. In 2017 KPMG reported that around 42% of global financial services firms have a fintech strategy[[58]](#footnote-58), in reflection to the increasing demand of customers wanting to access their financial services online and on their mobile devices.
* KPMG report: “At the rate the industry is evolving, financial products and services – and the technological infrastructure behind them – will look remarkably different in a decade. Financial institutions that take the time to define their fintech strategy and align it to their future vision and business goals will be best positioned to forge the future of financial services.”
* Key facts made available through the FCA highlights the extent to which digitisation of products and services has played a significant role shaping the overall service offer for the industry, impacting on functional roles and skills requirements- 53% of payments are made electronically (2015), with a 228% increase in contactless payments[[59]](#footnote-59). In 2013 Ernst and Young reported that globally there are approx 7 billion mobile subscriptions and that 57% of insurers were aiming towards the development of a ‘digital business case’ to respond the fundamental demand for online product channels.[[60]](#footnote-60)
* Although the employer consultation highlighted a view of ‘levelling off’ for SMEs within the sector in terms of digital technology and automation- particularly within the financial advice and planning industries- the extent to which fintech is seen as a key catalyst for driving competitiveness for the sector as a whole and in turn the skills demands to support it- should not be overlooked. Norwich as a business cluster for the sector- is already highlighting the important relationship between the financial services industry and the creative digital industry, which also has a significant presence. There is already an ‘industrial heritage’ between contactless payment and the initial application and testing development through Norwich enterprises, with firms like AVIVA also championing the role that creative digital enterprises can play in diversifying the reach of financial services across online, app and mobile technology. AVIVA also cite UEA’s role in the sourcing of suitably qualified ‘web app’ programmers, more than any other UK HEI.

## **Cultural Sector**

The cultural sector skills plan noted that a cross-cutting theme seen by stakeholders as providing a direction across the whole skills plan was digitalisation: embracing of technology with the understanding and practical skills to exploit it for artistic, commercial and community benefit.

The Independent Review of the Creative Industries[[61]](#footnote-61) noted that the Creative Industries are also enablers to other industries. Not only is there is significant overlap between the creative and digital sectors (for instance the IT, software and games sub-sector contribute almost 40% of the GVA of the Creative Industries) but the wider creative economy – industries which include creative roles – also has a far larger footprint. For example, 3D modelling – a technology pioneered in the video games sector – is helping Rolls Royce to develop their understanding of engines, improve their efficiency and enhance performance in their manufacture.

Skills shortages exist in relation to creative sectors like animation, visual effects and video games. Digital skills remain a systemic problem throughout the sector[[62]](#footnote-62).

Creative, digital, design and engineering occupations have bright outlooks and are strongly complemented by digital technology[[63]](#footnote-63).

## **Skills Needs in Construction and Health and Social Care**

New Anglia also produced two other sector skills plans in house (early in 2016), but neither has any real focus on digitalisation or the uptake of emerging technology:

* Construction - The current published New Anglia Skills Plan has no mention of ‘digital’ and only one mention of adopting new ‘technology’.
* Health and Social Care - The current published plan has no mention of ‘digital’ or adopting new ‘technology’, which is surprising as the consultations with senior NHS managers for the Life Sciences and Bio-economy plan identified that the NHS will be unable to meet its future commitments practically (labour supply) or financially without adopting new digitally enabled technologies.

Both sectors are increasingly using new technology including digital solutions and numerous reports are identifying that automation and robotics will have a major impact on these sectors in the medium to long term.

Both sectors are also very exposed to restrictions on migration following Brexit as their workforce uses a high proportion of EU migrants. Further consideration of these challenges is therefore urgently required including:

In Construction:

* Digital design, 3D printing and other forms of automated construction. There is a recent McKinsey report (2018)[[64]](#footnote-64) which looks in detail at the way in which digital and new technology is being integrated into the construction sector at every stage of the process from design to build and operation. It identifies that investment in construction technology has doubled in the last decade to over $1billion of venture capital investment in 2017;
* In November 2018 BEIS announced an investment of £72 million to create a Core Innovation Hub[[65]](#footnote-65), as part of the modern Industrial Strategy to make the UK a world leader in the latest construction techniques. Linked to the Industrial Strategy and Construction Sector Deal, the hub will support essential research and development in digital and offsite manufacturing technologies, focusing on technologies such as augmented and virtual reality. The aim is to transform the sector and improve UK infrastructure;
* The Transforming Construction Alliance (TCA) has been selected to deliver the national hub. It is partnership between 3 centres of established excellence: Manufacturing Technology Centre (MTC); BRE; and, Cambridge University’s Centre for Digital Built Britain (CDBB). The UEA already has links to BRE having included them in the UEA led InCrops partnership (2008-’15) which also included Cambridge University. The UEA Adapt Group has also been active in this area.

In Health and Social Care:

* Telemedicine, sensors to monitor health, AI and imaging technologies for diagnosis, robotics to help with social and physical care needs and cobots to assist carers so that the musculo-skeletal problems experienced by many staff through lifting patients are reduced;
* A consultation with an NHS board chairman for the New Anglia Life Sciences and Bio-economy Sector Skills Plan (2018), explored the premise that to be able to provide future services successfully the NHS had to embrace new technology. A key blockage in achieving this was felt to be the fact that most current NHS staff do not have the technical skills to be an ‘expert client’ and thus cannot specify and embrace the potential which digitalisation has;
* This need to embrace digitalisation was at the heart of the announcements in January 2019 of the NHS Long Term Plan[[66]](#footnote-66), from Matt Hancock MP Secretary of State for Health (and Suffolk MP). This signalled a move to embrace telemedicine and the potential of digitalisation more broadly in diagnosis and treatment, with a focus on prevention as well as cure.

## **Future work on Digital Creative and Education sectors**

A sector skills plan for Digital Creative, building on both the plan for Digital Tech and Cultural Sector skills plans, is currently being developed.

Given the focus on digitalisation this plan is expected to focus heavily on how digital technologies can support this emerging sector.

Further work is looking at whether and how to develop a skills plan for the education sector itself, to address the challenges reported across many of the sectors in securing the lecturers needed. In New Anglia, reports also regularly show major challenges with attracting graduates with STEM skills into teaching. Given the focus on digital skills across the economy, this plan would, if developed, clearly explore the need for digital skills amongst teachers and lecturers.

## **The Retail Sector**

The one large sector in New Anglia which has not yet been covered by a skills plan is the retail sector. Given the magnitude of change which is already happening in this sector due to digitalisation, it is proposed to cover at least the digital aspects of the retail industry in the Emerging Technology Sector plan.

Retail is the largest private sector employer in New Anglia and widely accepted to be very exposed to digitalisation:

* In 2017, IPPR reported that retail was one of four sectors where collectively 5million jobs were at risk due to automation.
* BBC News in August 2017[[67]](#footnote-67) reported that: The popularity of online shopping has contributed to a near doubling in demand for warehouse space over the past 10 years, according to figures from property research firm CBRE. About 235 million square feet of warehouse space was leased or purchased between 2007 and March 2018 - equivalent to more than 3,000 Wembley Stadiums. That figure is up from about 130 million square feet in the previous decade. About 60% of the space is now used by retailers, according to CBRE.
* Online sales now account for 18.2% of all Great Britain’s retail trade[[68]](#footnote-68) and have grown by 15.2% in value in the year to July 2018, against growth of 5.1% (value excluding automotive fuel) for the sector as a whole. High street food stores only saw growth of just over 2% and non-food retail stores saw growth of less than 1% when online sales were excluded.

Analysis by PWC in autumn 2018[[69]](#footnote-69) has shown that the challenges for the high street have intensified with the biggest gap between the number of store openings and closures in 5 years. In the first half of 2018 there was a net loss of 1,123 shops from the UKs top 500 high streets as 2,692 shops closed and only 1,569 opened. In contrast the figure for the first half of 2017 was a net loss of 222 shops.

Earlier in 2018, PWC[[70]](#footnote-70) had reported that ‘many retailers are increasingly feeling the impact of the acceleration of online shopping as consumers begin to feel more comfortable with the price transparency and reliability of delivery options offered by online retailers’.

Analysis by SkillsReach for this plan has looked at the Retail sector and has found that:

**Table 6 - Retail Centre Consumer Spending[[71]](#footnote-71)**



Referring to retail specialists Harper Dennis Hobbs ‘2017 Vitality Rankings – Top 50 British Centres’ publication we can see that Norwich is ranked just outside the top 10 retail centres nationally with a retail spend potential of approximately £2.3bn.

Only three other areas in the East of England region appear in the top 50, all with much lower retail spend figures. This means that Norwich is particularly exposed to the changes being seen in retail.

**Table 7 - East of England Major Retail Centres[[72]](#footnote-72)**



This conclusion is further reinforced by looking at the ratio between population and the number of retail units in a retail centre. Despite having one of the lowest populations of major towns and cities in the East of England, Norwich has the highest number of retail business units

This implies that Norwich services both a much wider area and larger population than other major towns and cities in the region.

As the retail sector transitions to an online model facilitated by, often automated, ordering, warehousing and delivery systems, the sector’s skills needs and workforce requirements will change very rapidly.

With this sector being (retail, wholesale and transport) New Anglia’s single largest employment sector, it is vital to look at how the region can support positive change in this sector of the economy.

# **Annex 3 - Common Themes on Emerging Technology in the Sector Skills Plans**

Across all the sector for which skills plans were produced common themes in relation to digital and emerging technologies are apparent (drawn from the skills plans and national reports):

| Sector Skills Plan | Industry 4.0 Technology provider | Industry 4.0 application & user | |
| --- | --- | --- | --- |
| Data, AI, VR, Machine Learning | Robotics & Automation Systems (RAS) |
| SkillsReach led plans in 2016-18: | | | |
| Digital Tech | Central role as developer of technology alongside Digital Creative and AME sectors | Provide the ICT and data analytics to underpin the developing of smart systems including AI, VR and machine learning | key role to provide the control systems for robotic and automated systems (RAS) |
| Life Sciences & Bio-economy | Centres such as Earlham Institute have helped spearhead new data analytics platforms and technologies to help DNA profiling | Major end user of AI, machine learning and data analytics in research and commercial applications | Major challenge regionally to turn R&D base into saleable products, which will require cutting edge manufacturing |
| Advanced Manufacturing & Engineering (AME) | Central role as developer of new Industry 4.0 systems alongside Digital Tech and Digital Creative sectors, but also a major end user of the technology as well | Control systems, sensors and AI/machine learning all being applied extensively with an expectation of much faster adoption in future | Investment RAS across many other sectors anticipated to increase demand for AME company services to design, build, install and maintain RAS |
| AgriFood Tech | Sector combines both end users (majority) and companies developing new technologies for agrifood, although New Anglia R&D base mainly focused on other tech areas | Still in its infancy, but multiple UK and global start ups targeting the food chain with data platforms, MIS and control systems | UK adoption is accelerating rapidly due to labour constraints, wage cost pressures and availability of automated systems as global investment accelerates |
| Energy | Mainly an end user sector | Smart grid technology will increase the use of data, AI and machine learning across the energy economy and move it from a technology used by energy companies to technology adopted by energy using companies and households | Applications for dangerous roles (e.g. marine or nuclear) is driving adoption and supported by government ISCF programmes  More broadly adoption is supporting energy infrastructure, smart grid technology (sensors) and logistics for energy |
| Ports and Logistics | Mainly an end user sector | The use of digital systems to track and plan logistics is established  However, the expectation is that the growth of direct delivery services, automated supply chains and new transport infrastructure will increase the demand for data services substantially.  Potential for substantial disruption to other sectors, such as retail, whose business models will be displaced | Major investment in automation expected, including self driving vehicles, automated warehousing, ports loading and unloading and delivery using drones, autonomous vehicles etc.  Major disruption to existing skills base and need for new skills. Improved health and safety is a key driver of RAS adoption |
| Financial & Insurance Services | Mainly an end user sector, although some new technologies are being developed by the sector directly (including start ups) | Fintech is changing the way financial services are delivered and is attracting substantial investment. UK is leading some of this work globally based on the strong UK financial services sector | No major needs identified |
| Cultural Sector | Mainly an end user sector | Digital is revolutionising the way that cultural services are developed (e.g. animation, gaming) and delivered (apps, VR). Virtual tours, marketing, online media and information services expected to grow in importance in the future | No major needs identified |
| Earlier plans developed by the LEP: | | | |
| Construction | Mainly an end user sector | Digital technology already used extensively for design and engineering for construction. Smart building technology utilises data analytics (including sensor networks) and AI and machine learning to manage build environment services and funtionality | Technology being developed to reduce costs, increase efficiency and improve health and safety. 3D printing of buildings, offsite construction and automated building systems in development |
| Health and Social Care | Mainly an end user sector | Telemedicine, real time monitoring of patients conditions and imaging are all growing rapidly  New diagnostic tools using AI and machine learning many replace many traditional clinician roles allowing more focus on patient care  Social care services will be supplemented with digital monitoring of patients | Automated procedures being developed for diagnosis and treatment of a wide range of health needs  Robots and cobots for care being developed across the World to reduce danger to staff (from lifting) and to provide costs effective 24 hour care services |
| Plans in development: | | | |
| Digital Creative | Yes, central role as developer of technology alongside the Digital Tech and AME sectors | Provide the ICT and data analytics to underpin the developing of smart systems including AI, VR and machine learning | key role to provide the control systems for robotic and automated systems (RAS) |
| Education | Skills for technology is a key role for the education sector in the delivery of Industry 4.0 | Online, digitally enabled education and training systems are becoming more common with VR and AI being used to enrich the experience | Limited applications, but key role in providing skills for this technology |
| Clean Energy | Mainly an end user sector | The development of smart grids and smart energy systems will create demand for technology and new skills to support new technology and business models | Limited applications |
| Sectors not covered by a skills plan where Industry 4.0 will impact substantially | | | |
| Retail | Mainly an end user sector | Online retail is growing very rapidly at the expense of traditional high street sales. The retail sector employs 3.1m staff and so change has major impacts on the workforce. AI and machine learning are allowing retailer to directly target consumers | Changes in retail distribution is being enabled by RAS and future prognosis suggests a continued move away from high street stores and shopping centres to warehouses, direct delivery services and automated logistics solutions |

# **Annex 4 - Consultees**

In developing this plan the SkillsReach team consulted directly with:

* Adam Golding, Tait Technologies Ltd
* Andrew Whilding, Institute of Productivity
* Bradley Rowley, New Anglia LEP
* Carolyn Barnes, East Suffolk Councils
* Clare Harding, West Suffolk Councils
* Clarke Willis, New Anglia AgriFood Skills Group
* Colin Noble, Noble Group
* David Parfrey, Norwich Research Park
* David Sparkes, New Anglia Growth Hub skills advisor
* Deborah Blumfield, Estrata Recruitment
* Eve Cronin, Norfolk County Council
* Gary Jefferson, West Suffolk College
* Gordon Jones. Suffolk County Council
* Helen Clements, Morgan Sindall
* Helen Lewis, UEA
* Howard Partridge, Innovate UK (UKRI)
* Jo Pearson, Pearsons Capital Projects Ltd
* Jonathan Reynolds, Nautilus Associates Limited
* Julia Nix, Department for Work and Pensions
* Julian Munson, New Anglia LEP
* Laura Smith, Broadland District Council
* Madeleine Coupe, New Anglia LEP
* Michael Gray, Suffolk County Council
* Natasha Waller, New Anglia LEP
* Paul Reed, Anglia Innovation Partnership LLP
* Phil Stittle, West Suffolk College
* Professor Fiona Lettice, UEA
* Professor David Richardson, UEA
* Richard Bridgeman, Warren Services Limited
* Richard Denetto, CBI
* Robert Campbell, Breckland Council
* Roderick Sutherland, Suffolk New College
* Simon Coward, Hethel Innovation
* Vimmi Hayes, Suffolk County Council

In addition over 300 stakeholders across New Anglia have contributed to the individual sector skills plans which inform this Emerging Technology Plan, with many reporting issues for future skills demands linked to the adoption of Industry 4.0 which led to the development of this plan.

Further input was received from the partners in the Eastern Institute of Technology (EIoT) team at meetings in July and October 2018 and from a workshop at the Hethel Innovation event at UEA in September 2018.

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