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Artificial Intelligence Regulation, Use and Innovation in the United Kingdom: a broad overview

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This Briefing Paper, requested by the Committee for the Economy, provides a broad overview of AI (Artificial Intelligence) regulation, use and innovation in the United Kingdom, to inform the Committee's initial consideration of this area. Included are regulatory frameworks at United Kingdom and Northern Ireland governmental levels, with a comparative look at the European Union's and the United States of America's regulatory approaches. The paper outlines AI deployment in public sector. Where available, the Paper highlights governmental data reporting on key potential economic impacts of AI deployment.

This information is provided to Members of the Legislative Assembly (MLAs) in support of their duties, and is not intended to address the specific circumstances of any particular individual. It should not be relied upon as professional legal advice, or as a substitute for it.

Key Points

There is no universally agreed definition of Artificial Intelligence (AI). Existing definitions emphasise the technology's autonomy, adaptability and ability to infer patterns. AI systems are generally underpinned by algorithms and machine learning, with a broad range of applications, across economic sectors.

The United Kingdom has chosen to regulate AI using existing laws, enforced by existing regulator. That differs from, for example: the European Union, where an AI Act currently is in development; and, the United States of America, where an Executive Order on AI has been issued by the President and his administration has signalled his intention to introduce AI legislation.

AI regulation in the United Kingdom raises matters that are within both devolved and reserved policy areas. The United Kingdom Government has committed in its Command Paper, published in February 2024, to engaging with devolved administrations on its regulatory approach.

In Northern Ireland, Queen's University Belfast and the Ulster University have a strong history of AI research that aims to enable and support innovation in this area. More recently, since 2024, both universities have partnered on an AI Collaboration Centre. The Centre has received £16.3 million funding from the Department for the Economy and Invest Northern Ireland Northern Ireland is also home to a number of spin-out companies and larger firms working in AI.

There are a range of potential public sector AI applications, such as fraud and error detection and managing operations. Based on the available evidence examined for purposes of this Paper, the technology does pose some risks to the public sector, including data privacy, bias and public trust.

As of 2023, 37% of United Kingdom governmental bodies had deployed AI; with a further 82% stating their intention to do so over the next 12 months. In January 2024, some Northern Ireland Executive Departments had deployed AI, including the Executive Office, the Department for the Economy, and the Department of Finance. The remaining departments reported that they had not yet deployed such technology.

As of 2023, a study commissioned by the Whitehall Department for Science, Innovation and Technology estimated that there were 3,170 active dedicated and diversified AI companies in the United Kingdom; 96% of which were small-to-medium companies. Approximately 1% of the United Kingdom's AI companies were based in Northern Ireland. Across the United Kingdom, 36% of AI companies were computer software firms; while 18% worked in information technology and services. The study also estimated the AI sector's Gross Value Added was £3.7 billion in the same year.

In 2021, a study commissioned the then Whitehall Department of Business, Energy and Industrial Strategy (the BEIS Study) found that 7% of United Kingdom jobs faced a high probability of automation over a five-year period. That figure increased to 30% over 20 years. Overall, the BEIS Study anticipates a neutral long-term effect, with job creation balancing job displacement.

The BEIS Study also found that net job gains were expected in the health, professional and scientific, education, and information and communication sectors. Net job losses were predicted for manufacturing, transport and logistics, public administration, and wholesale and retail.

The BEIS Study further predicted that in managerial and professional occupations, higher earners were to experience net job gains. Less-well paid, process orientated jobs were expected to experience net job losses. Job gains were predicted for jobs requiring higher education, or degree level qualifications. Job losses were predicted for jobs requiring lower education levels.

At a regional level, the BEIS Study found that Northern Ireland was likely to experience a small percentage decrease in jobs over a 20-year period. Net job gains were predicted for Belfast, Causeway Coast and Glens, Derry and Strabane, and Lisburn and Castlereagh. All other Local Government District in Northern Ireland were predicted to experience net job losses, with Armagh, Banbridge and Craigavon estimated to experience the highest number of job losses.

Introduction

Artificial Intelligence (AI) has been hailed as the fourth industrial revolution.¹ AI adoption has the potential to transform the global economy. Price Waterhouse Coopers (PwC) has estimated that AI use across the economy could increase the United Kingdom's Gross Domestic by £232 billion, by 2030; with Northern Ireland seeing an increase of £2.6 billion in that same timeframe.²

The technology also has the potential to transform the way people work. It has been forecast by actors such as the United Kingdom Government to both create and displace jobs, and to introduce a range of ethical challenges for users, policymakers and citizens.

This Briefing Paper, requested by the Committee for the Economy, provides a broad overview of AI (Artificial Intelligence) regulation, use and innovation in the United Kingdom Government, to inform the Committee's consideration of this area. The paper provides an overview of the AI regulatory approach in the United Kingdom, with a with a comparative look at the European Union and the United States of America's regulatory approaches. The paper outlines AI deployment in United Kingdom public sector, including in Northern Ireland. Where available, the Paper highlights governmental data reporting on key potential economic impacts of AI deployment.

It is presented using the below sections:

1. Defining AI
2. Regulating AI: a comparative perspective
3. AI innovation in Northern Ireland
4. AI use in the United Kingdom public sector
5. Potential impact of AI in the United Kingdom
6. Key takeaways

¹ McKinsey & Company, Adopting AI at speed and scale: The 4IR push to stay competitive (21 February 2024) <https://www.mckinsey.com/capabilities/operations/our-insights/adopting-ai-at-speed-and-scale-the-4ir-push-to-stay-competitive>

² PwC, The Economic impact of artificial intelligence on the UK economy (June 2017) <https://www.pwc.co.uk/economic-services/assets/ai-uk-report-v2.pdf>

1 Defining AI

Before examining AI regulation, use and innovation, as well as AI's potential impacts, some essential context-setting information is needed, to briefly explain the technology and its broad applications.

1.1 Absence of a universally agreed definition

There is no universally agreed definition of AI, or AI technologies.³ In the United Kingdom Government's August 2023 White Paper, entitled "A pro-innovation approach to AI regulation", "AI, AI systems, or AI technologies" was defined as products and services that are "adaptable and 'autonomous'".⁴ It further defines "adaptable" as systems that are "trained" and "operate by inferring patterns and connections in data which are often not easily discernible to humans". The White Paper continues:

*Through such training, AI systems often develop the ability to perform new forms of inference not directly envisioned by their human programmers.*⁵

On autonomy, the noted United Kingdom Government policy document states "some AI systems can make decisions without the express intent or ongoing control of a human".

Organisation for Economic Co-operation and Development (OECD) member countries began work to agree a definition in 2018. Their extended and detailed discussions and revisions eventually led to the following agreed definition in 2023:

An AI system is a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or

³ United Kingdom Parliament, POST Note, Artificial Intelligence: AN explainer (14 December 2023) <https://post.parliament.uk/research-briefings/post-pb-0057/>

⁴ Department for Science, Innovation and Technology, A pro-innovation approach to AI regulation (3 August 2023) <https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper>

⁵ As cited immediately above

*decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment.*⁶

Further details on this definition and the rationale behind it are specified in an OECD [blog post](#).

1.2 How does AI work?

1.2.1 Algorithms

The Parliamentary Office for Science and Technology (POST) explains:

*All AI technologies are underpinned by an algorithm or a set of algorithms. An algorithm is a set of instructions used to perform tasks (such as calculations and data analysis) usually using a computer or another smart device. AI often involves retraining algorithms with new data.*⁷

1.2.2 Machine learning

AI applications are often underpinned by machine learning. The POST Note again explains:

Machine learning systems learn by finding patterns in sample data. They then create a model (with algorithms) encompassing their findings. This model is then typically applied to new data to make predictions or provide other useful outputs, such as translating text. Sample data can be labelled (for example, picture of cats and dogs are labelled “cat” or “dog” accordingly) or unlabelled.

*Training machine learning for specific applications can involve specific forms of learning, such as supervised, unsupervised, semi-supervised and reinforcement learning.*⁸

⁶ OECD, What is AI? Can you make a clear distinction between AI and non-AI systems (6 March 2024) <https://oecd.ai/en/wonk/definition>

⁷ United Kingdom Parliament, POST Note, Artificial Intelligence: AN explainer (14 December 2023) <https://post.parliament.uk/research-briefings/post-pb-0057/>

⁸ As cited immediately above

Those different forms of learning demonstrate varying degrees of autonomy. Table 1, below, provides a summary:

Table 1: Types of machine learning

Learning type	Definition
Supervised learning	The AI system is trained with labelled data (see quote from POST Note above). The system is trained from this data and the resulting model to test if it can correctly apply those labels to new unlabelled data.
Unsupervised learning	The AI system is trained with unlabelled data. The system then begins to identify patterns on its own.
Semi-supervised learning	The AI system is trained with a mix of supervised and unsupervised learning and with labelled and unlabelled data.
Reinforcement learning	The AI system is trained by being rewarded for “correct” strategies and punished for “incorrect” strategies” through feedback. Through this, the AI system is “encouraged” to use correct strategies.

Source: [POST](#) (2024)

“Deep learning” is a sub-category of machine learning:

...that uses artificial neural networks... to recognise patterns in data and provide a suitable output, for example, a prediction. Deep learning is suitable for complex learning task, and has improved AI capabilities in tasks such as voice and image recognition, object detection and autonomous driving.⁹

1.2.3 Foundation models

“Foundation models” are a type of machine learning that can be used to fulfil a range of tasks, such as: translation; summarising text; responding to queries;

⁹ United Kingdom Parliament, POST Note, Artificial Intelligence: AN explainer (14 December 2023) <https://post.parliament.uk/research-briefings/post-pb-0057/>

or, generating text, images etc based on user prompts. In general, a foundation model is trained on a large amount of data that can be adapted for the above range of general tasks.

“Large language models” are a type of foundation model, where an AI system is trained on “vast amounts of text to carry out natural language processing tasks”. Large language models underpin some popular generative AI tools, including:¹⁰

- OpenAI’s ChatGPT
- Antropic’s Claude
- Google’s Bard

1.3 Broad AI applications across the economy

AI has a range of potential uses across a variety of economic sectors. Table 2 provides a summary of such applications:

Table 2: Potential AI applications

Economic sector	Potential applications
Agriculture	AI may be used for identifying optimum crops for weather conditions; monitoring crops and conditions; improving crop quality; forecasting prices; and utilising automated workers.
Education	AI may be used by teachers to assist with: lesson planning; scheduling; marking; responding to queries; diagnosing learner needs; and matching learning material to need.
Engineering	AI may be used to: provide networks; forecast; assist in routing; maintenance and security; managing network quality in energy, water, transport and telecommunications infrastructure.

¹⁰ As cited immediately above

Economic sector	Potential applications
Finance	AI may assist with: enhancing data and analytics; improving operation efficiency; identifying fraud; modelling investment; assessing risk; approving loans; and automating compliance.
Freight and transport	AI may assist with: freight management; monitoring goods; transporting and managing last minute deliveries; monitoring traffic flows; providing traffic status; and automating compliance.
Healthcare	AI may assist with: medical imaging; helping clinicians make decisions; monitoring patient health; assisting surgeons in medical procedures; identifying high risk patients; diagnosing diseases; devising personalised treatments; and identifying and developing new drugs.
Justice, policing and security	AI may assist with: predicting crimes; issuing visas; and with facial recognition.
Manufacturing	AI may assist with: processing data; monitoring, predicting, modelling, optimising and controlling process; diagnosing faults; and estimating equipment lifespans.
Marketing and sales	AI may assist with: data gathering and analysis; developing marketing campaigns; and customer service through virtual sales representative.
National security and military	AI may assist with: gathering intelligence; analysing data; operating weapons systems.
Personal contexts	AI may assist through: search engines; chatbots; virtual personal assistants; activity trackers; and recommendation systems.
Recruitment and management	AI may assist with: designing advertisements; finding candidates; screening CVs; allocating tasks; managing and monitoring performance.

Source: [POST](#) (2024)

2 Regulating AI: a comparative perspective

This section provides an overview of the United Kingdom Government's approach to AI regulation. The section also compares the approach taken by the United Kingdom with that of the European Union (EU) and the United States of America (US).

2.1 United Kingdom's approach to AI regulation

The Whitehall Department for Science, Innovation and Technology (DSIT) published "A pro-innovation approach to AI regulation" – the AI Command Paper - in February 2024.¹¹ The AI Command Paper responded to an earlier, wider consultation on an AI regulation White Paper, which had been published in March 2023.

In the above-referenced papers, the United Kingdom Government set out its approach to AI regulation. That approach was to regulate AI using existing laws¹², which in turn would be enforced by existing regulators; rather than introducing new laws¹³ and a new dedicated regulator. Such an approach sought to create an AI "cross-sector and outcome-based" regulatory framework; underpinned by five "non-statutory", "core principles":

- safety, security and robustness
- appropriate transparency and "explainability"¹⁴
- fairness
- accountability and governance

¹¹ DSIT, A pro-innovation approach to AI regulation, consultation outcome (6 February 2024) <https://www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response>

¹² Including data protection law, equalities, privacy and common laws, and intellectual property law

¹³ The AI Command Paper notes that legislation may be required in the future.

¹⁴ Explainability is the capacity to express why an AI system reached a particular decision, recommendation, or prediction. See for example <https://www.mckinsey.com/capabilities/quantumblack/our-insights/why-businesses-need-explainable-ai-and-how-to-deliver-it>

- contestability and redress¹⁵

DSIT explained that it has not codified those principles via a statute, in order to avoid the introduction of new “rigid and onerous” legislative requirements for businesses, which “could hold back AI innovation and reduce our ability to respond quickly and in a proportionate way to future technology advances”.¹⁶

Under DSIT’s approach, it is envisioned that existing regulators will implement the framework in their sectors, while relying on existing relevant laws that will be supplemented by the United Kingdom Government’s issuance of additional regulatory guidance via the Whitehall Department DSIT. In preparation, the United Kingdom Government has asked specific regulators¹⁷ to publish their AI strategic plans by 30 April 2024.

Centrally, the United Kingdom Government has begun developing functions to support risk monitoring, regulator coordination and knowledge exchange. It has also issued “Phase 1 Guidance” to regulators in February 2024. On the central role of government, that Phase 1 Guidance states:

*...To ensure a coherent and streamlined AI regulatory landscape, DSIT has started establishing a central function. The central function supports United Kingdom regulators’ understanding of the AI landscape and will support them to conduct risk assessments by providing expert risk analysis, which is already underway within DSIT. This allows us to monitor risks holistically and identify and potential gaps in our approach that leave risk not adequately mitigated.*¹⁸

¹⁵ DSIT, A pro-innovation approach to AI regulation, consultation outcome (6 February 2024) <https://www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response>

¹⁶ DSIT, A pro-innovation approach to AI regulation (March 2023) <https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper>

¹⁷ The following regulatory bodies have been asked to published strategic plans: Office of Communications; Information Commissioners Office; Financial Conduct Authority; Equality and Human Rights Commission; Medicines and Healthcare products Regulatory Agency; Office for Standards in Education, Children’s Services and Skills; Legal Service Board; Office for Nuclear Regulation; Office of Qualifications and Examinations Regulation; Health and Safety Executive; Bank of England; Office of Gas and Electricity Markets; Office of Product Safety Standards.

¹⁸ DSIT, implementing the United Kingdom’s AI Regulatory Principle – Initial Guidance for Regulator (5 February 2024)

Moreover, in its February 2024 AI Command Paper, DIST announced a £10 million package to boost regulators' AI capabilities.¹⁹

In this context, a Private Members' Bill (PMB) on AI regulation is noteworthy. That PMB was introduced in the House of Lords on 22 November 2023; and entered its Committee Stage in the House of Lords on 24 April 2024.²⁰ It seeks to establish a new AI Authority to regulate AI in the United Kingdom. That approach is contrary to the United Kingdom Government's approach, which is to regulate AI via existing regulators enforcing existing law.

2.1.1 United Kingdom AI regulation and devolution

The United Kingdom Government's White Paper on AI regulation – March 2023 – outlined its intention for its “regulatory framework to apply to the whole of the United Kingdom subject to existing exemptions and derogations for unique operating requirement, such as defence and national security”. The Government noted that AI impacts on both reserved and devolved policy areas. It also recognised the existing overlap between regulators across the United Kingdom.²¹

The White Paper argued that the non-statutory framework will “not alter the current territorial arrangement of AI policy”. It also stated that the Government will “rely on interactions with existing legislation on reserved matters, such as the Data Protection Act 2018 and the Equality Act 2010”, to implement the framework. Moreover, the Government committed to:

https://assets.publishing.service.gov.uk/media/65c0b6bd63a23d0013c821a0/implementing_the_uk_ai_regulatory_principles_guidance_for_regulators.pdf

¹⁹ DSIT, A pro-innovation approach to AI regulation (March 2023) <https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper>

²⁰ UK Parliament, Parliamentary Bill, Artificial Intelligence (Regulation) Bill, Private Members' Bill (starting in the House of Lords) (updated 17 April 2024) <https://bills.parliament.uk/bills/3519>

²¹ DSIT, A pro-innovation approach to AI regulation (March 2023) <https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper>

...engage with devolved administrations, businesses and members of the public from across the United Kingdom to ensure that every part of the country benefits from our pro-innovation approach.²²

That engagement – the Government explained - will include seeking the devolved administrations’ views on governmental functions relating to AI and potential implications that could arise from regulators having a new statutory duty to have regard for the framework’s five underlying principles, as specified above.

Potential scrutiny point:

1. To date, what engagement have Northern Ireland Executive Departments had with the United Kingdom Government on AI regulation? Please detail in full.

2.2 The European Union’s approach to regulation

Currently, the EU is introducing AI regulation through an AI Act, which will categorise AI applications into three risk categories: unacceptable, high-risk, and, neither unacceptable or high-risk. Under the EU regulatory system, technology is categorised as:

- unacceptable, such as government social scoring systems, which is banned
- high-risk, such as CV scanning tools, which is subject to specific legal requirements
- neither unacceptable or high-risk, which is “largely left unregulated”.²³

On 13 March 2024, the European Parliament adopted the AI Act at first reading; adopting the Act with 523 votes in favour, 46 against and 49 abstentions. Of

²² DSIT, A pro-innovation approach to AI regulation (March 2023) <https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper>

²³ EU Artificial Intelligence Act (accessed 23 April 2024) <https://artificialintelligenceact.eu/>

course, the Act still requires European Council approval; and no date for such final adoption has been set at the time of writing this Paper.²⁴

2.3 The United States of America's approach to regulation

In the US, regulation of AI takes place at both state and federal levels of government. As of December 2023, 17 states have enacted 29 bills to regulate the design, development and use of artificial intelligence. In addition to those states, California, Colorado and Virginia have established regulatory and compliance frameworks for AI systems.²⁵

At the federal level, the President issued an Executive Order in October 2023, to introduce new standards for AI safety and security. That Order set out a range of actions to achieve the following eight specified aims:

- protect Americans from the potential risks of AI
- protect privacy
- advance equity and civil rights
- stand up for consumers, patients and students
- support workers
- promote innovation and competition
- advance American leadership abroad
- ensure responsible and effective government use of AI²⁶

A full list of what that Executive Order currently requires is available [here](#). It is noteworthy that the Order further specifies that “more action” will be required and that the President’s Administration “will continue to work with Congress, to

²⁴ EU Issue Tracker, AI Act: Proposal for Regulation (accessed 24 April 2024, requires subscription) <https://app.euissuetracker.com/dossier/63408f396eaf349b2ec48938>

²⁵ The Council of State Governments, Artificial Intelligence in the States: Emerging Legislation (6 December 2023) <https://www.csg.org/2023/12/06/artificial-intelligence-in-the-states-emerging-legislation/>

²⁶ The White House, Executive Order on the Safe, Secure and Trustworthy Development and Use of Artificial Intelligence (30 October 2023) <https://www.whitehouse.gov/briefing-room/presidential-actions/2023/10/30/executive-order-on-the-safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence/>

pursue bipartisan legislation to help America lead the way in responsible innovation".²⁷

3 AI innovation in Northern Ireland

This section provides a brief overview of AI innovation in Northern Ireland academia and business, including some of the AI projects funded through City and Growth Deals in the region.

3.1 Academia and business

According to Matrix, in 2019, academic AI innovation in Northern Ireland is concentrated in Queen's University Belfast (QUB) and the Ulster University (UU) - with 150 permanent staff are involved in AI research across both. Both universities have carried out significant research into AI; with 12% of UU's AI publications and 10% of QUB's AI publications accounted for in the top 10% citation percentiles for AI.²⁸

In addition, Research at UU has led to the creation of a number of spin-out companies, including:

- Intelesens, which uses AI in wireless wearable ECG and respiration detection systems
- Heartsine Technologies, which developed Automated External Defibrillators
- axial3d, which is a medical technology firm focused on the global adoption of 3D printing within healthcare
- Datactics, which develops software platforms to cleanse and reformat data for analytics in the banking, finance, government and healthcare sectors²⁹

²⁷ As cited immediately above

²⁸ Matrix, Artificial Intelligence Research in Northern Ireland (2019) <https://matrixni.org/wp-content/uploads/2019/06/Artificial-Intelligence-Research-in-Northern-Ireland.pdf>

²⁹ As cited immediately above

Research at QUB has also led to the creation of a spin-out companies, including:

- AnyVision, which is focused on real-time facial recognition
- BrainWaveBank, which is developing a neuroscience platform to track cognitive fitness
- Sonari Analytics, which is focused on data analytics
- PathXL, which has developed image analysis algorithms for digital pathology
- Almac Diagnostics, which has developed advanced computational genomics for treatment prediction
- Yedup, which is focused on real-time news and events analysis for finance³⁰

In March 2024, Invest Northern Ireland and the Department for the Economy announced a £16.3 million investment in an AI Collaboration Centre (AICC) that will be based at UU and operated in partnership with QUB. The AICC will focus on increasing business awareness and adoption of AI to “boost competitiveness and productivity across all industries including logistics, finance, life-science, manufacturing and Agri-Tech”.³¹ Matrix research carried out in 2021 has informed the sectoral focus of the AICC. The sectors identified by Matrix were:

- Advanced Manufacturing, Materials and Engineering
- Biomedical R&D and Pharmaceutical Manufacturing
- Cryptocurrency and Cyber Security
- Finance, including FinTech
- Human Health and Social Work³²

In the broader economy, larger companies - such as Allstate, Kainos, Citi, BT and PWC as well as Etain and RepKnight, Analytics Engines, Serafim and Big

³⁰ Matrix, Artificial Intelligence Research in Northern Ireland (2019) <https://matrixni.org/wp-content/uploads/2019/06/Artificial-Intelligence-Research-in-Northern-Ireland.pdf>

³¹ University of Ulster, Artificial Intelligence Collaboration Centre (March 2024) <https://www.ulster.ac.uk/news/2024/march/16.3-million-investment-in-artificial-intelligence-collaboration-centre>

³² Matrix, Northern Ireland response to the AI Council AI Roadmap (April 2021) <https://matrixni.org/wp-content/uploads/2021/04/NI-Response-to-UK-AI-roadmap.pdf>

Motive - are involved in AI development to improve their business processes. Moreover, new companies are working to advance and compete in rapidly emerging new markets for AI-driven products and services, such as Kanios, PathXL, Yedup, and Analytical Engines.³³

3.2 City Deals and AI in Northern Ireland

Both the Belfast Region and the Derry and Strabane City and Growth deals have included AI projects. Developed as part of the 2021 Belfast Region deal, the Global Innovation Institute (GII) is described as a “nexus for co-innovation between researchers and industry in data security, connectivity and analytics”. The GII project is led by QUB and builds on the University’s Institute of Electronic, Communications and Information Technology. The GII will utilise AI, high-performance computing, real-time data analytics and machine learning as delivery tools.³⁴

The 2021 Derry and Strabane City Deal has allowed UU to further develop the Cognitive Analytics Research Laboratory (CARL). CARL is a “cutting-edge research centre” that is seeking to “equip and educate Northern Ireland business to adopt AI for their industry needs”. It is focussed in sectors such as health, financial technology, media, energy and public policy. The project has seen engagement with private sector partners, including Kainos, Allstate, Pramerica and Seagate.³⁵

4 AI use in the United Kingdom public sector

The following sub-sections outline the potential applications for AI use within the public sector. They also look at AI deployment in the public sectors, as directed by the United Kingdom Government and the Northern Ireland Executive.

³³ Matrix, Artificial Intelligence Research in Northern Ireland (2019) <https://matrixni.org/wp-content/uploads/2019/06/Artificial-Intelligence-Research-in-Northern-Ireland.pdf>

³⁴ Belfast Region City Deal, Global Innovation Institute (accessed 24 April 2024) <https://www.brcd-innovation.co.uk/projects/gii>

³⁵ Derry and Strabane City Deal, Cognitive Analytics Research Laboratory (CARL) (accessed 24 April 2024) <https://derrycitydeal.com/projects/carl>

4.1 General AI application within the United Kingdom Public Sector

In March 2024, the National Audit Office examined the “Use of Artificial Intelligence in government “. The resulting report identified a number of potential AI applications within the United Kingdom public sector, including:

- Computer vision – Computer vision can be used to extract information from documents and to identify and classify data. That technology can be applied to extracting text from forms, for analysing CCTV images, or monitoring farming operations through remote-sensing tools.
- Coding assistance – AI can be used to write code for programming purposes. This application of the technology can be used by coders to improve efficiency.
- Fraud and error detection – Machine learning models can be trained to identify anomalies in datasets. That functionality can be used by organisation to identify fraud, or to analyse invoices to spot trends and patterns.
- Virtual assistants – Virtual assistants are computer programmes designed to perform tasks and provide information based on user command. That functionality can be used to support staff in generating emails, presentations, documents, and spreadsheets.
- Text generation – Natural language processing can produce written statements and documents based on user prompts or existing text. That functionality can be used to summarise consumer sentiment, or to create simplified versions of court reports for children involved in cases.
- Research and monitoring – Machine learning can be used to assess trends and patterns in data. Over time, the model can be used to predict likely outcomes. That functionality can be used to monitor markets to identify potential consumer harms, or to monitor carbon capture data and assess trends.
- Managing operations – Machine learning can monitor business metrics and automate processes. That functionality may be used to automate

routine checks of applications, or allocate work load to the optimal employee.³⁶

4.2 Potential risks

Alongside the above-noted of potential AI use benefits in the United Kingdom, AI also carries a number of potential risks. The Institute for Government categorises those risks into three groups:

- **Data privacy:** certain AI functions that would be useful to the public sector, such as personalised medicine, or education, rely on making personal data available to the algorithm. This could entail the transfer of public sector data into the private sector. Transparency could help maintain public confidence.
- **Bias and other unintended consequences:** the effectiveness of general-purpose AI, such as ChatGPT, is limited by the data on which it is trained. ChatGPT, for example, is only able to provide answers based on data up to January 2022³⁷, which coincides with the end of its training period.³⁸ There have already been examples of bias in AI applications. For example, when facial recognition was used by the passport service for passport checks, it subsequently was found that it could not recognise darker skin tones.³⁹
- **Civil engagement:** the use of general-purpose AI may lead to questions about how organisations make decisions. The wide spread availability of the technology means that it is now no longer clear that a piece of text has been written by a human. The emergence of “deepfake” systems

³⁶ The National Audit Office, Use of Artificial Intelligence in government (15 March 2024) <https://www.nao.org.uk/wp-content/uploads/2024/03/use-of-artificial-intelligence-in-government.pdf>

³⁷ For the free version ChatGPT3.5. Paid for ChatGPT 4 Turbo has knowledge of events up to April 2023.

³⁸ ZDNET, ChatGPT is no longer as clueless about recent events (7 November 2023) <https://www.zdnet.com/article/chatgpt-is-no-longer-as-clueless-about-recent-events/>

³⁹ BBC News, Passport facial recognition checks fail to work with dark skin (9 October 2019) <https://www.bbc.co.uk/news/technology-49993647>

that clone voice and videos, can raise further questions about authenticity.⁴⁰

In its “Pro-innovation approach to AI regulation”, the United Kingdom Government identified risks as those relating to, for example:

- human rights
- safety
- fairness
- privacy and agency
- societal wellbeing
- security⁴¹

The United Kingdom Government noted that:

...not all AI risks arise from the deliberate action of bad actors. Some AI risks can emerge as an unintended consequence or lack of appropriate controls to ensure responsible AI use.⁴²

The 2024 “Pro-innovation approach to AI regulation” Command Paper emphasised the importance of managing risks to increase public trust in AI.

4.3 Uptake of AI in the United Kingdom and Northern Ireland public sectors

4.3.1 The United Kingdom

An autumn 2023 National Audit Office survey of 87 United Kingdom Government bodies found that 37% had deployed AI at that point in time. A greater proportion of organisations, 82%, reported their intention in the next 12

⁴⁰ The Institute for Government, Artificial Intelligence: definitions and implications for public service (27 October 2023) <https://www.instituteforgovernment.org.uk/explainer/artificial-intelligence-public-services>

⁴¹ DSIT, A pro-innovation approach to AI regulation, consultation outcome (6 February 2024) <https://www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response>

⁴² DSIT, A pro-innovation approach to AI regulation, consultation outcome (6 February 2024) <https://www.gov.uk/government/consultations/ai-regulation-a-pro-innovation-approach-policy-proposals/outcome/a-pro-innovation-approach-to-ai-regulation-government-response>

months. Of the organisations that had deployed AI, 66% had done so to support operational decision making, 59% to support research or monitoring, and 59% to improve internal processes. A smaller proportion, 19%, had deployed AI to directly provide a service to the public. Of the organisation that were planning to introduce AI, 87% wanted to improve internal processes, 75% wanted to support decision making, 52% wanted to support research or monitoring, and 30% wanted AI to directly provide a service to the public.⁴³

4.3.2 Northern Ireland

The Northern Ireland Civil Service (NICS) published staff guidance on the use of generative AI in June 2023. Following the publication, in January 2024, AgendaNI asked the following three question to the nine Executive departments and the Northern Ireland Office:

1. Does the Department have guidelines regarding the use of AI by department officials?
2. To what extent is the Department using ChatGPT or other AI applications to conduct business?
3. What is the Department's rationale for the use of ChatGPT and/or other AI applications by officials?⁴⁴

The results of this line of questioning are shown in Table 3 of this Paper. As can be seen from that Table, the use of AI across the NICS is mixed. Some departments have deployed AI for a range of purposes, such as: analysing consultation responses; to assist with developing code for statistical publications; and, to improve the accessibility of social media videos. Other departments had not deployed AI as of January 2024. The responses also demonstrate that some Northern Ireland departments were considering the potential risks to the public sector, as outlined in sub-section 4.2 above:

⁴³ The National Audit Office, Use of Artificial Intelligence in government (15 March 2024) <https://www.nao.org.uk/wp-content/uploads/2024/03/use-of-artificial-intelligence-in-government.pdf>

⁴⁴ Agenda Northern Ireland, AI in the public sector (January 2024) <https://www.agendani.com/ai-in-the-public-sector/>

Potential scrutiny points:

2. The Committee may wish to ask the Department for the Economy about its future plans to deploy AI, including, but not limited to, programmes and activities, as well as timetabling for same. Please detail in full
3. The Committee may wish to ask the Department for the Economy about any evaluation it has undertaken of its AI deployment to date. If none undertaken to date, any plans for the future?
4. How often does the Northern Ireland Civil Service intend to review its staff guidance on generative AI?

Table 3: Northern Ireland Executive department responses to AgendaNI’s AI questions, January 2024

Department	Response to AgendaNI questions (January 2024)
Northern Ireland Office	<p>“Civil servants are encouraged to use new technology that improves the productivity of government so we can deliver more for less. Use of tools such as ChatGPT must be done in a way the protects against any bias in AI and complies with all protection and security protocols.”</p> <p>“The Cabinet Office has published guidance [Guidance to civil servants on use of generative AI, published in September 2023] for civil servants on the use of publicly available generative AI tools”</p>
The Executive Office	<p>“At the time of this response, The Executive Office has a single use case for AI based applications.”</p> <p>“For our current use case, an AI based tool is used to provide accurate subtitles to improve the accessibility of social media videos. The resulting subtitles are vetted before videos are released”.</p> <p>“The potential of this emerging technology for future use cases has been recognised. There is a commitment to explore the benefits that can be derived from AI, while ensuring there is awareness of the associated risks”.</p>
Department of Agriculture, Environment and Rural Affairs (DAERA)	<p>“DAERA is not currently using generative AI (ChatGPT). To a limited extent it is using other AI applications, for example Azure AI services for document checks and image recognition.”</p> <p>“The Department will consider safe and controlled use of AI (following proof of concepts) where it is shown it can deliver efficiencies or improved customer service.”</p> <p>“AI is only used to provide recommendations, with no automated decision making, and there is always an element of consideration or assessment by officials.”</p>

Department	Response to AgendaNI questions (January 2024)
Department for Communities	<p>“The Department for Communities does not currently use AI application to conduct business.”</p> <p>“The Department relies upon the digital systems of the Department for Work and Pensions (DWP) for the delivery of social security services in Northern Ireland. The use of AI or ChatGPT solutions within the wider social security systems would be a matter for DWP to consider”.</p>
Department for the Economy	<p>“The Department for the Economy (DfE) has used AI tools to aid the analysis of consultation responses. They have proved very useful for identifying key topics and themes from responses. Natural language processing (NLP), and large language models (LLM) are two of the AI tools used to clarify topics and group them. By employing AI techniques, we aimed to enhance the efficiency and accuracy of extracting valuable insights from the consultation data as well as adding an element of quantification to otherwise qualitative analysis. These methods have been used alongside conventional methods including review by subject-matter experts.”</p> <p>“In addition, DfE is investigating how AI could be used to query documents and perform analysis to assist with measuring achievement, driving policy development and, in turn, the delivery of the Department’s 10X economic vision.”</p>
Department of Finance	<p>“AI is currently being informally investigated by the Northern Ireland Statistics and Research Agency exploring it use in coding and answering of FAQs.”</p> <p>“NICS departments are committed to identifying and capturing opportunities arising from emerging technologies. For all new technologies it is important to be both aware of the risks and the opportunities they offer”.</p>

Department	Response to AgendaNI questions (January 2024)
Department of Health	<p>“In line with NICS guidance access to AI services, such as ChatGPT, Google AI or earlier IBM Watson, are restricted whilst the limitations of these maturing technologies are researched.”</p> <p>“The Department, and the HSC [Health and Social Care] recognise the potential for AI and other developing technologies to contribute to the provision of health and social care in Northern Ireland. However, as with all health or social care services patient safety and confidentiality is paramount and exploration of the limitations of the immature technologies must be undertaken. Some earlier experimental use by other health bodies within the United Kingdom have provided useful insights and we will continue to monitor developments to help inform our decisions on its use.”</p>
Department for Infrastructure	No response.
Department of Justice	“The Department of Justice does not use ChatGPT/AI to conduct its business. This is line with NICS policy on the use of generative AI and ChatGPT.”

Source: [AgendaNI](#) (January 2024)

4.4 Examples of public sector AI deployment in practice

To compliment the general examples of public sector AI applications outlined in sub-sections 4.1 and 4.3 of this Paper, Table 4, below, provides examples of practical public sector AI applications across the United Kingdom.

That Table is not intended to provide an exhaustive list of AI deployments in the United Kingdom public sector. Rather, it seeks to provide the Committee with a flavour of those deployments, including their breadth.

As can be seen from the Table, use spans health, transport, education, international relations and fraud detection. The Table examples listed also demonstrate collaboration between the public sector, the private sector and academia:

Table 4: Practical examples of public sector AI deployment in the United Kingdom, compiled April 2024

Project	Jurisdiction	Details, compiled April 2024
Rapid AI	Northern Ireland	Rapid AI supports the speedier diagnosis and identification of stroke patients that could benefit from thrombectomy , utilising AI in the analysis of CT scan images. The technology was first introduced into the Royal Victoria Hospital, before being introduced in the Southern Health and Social Care Trust in July 2023 as part of a regional pilot.
HeartFlow	England	Since 2021, National Health Service (NHS) England have mandated that English hospitals adopt HeartFlow. The technology creates a 3D model of a patient’s coronary arteries and uses AI to predict the impact of blockages on the arteries. According to NHS England , during 2021/22 the number of patients accessing Heart Flow increased by 35% and “innovation created over £2.2 million worth of savings for the NHS”. The technology has received funding from NHS England’s Technology Payment Programme, which seeks to accelerate the uptake of innovations in health service. Note: the TPP has been replaced by the MedTech Funding Mandate .
MOT Testing	The Driver and Vehicle Standards Agency (DVSA), Great Britain	The DVSA is responsible for ensuring garages in Great Britain apply appropriate MOT standards when conducting MOT tests. A team of 300 people was responsible for the inspection of 23,000 garages across the region. The DVSA used the AI technique known as “clustering” – machine learning process of organising data into subgroups with similar attributes – to group MOT test centres based on their MOT test behaviour. This was then combined with risk score and historical data on inspection frequency, to rank garages and identify regional trends. The process has allowed DVSA to better target their resources, leading to a 50% decrease in the time taken to prepare for inspection and an increase in disciplinary action against garages.

Project	Jurisdiction	Details, compiled April 2024
Website Accessibility	Government Digital Services (GDS), United Kingdom	<p>GDS was required to tag GOV.UK webpages using an in-house taxonomy, but the process was resource-intensive. To increase efficiency, the GDS data science team built a supervised machine learning model. The model used three data inputs: the taxonomy; a sample of pages that has already been tagged; and more pages that had not been tagged or organised. The model was trained on pages that had already been tagged. Natural language processing was then used to make text content on a page machine learnable. Those results, alongside meta data, were used to the system to recognise patterns and predict where untagged pages would best fit within the taxonomy. The final model was able to provide tags for 96% of existing web content. The timeline task of tagging untagged content, was reduced from a number of years to six months.</p>
Population Estimates	Department for International Development (DFID), United Kingdom	<p>DFID, in partnership with the University of Southampton, Columbia University and the United Nations Population Fund, to apply machine learning to analyse satellite imagery of developing countries. The analysis allowed for the identification of settlement boundaries, buildings, transport networks, waterways, lighting, and industrial areas. That information was then used to estimate the population density of those areas. The programme has been deployed in Nigeria, Zambia, Mozambique and Democratic. It is being used to support developing counties as they develop censuses, plan vaccination campaigns and other services, support developing countries to gather population estimates for areas in conflict.</p>

Project	Jurisdiction	Details, compiled April 2024
Oak Education Academy	England	<p>Oak National Academy (ONA) is an online platform that provides resources for teachers, students and parents. It was initial established during the COVID-19 pandemic. In October 2023, the United Kingdom Government announced a £2 million investment into the curriculum and teaching resources platform ONA to provide free access to AI-powered lesson planning resources to all teachers in England. The ONA developed a tool that uses generative AI to develop lessons plans. The tool was used to create 2,500 plans in the” first few days” following its launch. As of April 2024, an estimated 30,000 teachers across England make use of the tool.</p>
Single Network Analytics Platform (SNAP)	Public Sector Fraud Authority, United Kingdom	<p>In 2023, the United Kingdom Government established the PFSA to “help public bodies to tackle fraud against the public purse”. In January 2023 the PFSA entered into a £4 million contract with the firm Quantexa. Under the contract, Quantexa will use “new data and cutting technology, including Artificial Intelligence, to find and prevent more fraud across the public sector”. The technology allows for the rapid analysis of “billions of data points” to help identify suspicious activity. SNAP was initially launched in 2023. In March 2024, an updated version was announced. “SNAP 2” will enable the Financial Conduct Authority and Companies House, to identify “shell companies” and “bad actors”.</p>

Source: Compiled by RaISe (2024, links to source material in table)

5 Potential impact of AI in the United Kingdom

A vast amount of academic, governmental and private sector literature has been written on the topic of AI and its potential impacts.⁴⁵ This Paper is not intended to provide a comprehensive literature review. Instead, it relies on two key studies commissioned by United Kingdom Government in recent years, to provide an overview of the potential impact of AI on business and on jobs; albeit commissioned by Whitehall departments. Nonetheless, those studies collectively provide a useful evidence base, to support the Committee's initial consideration of this area, and thereby facilitate its decision-making on how it may wish to engage further.

The two central government studies are:

- the Whitehall DSIT commissioned "Artificial Intelligence Sector Study" (2023); conducted by Perspective Economics⁴⁶
- the Whitehall Department for Business, Energy and Industrial Strategy commissioned "The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills" (2021); conducted by PwC⁴⁷

5.1 Potential impact on business

As noted in the introduction to this Briefing Paper, PwC estimated in 2017 that AI could increase United Kingdom Gross Domestic by £232 billion by 2030 a (10.6% increase); with Northern Ireland seeing an increase of £2.6 billion (a 5.4% increase) in the same time frame.

⁴⁵ For example, Google Scholar lists 14,000 academic articles on the "AI impact on jobs in the UK" published in 2024 to date.

⁴⁶ DSIT, Artificial Intelligence Sector Study (March 2023) https://assets.publishing.service.gov.uk/media/641d71e732a8e000cfa9389/artificial_intelligence_sector_study.pdf

⁴⁷ BEIS, The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills (October 2021) <https://www.gov.uk/government/publications/the-potential-impact-of-ai-on-uk-employment-and-the-demand-for-skills>

A March 2023 study commissioned by the DSIT sought to “better understand the profile of the United Kingdom AI sector and its contribution to the United Kingdom economy”. That study was entitled “Artificial Intelligence Sector Study” (the DSIT Study). To facilitate the Committee’s consideration of AI, this sub-section of the Paper takes a closer look at that DSIT Study’s key findings - in particular, the predicted regional and sectoral impacts.⁴⁸

5.1.1 Active AI companies and their impact

The DSIT Study defined two types AI company – dedicated and diversified companies. Within that Study, dedicated AI companies are defined as businesses that “provide a proprietary AI technical service, product, platform of hardware as their primary revenue source”. Diversified AI companies are defined as businesses where “AI activity makes up a smaller proportion of a much broader commercial business offering.”⁴⁹ Both categories are mainly made up of businesses operating in the following industry sectors:

- Computer Software
- Information Technology and Services
- Biotechnology, Life Sciences and Pharmaceutical
- Financial Services
- Professional Services
- Wider Health and Medical Practice
- Research and Development (R&D) and Scientific
- Automotive, Industrial Automation and Machinery
- Energy, Utilities and Renewables
- Agricultural Technology⁵⁰

The DSIT Study did not consider the economic impact of “adopters of AI products or services developed by others”. That decision was taken to “avoid double counting and to help ensure that the analysis [was] predominantly

⁴⁸ DSIT, Artificial Intelligence Sector Study (March 2023)
https://assets.publishing.service.gov.uk/media/641d71e732a8e000cfa9389/artificial_intelligence_sector_study.pdf

⁴⁹ As cited immediately above

⁵⁰ As cited in footnote 48

focussed on the value added to the United Kingdom economy by AI sector activity”. In this regard, the DSIT Study’s findings capture firms working directly in AI, rather than those that have adopted AI into their business practices. For example, the findings do not include the economic impact of a manufacturing firm adopting AI to improve the efficiency of their operations.

5.1.2 Number of active companies and their geographic spread

The DSIT Study found that, as of 2023, there were 3,170 active AI companies in the United Kingdom. Of those companies:

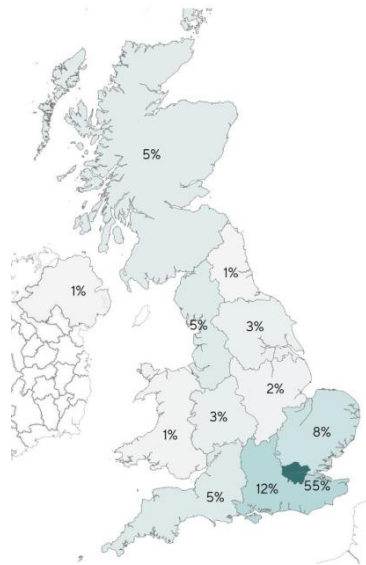
- 96% were found to be small-to-medium companies (SMEs); 60% were micro businesses
- 60% were dedicated AI business, 40% were diversified AI businesses
- 10% (311 companies) were headquartered outside of the United Kingdom, of which a majority (168 companies) were head quartered in the United States

As can be seen from Figure 1, below, as of 2023, the trading location of 55% of United Kingdom AI business was London; with a further 20% concentrated in South East and East of England. The DSIT Study concluded that geographic concentration was “likely due to several factors”, including that:

...prominent United Kingdom AI sectors (e.g., within financial and wider professional services and the significant role of Venture Capital (VC) and Private Equity (PE) funding, [are] believed to be more accessible in London.⁵¹

⁵¹ DSIT, Artificial Intelligence Sector Study (March 2023)
https://assets.publishing.service.gov.uk/media/641d71e732a8e000cfa9389/artificial_intelligence_sector_study.pdf

Figure 1: Regional AI activity in the United Kingdom 2023 (% of AI businesses)



Source: [DSIT](#) (2023)

Moreover, the DSIT Study found that Northern Ireland was the trading location for just 1% of AI businesses. Based on the estimated 3,170 active AI companies in the United Kingdom, that means that there are approximately 32 active AI companies with trading addresses in Northern Ireland. Although the number of dedicated and diversified AI companies operating in Northern Ireland is relatively low by United Kingdom comparison, there is visible activity taking place across business, academia and governments. Sections 3 and 4 of this Paper provided a closer look at AI deployment in Northern Ireland.

Potential scrutiny point:

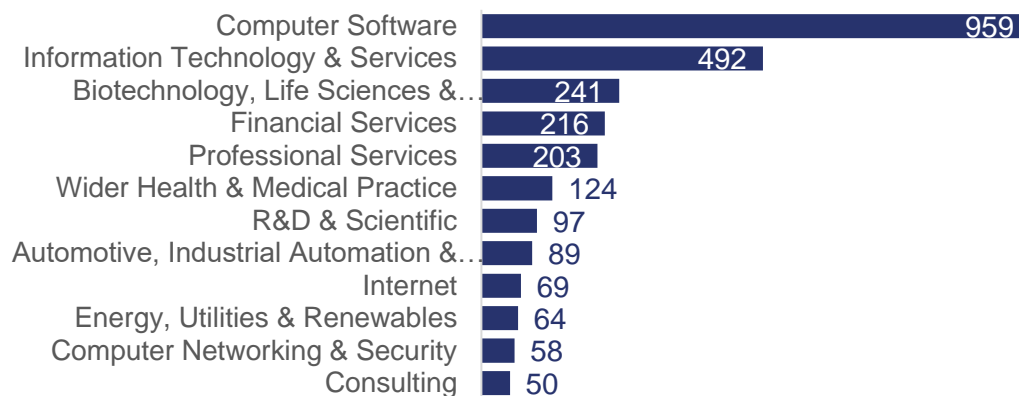
5. The Committee may wish to ask the Department for the Economy if it has plans to carry out or commission its own study into AI business demographics in Northern Ireland.

5.1.3 AI active companies by industry

Figure 2, below, provides an overview of the DSIT Study's findings by sectoral profile of AI companies in the United Kingdom, as of 2023. That figure, which provides a breakdown of 2,662 AI business, shows that 36% of those were

computer software companies; with a further 18% were information, technology and services companies. Biotech (9% of the total), Financial Services (8%) and Professional Services (8%) also represented a significant share of AI companies in the United Kingdom:⁵²

Figure 2: Count of active companies by business sector 2023, United Kingdom



Source: [DSIT](#) (2023)

5.1.4 Economic contribution of AI in the United Kingdom

On the economic contribution of AI in the United Kingdom, the 2023 DSIT Study found that:

- total revenue generated by AI companies in the United Kingdom was £10.6 billion; of which 71% (£7.6 billion) was generated by large firms, SMEs generated 26% (£2.6 billion), and micro-business generated approximately 2% (£230 million).
- total employment in AI was estimated to be 50,040 Full Time Equivalents (FTEs); of this 47% (2,608 FTEs) were in large companies, 43% (21,550 (FTEs) were in SMEs, and 10% were employed by micro businesses (4,882 FTEs).

⁵² DSIT, Artificial Intelligence Sector Study (March 2023) https://assets.publishing.service.gov.uk/media/641d71e732a8e0000cfa9389/artificial_intelligence_sector_study.pdf

- the Gross Value Add (GVA) delivered by the AI sector was found to be £3.7 billion.⁵³

5.2 Potential impact on jobs in the United Kingdom

In 2021, the Whitehall Department for Business, Energy and Industrial Strategy published⁵⁴ “The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills”⁵⁵ (the BEIS Study). That Study provides estimates of the potential impact of AI and related technologies, such as robotics, drones and autonomous vehicles on United Kingdom employment. In that regard, the BEIS Study had a broader focus than the DSIT Study outlined in Section 3 above. While the BEIS Study looked at AI and related technology, the DSIT Study focussed on “dedicated” and “diversified” AI companies and excluded “adopters of AI products or services developed by others”.

The BEIS Study estimated that approximately 7% of United Kingdom jobs faced a high probability of automation over a five-year period; increasing to 18% over ten years and to just under 30% after 20 years. However, it also noted that AI was forecast to create jobs through productivity and economic growth. Based on BEIS findings at that time, the BEIS Study anticipated that some of the noted job creation will be linked directly to AI development; while “most” additional employment will be “in providing relatively hard-to automate services (e.g. health and personal care) that are in greater demand due to the additional real incomes and spending arising from higher productivity generated by AI”.

Overall the BEIS Study concluded that the:

⁵³ DSIT, Artificial Intelligence Sector Study (March 2023) https://assets.publishing.service.gov.uk/media/641d71e732a8e000cfa9389/artificial_intelligence_sector_study.pdf

⁵⁴ The Department for Business, Energy and Industrial Strategy was dissolved in 2023, replaced by the Department for Energy Security and Net Zero, the Department for Science Innovation and Technology, and the Department for Business and Trade.

⁵⁵ BEIS, The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills (October 2021) <https://www.gov.uk/government/publications/the-potential-impact-of-ai-on-uk-employment-and-the-demand-for-skills>

...net effect on employment is unclear, with the most plausible assumption based on historical trends and past macroeconomic research for the United Kingdom being a broadly neutral long-term effect. ⁵⁶

The BEIS Study highlighted previous research, that examined the net employment impact in other regions. It cited the McKinsey Global Institute in 2017. That study concluded that AI would have a small net positive employment effect in the United States of America, and a small negative impact on Germany and Japan. The BEIS Study also cited a 2018 World Economic Forum that found a small net positive impact on global jobs between 2018 and 2022. The BEIS Study noted, however, that neither of those studies included estimates for the United Kingdom.⁵⁷

5.2.1 AI Employment impacts by industry

The BEIS Study found that AI's impact on jobs would vary on a sectoral basis. Figure 3, below, sourced from the BEIS Study, shows the net employment effects on specific industry sector over the 20-year period 2021-2041. As can be seen from the figure, net jobs gains were estimated in the following sectors:

- health and social work
- professional and scientific
- education
- information and communications
- other sectors

Net job losses were estimated by the BEIS Study in the following sectors:

- manufacturing
- transport and logistics
- public administration and defence

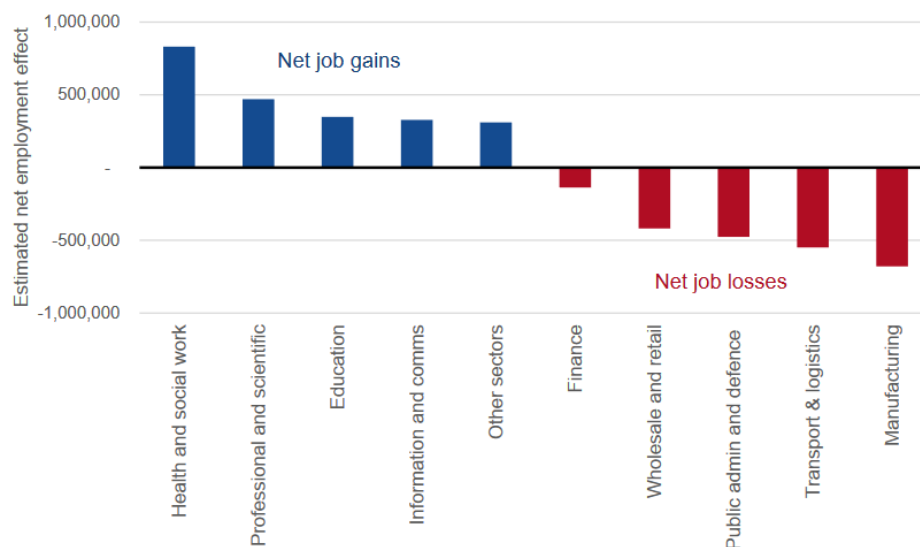
⁵⁶ BEIS, The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills (October 2021) <https://www.gov.uk/government/publications/the-potential-impact-of-ai-on-uk-employment-and-the-demand-for-skills>

⁵⁷ As cited immediately above.

- wholesale and retail⁵⁸

The BEIS Study further noted that the sectors predicted to experience net job gains were sectors that included “many highly skilled jobs linked with closely to AI and other emerging technologies”. By contrast, those sectors predicted to experience net job losses were sectors that were “relatively automatable”:

Figure 3: Estimated net employment effects of AI on selected industries over 20 years (2021-2041)



Source: [BEIS](#) (2021)

5.3 AI Employment impacts by occupation and earnings

The BEIS Study also found variation across occupation groupings and earnings. Figure 4, below, again sourced from the BEIS Study, shows the estimated net employment effects of AI adoption by occupation and median earnings level of the noted 20-year period. The Figure shows that managerial and professional occupations with higher median earning tended “to see significantly positive net employment effects”. Conversely, “less well-paid clerical and process-orientated

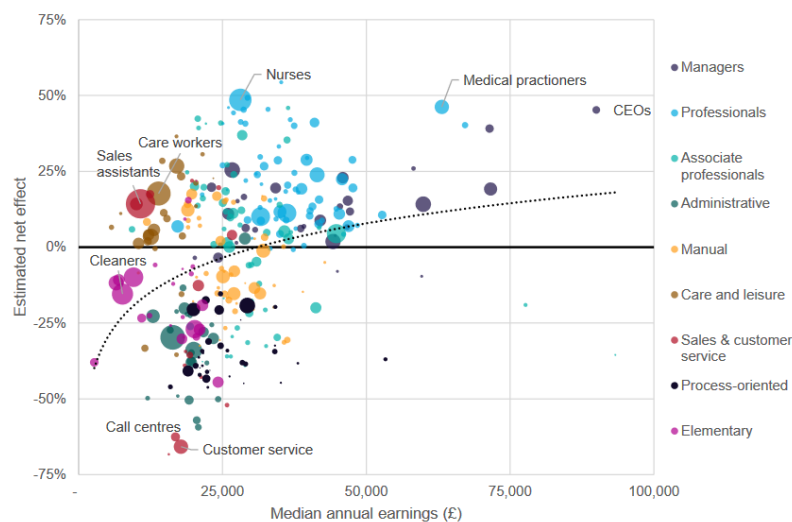
⁵⁸ BEIS, The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills (October 2021) <https://www.gov.uk/government/publications/the-potential-impact-of-ai-on-uk-employment-and-the-demand-for-skills>

roles” are predicted to experience net job losses over a 20-year period. The BEIS Study’s analysis noted that:

...there are still many relatively lower paid jobs (e.g. care workers) that may see rising net labour demand due to the positive macroeconomic effects on AI on real income levels and so the ability to pay for these services (either directly or via taxation for public services like the NHS).⁵⁹

Moreover, and significantly, the BEIS Study concluded that AI adoption across the economy “could see a continuation of a skill-biased technological change⁶⁰” and that change could potentially “widen existing earnings differentials”:

Figure 3: Estimated net employment effects of AI by occupation and median earnings level over 20 years (2021-2041)



Source: [BEIS](#) (2021)

5.4 AI Employment impacts by education

The BEIS Study also estimated that impact of AI adoption on jobs would vary across education level. Figure 5, below, shows the findings of the BEIS Study’s

⁵⁹ BEIS, The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills (October 2021) <https://www.gov.uk/government/publications/the-potential-impact-of-ai-on-uk-employment-and-the-demand-for-skills>

⁶⁰ This is defined within the study as a change that “mainly enhances the earnings professional of skilled professionals”

impact analysis by educational level. As can be seen from the Figure, a net loss was predicted at the following levels:

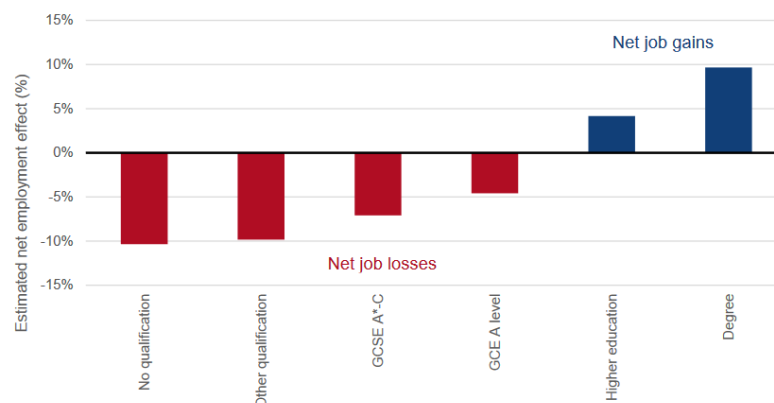
- no qualifications
- other qualification
- GCSE A*-C
- GCE A level

The study predicted a positive effect for only two education levels:

- higher education
- degree⁶¹

According to the BEIS Study, these findings further support its hypothesis that AI adoption will result in the “continuation of a skill-biased technological change”:

Figure 5: Estimated net employment effects of AI by education level over 20 years (2021-2041)



Source: [BEIS](#) (2021)

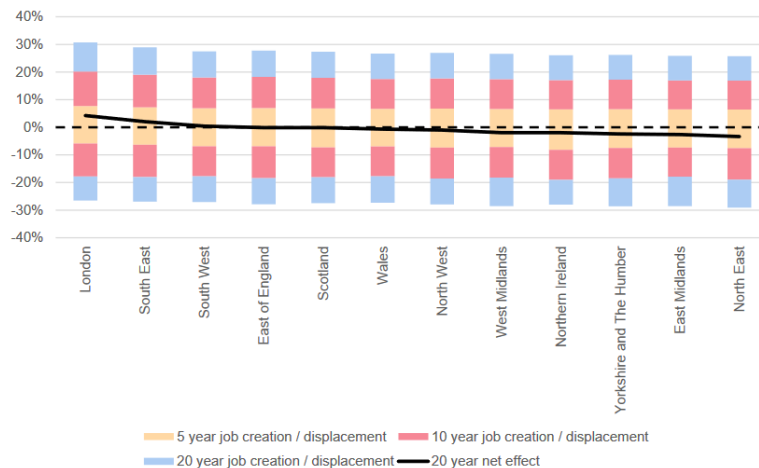
5.5 AI Employment impacts by United Kingdom region and sub-region

Looking at the noted 20-year period and the net impact of AI at a United Kingdom regional level, the BEIS Study found that the net impact was relatively flat. The BEIS Study estimated small percentage increases in London and the

⁶¹ BEIS, The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills (October 2021) <https://www.gov.uk/government/publications/the-potential-impact-of-ai-on-uk-employment-and-the-demand-for-skills>

South East; and small percentage decreases in a number of regions, including Northern Ireland. Figure 6, below, provides a summary of the BEIS Study's regional analysis:

Figure 6: Estimated % of jobs created and displaced by AI at United Kingdom Regional level in 5 (2021-2026), 10 (2021-2031) and 20 years (2021-2041)



Source: [BEIS](#) (2021)

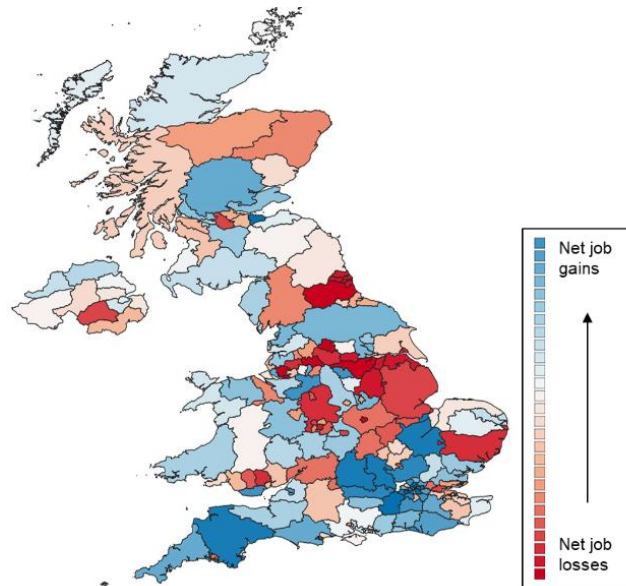
The BEIS Study also found variation in estimated 20-year employment impact of AI at a sub-regional level, from 2021. Figure 7, below, shows the findings of the BEIS Study's impact at Internal Territorial Level 3 (ITL)⁶² sub-regional level. From a Northern Ireland perspective, there is considerable variation in the BEIS predicted impact. The largest number of losses, according to the BEIS Study, are predicted to be in Armagh City, Banbridge and Craigavon. Moreover, net job gains, per BEIS, are predicted for:

- Belfast

⁶² As of 1 January 2021, the United Kingdom has adopted the International Territorial Level (ITL) system for regional geographies. The ITL system replaced the Nomenclature of territorial units for statistics (NUTS) geographies that the United Kingdom was a member for the European Union. From a Northern Ireland perspective, ITL Level 3 mirrors local government districts (LGD). The 11 ITL Levels 3 geographies in Northern Ireland correspond to the 11 LGDs: Antrim and Newtownabbey; Ards and North Down; Armagh City, Banbridge and Craigavon; Belfast; Causeway Coast and Glens; Derry and Strabane; Fermanagh and Omagh; Lisburn and Castlereagh Mid and East Antrim; Mid Ulster; Newry, Mourne and Down.

- Causeway Coast and Glens
- Derry and Strabane
- Lisburn and Castlereagh⁶³

Figure 7: Estimated net effect of AI by region over 20 years (number of jobs) (2021-2041)



Source: [BEIS](#) (2021)

Potential scrutiny points:

6. The Committee may wish to ask the Department for the Economy if it has, or has plans to, carry out or commission its own study of the potential impacts of AI on the Northern Ireland job market.
7. The Committee may wish to ask the Department for the Economy how it is or is planning to assist those affected by AI job losses with re-entry to employment.

⁶³ BEIS, The Potential Impact of Artificial Intelligence on United Kingdom Employment and the Demand for Skills (October 2021) <https://www.gov.uk/government/publications/the-potential-impact-of-ai-on-uk-employment-and-the-demand-for-skills>

8. What actions are Northern Ireland Executive departments taking to ensure AI associated job creation is evenly distributed across Northern Ireland?
9. What engagement has the Department for the Economy had with Northern Ireland's Higher and Further Education Institutions, along with other the Department for Education in relation to Northern Ireland's Secondary and Grammar Schools, to "future-proof" using a "joined-up" approach that aims to ensure course curriculum align with anticipated future labour force requirements in Northern Ireland?

6 Key takeaways

There is no agreed definition of AI across jurisdictions. The definitions identified in this briefing emphasise the technology's autonomy, adaptability and its generative abilities. In general, AI technologies rely on algorithms and machine learning.

AI has a range of broad applications across the economy. It is predicted by sources such as the United Kingdom Government and POST to have applications in a variety of economic sectors, and in both the public and private sectors.

The United Kingdom Government has adopted what it refers to as a "pro-innovation approach" to AI regulation. It has chosen to regulate the technology through existing laws, applied by existing regulators. The United Kingdom Government has argued that its "non-statutory" approach will facilitate innovation.

That differs from, for example: the European Union, where an AI act currently is in development; and, the United States of America, where an Executive Order on AI has been issued by the President and his administration has signalled his intention to introduce AI legislation.

In the United Kingdom, AI spans a range of policy areas, including areas that are devolved and areas that are reserved. In its February 2024 Command Paper on AI, the United Kingdom Government committed to engaging with the devolved administrations on AI regulation.

Northern Ireland's UU and QUB have a strong track record of AI research and innovation. The two universities have partnered on a new AI Collaboration Centre for Northern Ireland. The Centre was launched in 2024, and has received £16.3 million funding from the Department for the Economy and Invest Northern Ireland.

Northern Ireland is also home to a number of spin-out companies and larger firms working in and with AI.

AI has a range of potential applications in the public sector. It also poses a number of risks, including data privacy, potential bias, and potential damage to public trust in institutions.

According to the National Audit Office, as of 2023, 37% of United Kingdom government bodies had deployed AI, with a further 82% stating their intention to do so over the next 12 months. In January 2024, some Northern Ireland Executive Departments had deployed AI, including the Executive Office, the Department for the Economy, and the Department of Finance. The remaining departments reported that they had not yet deployed the technology.

In 2023, the Whitehall DSIT published a study (the DSIT Study) examining the United Kingdom's AI business landscape. It estimated that there were, at the time, 3,170 active, dedicated and diversified AI companies operating in the United Kingdom. Of those, 96% were SMEs. Approximately 1% of the United Kingdom's AI companies have trading addresses in Northern Ireland.

The DSIT Study estimated that AI companies contributed £3.7 billion to United Kingdom GVA as of 2023.

A 2021 study by the Whitehall Depart for BEIS (the BEIS Study) found that 7% of United Kingdom jobs faced a high probability of automation over the following five-year period. That rose to 30% over a 20-year period (2021-2041). The BEIS Study predicted that the overall impact on jobs would be neutral in the long-

term. Despite that, the BEIS Study's found the estimated impact AI on jobs to vary of by sector, occupation and earning, education level and geography.

Moreover, the BEIS Study found that Northern Ireland was likely to experience a small percentage decrease in jobs over a 20-year period (2021-2041). Net job gains were predicted for Belfast, Causeway Coast and Glens, Derry and Strabane, and Lisburn and Castlereagh. All other local government districts in Northern Ireland were predicted to experience net job losses; with Armagh, Banbridge and Craigavon estimated to experience the highest number of job losses.