Research Bulletin 18/8 | Understanding Artificial Intelligence Jobs and Skills Needs

Aine Clarke and Thomas Byrne, Analytical Services, Department for the Economy

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Summary

Artificial Intelligence has the potential to be a major disruptive factor in both the future labour market and society more generally. This presents both challenges and opportunities for employees and employers alike. Using Burning Glass Technologies, an innovative web-scraping tool of online job vacancies, this article provides an overview of the types of jobs that Artificial Intelligence is creating and the skills that employers need for these. Jobs are being created not just in ICT occupations, but also much more widely in healthcare, education and professional services. These jobs typically need people with STEM subjects, particularly computer science, maths and engineering, which are forecast to be under-supplied in Northern Ireland according to the latest Skills Barometer. Clever solutions, such as broadening into non-STEM subjects and retraining using models such as Assured Skills Academies, may therefore be needed to support the growth of AI jobs.

Introduction

Artificial Intelligence (AI) refers to technologies that aim to reproduce or surpass abilities (in computational systems) that would require 'intelligence' if humans were to perform them. The applications of AI systems are very diverse, ranging from understanding healthcare data to autonomous and adaptive robotic systems, to smart supply chains, video game design and content creation.[i] The draft Industrial Strategy recognises that digital technologies will have a transformative and disruptive effect across all aspects of the economy, and that companies need to understand the potential impact of these emerging digital technologies and the opportunities they will bring.[ii]

This article seeks to understand the potential job opportunities that AI can create and the skills that people need to take advantage of these jobs. It uses Burning Glass technologies[iii], which collects together almost 40 million unique job adverts posted online across the UK since 2012, to provide a deeper understanding of AI jobs and skills. There are inevitably limitations[iv] with any source such as Burning Glass which pulls information directly from a wide range of websites, but nonetheless it can be used to give useful insight into AI-related jobs that employers are seeking to fill and the skills they are asking for.

Economic Impact of Artificial Intelligence

PricewaterhouseCoopers (PwC) estimates that AI could contribute up to $15.7 trillion to the global economy in 2030, more than the output of China and India combined.[v] PwC initially expect the greatest potential uplift to come from increased productivity through automation of routine tasks, augmenting employees capabilities and freeing them up to focus on higher value-adding work. Capital-intensive sectors such as manufacturing and transport are likely to see the largest productivity gains, given that many of their operational processes are highly susceptible to automation. Eventually, the GDP uplift from product enhancements and subsequent shifts in consumer demand, behaviour and consumption emanating from AI will overtake the productivity gains.

This consumption impact is expected to benefit the healthcare and automotive sectors in particular, which have many market opportunities for innovation, appropriate drivers in place and high feasibility to adopt new AI technologies. There is, however, a gap between AI investment and adoption. McKinsey Global Institute found that AI investment is growing fast, and is dominated by digital giants such as Google. Global level tech companies are estimated to have spent around $20 billion on AI in 2016, but the adoption of AI outside of the tech sector is currently at an early and somewhat experimental stage with few firms having deployed it at scale.[vi]

It is estimated that UK GDP could be 10% higher by 2030 because of AI.[vii] This will primarily be driven by increased product quality (4.5% impact in 2030), more personalised and greater variety of goods (3.7%), as well as increased productivity through augmentation of the labour force and automation of some roles (1.9%). Realising this benefit will require action by government; an independent review made 18 recommendations across four areas: improving access to data; improving supply of skills; maximising UK AI research; and supporting uptake of AI.[viii] There are, however, already existing practical efforts currently underway to advance the understanding and use of AI. [ix]

Jobs Impact of Automation

AI and automation are expected to have a significant impact on the outlook for jobs and skills. Around 47% of US occupations are estimated to be at risk of computerisation in this period, particular those that pay low wages or require a low level of educational attainment. Workers in transportation and logistics, office and administrative support workers and in production based occupations are most likely to be substituted by computerised capital.[x]

It is estimated that 35% of current jobs in the UK are at high risk of computerisation over the next 20 years. Certain aspects of a job are simpler to automate than others. Social workers, nurses, therapists and psychologists are among the least likely occupations to be taken over as assisting and caring for others, which involves empathy, is a crucial part of the job. Roles requiring employees to think on their feet and come up with creative and original ideas, for example artists, designers or engineers, hold a significant advantage in the face of automation. Additionally, occupations involving tasks that require a high degree of social intelligence and negotiating skills, like managerial positions, are considerably less at risk from machines.[xi]

NESTA disagrees with the scale of the decline in some of these studies. It predicts that around one-tenth of the workforce are in occupations that are likely to grow, particularly in education, health care and professional occupations. Around one-fifth of the workforce are in occupations that will likely shrink; these are typically low or medium-skilled in nature although not all of these jobs are likely to face the same fate. This means that roughly seven in ten people are currently in jobs where we simply cannot know for certain what will happen. Occupational redesign coupled with workforce retraining could promote growth in these occupations. "21st century skills" such as teaching, social perceptiveness, service orientation, persuasion and higher-order cognitive skills such as complex problem solving, originality and fluency of ideas will be in high demand moving forward.

Centre for Cities has used the NESTA analysis to profile in which cities jobs are likely to be lost. With one in five jobs in an occupation that is very likely to shrink, this amounts to approximately 3.6 million jobs, or 20 per cent of the current workforce in cities. Those cities with relatively weak economies in the North of Great Britain are most vulnerable to job losses, with cities in the South at relatively less risk. Yet, despite 'scare stories' and the likelihood of job losses, all cities are likely to see an increase in jobs across both the public and private sectors – thus replacing any jobs lost to new technology. [xii]

For Northern Ireland (NI), Ulster University estimates that anywhere from 10% to 50% of jobs are at risk from automation. In line with other research, this would be typically low to medium skilled workers, particularly males who tend to work in those occupations most at risk. Regardless of whether it is 85,000 or 424,000 jobs at risk, this still represents a significant challenge. Nonetheless, there is optimism that anywhere from 43,000 to 595,000 jobs could be created from automation. AI and automation therefore will lead to a dynamic labour market which looks very different to present, regardless of whether total job numbers decline, stay the same or grow.[xiii]

Artificial Intelligence Jobs

Burning Glass has a set of defined "Skill Clusters" which are extracted and developed by their data analysts based on a comprehensive set of online job postings and CVs. One of these clusters is specifically for AI, which allows us to understand recent activity in the labour market for AI-related jobs. Over the period January 2017 to June 2018, there were a total of 17,070 active AI job postings across the UK with just 211 (or 1.2%) of these in NI. We will consider vacancies posted across both the UK and NI to get as broad a sense as to what these jobs might look like.

Across the UK, three occupations account for over half of AI jobs posted:

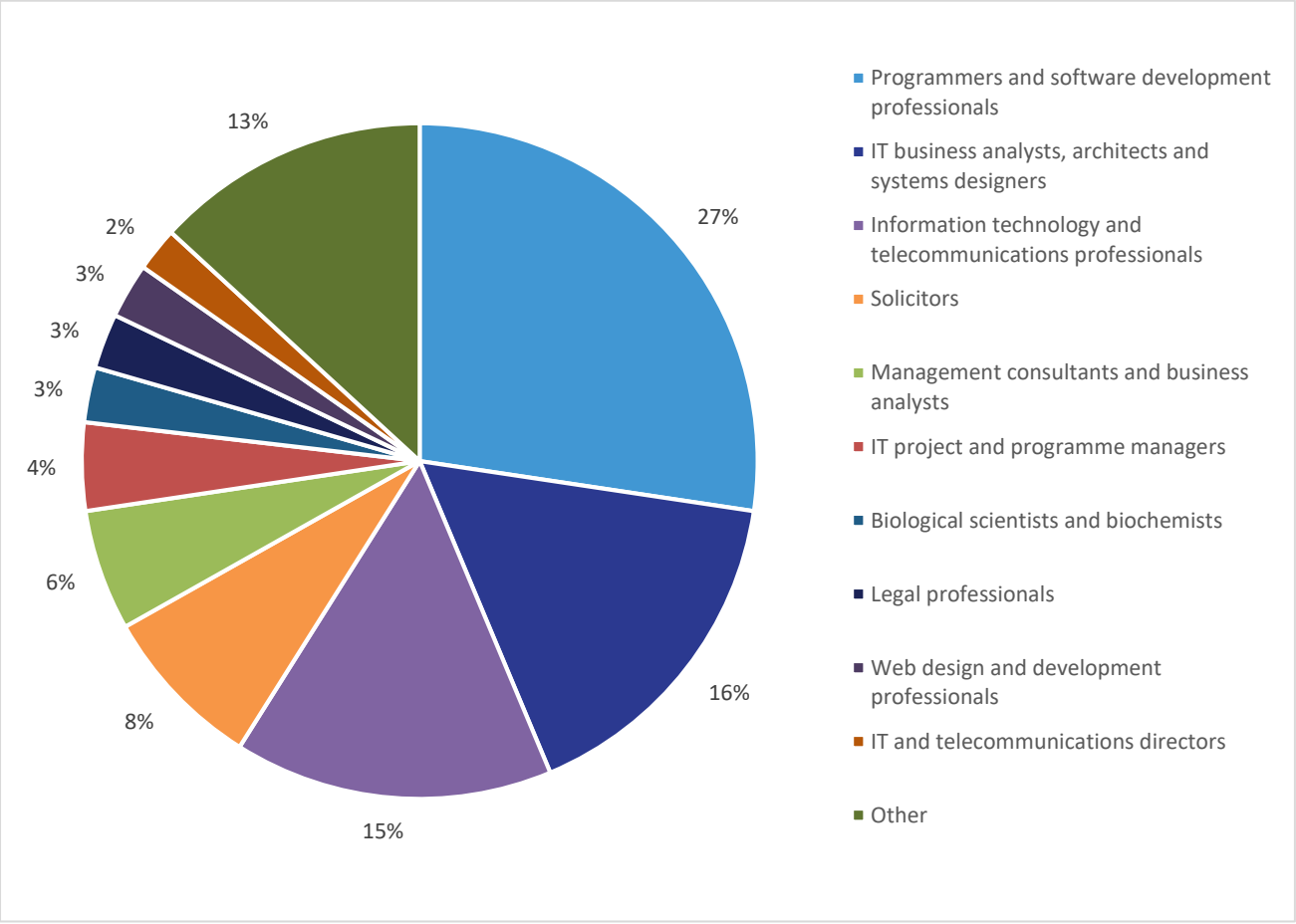
- Programmers and software development professionals (28% of total known occupations),
- IT and telecommunications professionals not elsewhere classified (14%); and
- IT business analysts, architects and systems designers (12%).

As would be expected, the largest demand is for IT and software jobs. However, there are many other occupations where AI is creating jobs, such as management consultants and business analysts (3%), marketing and sales

directors (2%), biological scientists and chemists (2%) and Higher Education teaching professions (2%). This demonstrates the potential of AI to create jobs across a wide range of areas.

A similar trend is replicated in NI (see Figure 1). 59% of total AI vacancies (where the occupation is known) are for software programmers, IT business analysts and other IT professionals. However, jobs are also being created locally for occupations such as solicitors and management consultants.

Figure 1: Top AI Occupations in NI, January 2017-June 2018



Source: Burning Glass

The employers recruiting for these AI jobs are not always known, as many employers tend to use recruitment agencies and many adverts do not state specific employers. We cannot therefore build up a comprehensive picture of all those companies recruiting for AI roles, but for the 3,750 vacancies where employers are known across the UK we can build up a picture of the types of companies seeking to take advantage of AI opportunities (see Table 1). The largest employers are dominated by accountants/management consultants and tech companies, although opportunities available in healthcare, education and banking are also evident.

Table 1: Largest Known Employers Recruiting for AI Jobs in the UK, January 2017-June 2018

Rank	Employer	Vacancies	Rank	Employer	Vacancies
1	Deloitte	170	**11**	Amazon.com	50
2	KPMG	154	**12**	Aston University	48
3	PricewaterhouseCoopers	151	**13**	Google	47
4	Microsoft	128	**14**	Astrazeneca PLC	47
5	EY	85	**15**	Imperial College London	41
6	McKinsey & Company	72	**16**	National Health Service	40
7	FDM Group Ltd	70	**17**	Barclays	39
8	Accenture	57	**18**	University of Essex	38
9	IBM Corporation	52	**19**	Durlston Partners	38
10	Assurance Technology Ltd	50	**20**	Capgemini	38

Source: Burning Glass

The small number of vacancies with employer listings in NI precludes a similar listing as above. For those adverts where employer information was available, PwC was the most active local employer (24 vacancies) whilst EY was the other management consultant represented (4). Ulster University (8) was the second largest known employer, demonstrating the reach of AI into Higher Education teaching. Companies such as Citigroup (5), Seagate (2) and Allstate (2) were also found to have been recruiting for AI-related jobs. There will also have been many employers outside these where information was not available from the job adverts who have recruited similar roles.

Information is available on the salaries of around half of these vacancies across the UK and for NI. This suggests that AI jobs these employers are recruiting tend to be very highly paid, with 92% of the jobs across the UK offer salaries of at least £30,000 per year and 63% offering at least £50,000. In NI, the equivalent figures are 83% and 22% respectively; this is lower than across the UK but still very high wages compared with the NI median wage (£25,999 for full time employees in 2017[xiv]).

Skills Needs of Artificial Intelligence Jobs

For those AI job adverts where subjects are known, employers tend to look for STEM qualifications in candidates, with the most sought after subject in both the UK and NI being computer science. The Skills Barometer suggests that there will significant demand for STEM subjects in NI over the next decade, leading to a significant under-supply of people with STEM qualifications.[xv] Indeed, computer science is forecast to have the greatest gap between supply and demand, and the competition for suitably qualified graduates could therefore be a key constraint in supporting the growth of the AI sector within NI (see Table 2). There may, however, be opportunities for employers to recruit from skilled graduates with subjects such as economics, business studies and statistics where there is not expected to be an under-supply; initiatives such as Assured Skills Academies could helpfully play in a role in retraining graduates with the skills needed for AI jobs.[xvi]

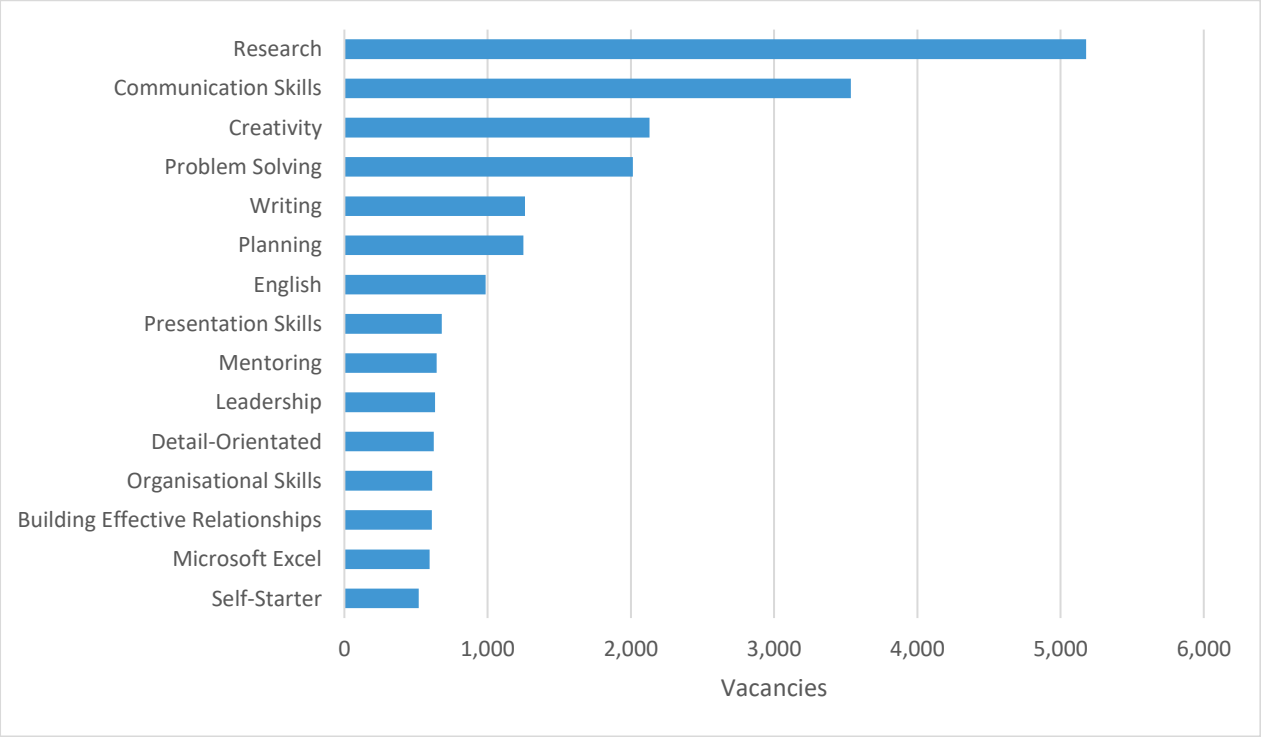
Table 2: Top 10 Subjects Sought by AI Employers, January 2017-June 2018

Rank	Subject Area	UK Vacancies	Skills Barometer Outlook
1	Computer science	2,895	Under-supplied ×
2	Engineering	1,589	Under-supplied ×
3	Mathematics (including applied maths)	1,301	Under-supplied ×
4	Computer software engineering	640	Under-supplied ×
5	Business administration	545	Over-supplied ✓
6	Electronics and electrical engineering	504	Under-supplied ×
7	Statistics	484	Broadly in balance •
8	Physics	430	Under-supplied ×
9	Computer engineering	234	Under-supplied ×
10	Economics	154	Over-supplied ✓

Source: Burning Glass

An important role of the education system is to provide leavers with not just qualifications, but also the actual skills needed by employers; the British Chamber of Commerce has highlighted that many students lack the skills and discipline needed by the workplace.[xvii] Employers recruiting for AI jobs therefore do not only need people with STEM qualifications, but also those that have skills such as research, communication, creativity and problem-solving (see Figure 2). Many of the skills sought for AI jobs are broader employability skills rather than technical abilities, suggesting that graduates from other related disciplines (such as economics and business studies which will be over-supplied in NI) may well be suitable for AI jobs if employers have a more open recruitment approach.

Figure 2: Skills Sought by Employers for AI Jobs, January 2017-June 2018



Source: Burning Glass

Conclusions

AI is expected to have a significant impact on not just the future labour market, but also society and our daily way of life more generally. AI will present challenges, particularly for those with lower skills who perform routine tasks as part of their jobs, but also many opportunities. NI has an opportunity to be a global leader in developing and supporting AI, and is already creating jobs not just in ICT, but also more broadly in education and professional services. However, in order to realise this opportunity, NI must supply people with the required qualifications and skills needed for AI jobs; the Skills Barometer suggests that many of the subjects needed for AI jobs are going to be under-supplied in the coming years which could potentially act as a constraint. Clever solutions, such as recruiting people with non-STEM subjects who show relevant skills and the Assured Skills model of retraining, may therefore be needed to support the growth of an AI sector in NI. In order to explore this area further, research is planned with UUEPC to understand the specific implications of automation (including AI) on the NI economy and further tailor future labour market projections in the Skills Barometer.

Aine Clarke and Thomas Byrne

For further information or queries please contact aine.clarke@economy-ni.gov.uk or thomas.byrne@economy-ni.gov.uk

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[i] https://epsrc.ukri.org/research/ourportfolio/researchareas/ait/
[ii] https://www.economy-ni.gov.uk/sites/default/files/consultations/economy/industrial-strategy-ni-consultation-document.pdf
[iii] https://www.burning-glass.com/
[iv] Information captured is dependent on what employers have put in job adverts and how websites have classified them. Even though Burning Glass has a highly sophisticated anti-duplication process, some duplicated postings inevitably remain, for example due to re-advertisement of postings across several different websites. A job posting may not always indicate an actual vacancy as some postings can refer to posts yet to be created, and the level of detail in job adverts can vary.
[v] https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf
[vi] https://www.mckinsey.com/~/media/McKinsey/Industries/Advanced%20Electronics/Our%20Insights/How%20artificial%20intelligence%20can%20deliver%20real%20value%20to%20companies/MGI-Artificial-Intelligence-Discussion-paper.ashx#
[vii] https://www.pwc.co.uk/press-room/press-releases/artificial-intelligence-could-add-232bn-to-UK-gdp.html
[viii] https://www.gov.uk/government/publications/growing-the-artificial-intelligence-industry-in-the-uk
[ix] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/566075/gs-16-19-artificial-intelligence-ai-report.pdf
[x] https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf
[xi] https://www2.deloitte.com/uk/en/pages/news-in-focus/articles/automation-could-threaten-uk-jobs.html
[xii] http://www.centreforcities.org/publication/cities-outlook-2018/
[xiii] http://connect.catalyst-inc.org/assets/general/Full-Research-Findings.pdf
[xiv] https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/4xu-NI-ASHE-Bulletin-2017.PDF
[xv] https://www.economy-ni.gov.uk/sites/default/files/publications/economy/NI-Skills-Barometer-2017-Summary-Report.pdf
[xvi] https://www.economy-ni.gov.uk/articles/assured-skills-programme
[xvii] https://www.independent.co.uk/student/news/students-lack-the-skills-and-discipline-essential-in-a-workplace-warns-boss-10457428.html