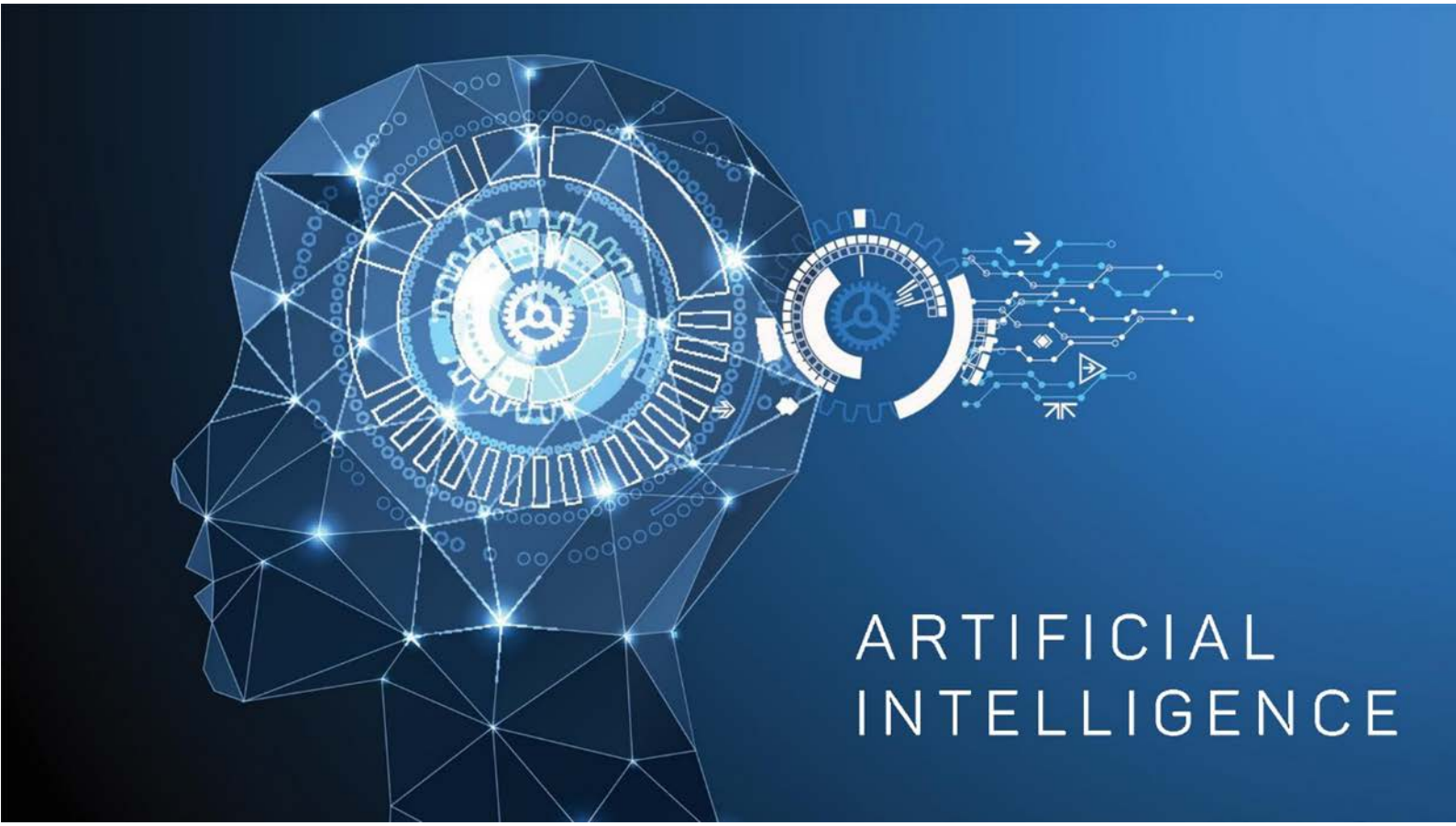
MATRIX – THE NORTHERN IRELAND SCIENCE INDUSTRY PANEL

AI Workshop Briefing Document



THE ANDREWS GALLERY- TITANIC BELFAST

10th JANUARY 2018

12:00 – 5:00pm

This real-time e-participation engage event is facilitated by Professor Jonathan Wallace, Dr Michaela Black and Brian Cleland from the Ulster University.

While all comments and votes stored in the engage system are anonymised, the final report from the event will be distributed to all participants, and may be passed to colleagues within the participating organisations, and other interested groups.

CONTENTS

AGENDA

12.00 Registration – Lunch, Tea & Coffee and Networking
12.30 Welcome & Introduction, Dr. Rob Hardeman MBE, MATRIX Chair
12:35 Engage E-Participation Tool
Prof. Jonathan Wallace, Dr. Michaela Black & Brian Cleland
12:45 Overview of the UK Review of AI
Ben Hawes, DCMS
12:55 UK Industrial Strategy (UKIS)
Lorraine Acheson, Innovate UK
13:10 Case Study
Austin Tanney, Analytics Engines
13.15 Icebreaker – Led by: Tom Gray
What is Northern Ireland's USP in AI?
13.30 Question 1: Prof Liam Maguire/Prof Roger Woods
In what ways can Northern Ireland maximise its key strengths in AI research?
14.05 Question 2: Ben Hawes, Dept. for Culture, Media & Sport
What are the barriers/ constraints to the development and deployment/uptake of AI in Northern Ireland?
14:40 Tea/Coffee
14:55 Question 3: John Healy, Allstate
Over and above the national level interventions, in what way might we encourage increased deployment/uptake of AI in Northern Ireland?
15:30 Question 4: Lorraine Acheson
Thinking about the eight challenge areas discussed which of these is North Ireland best placed to take advantage of and how might we take advantage of these?
16:05 Question 5: Prof Adele Marshall/Peter Devine
Looking beyond the current UK ISCF focus areas, what are NI's other key areas of strength in AI?
16:40 Reflection
17:00 Closing Comments – Dr. Rob Hardeman MBE, MATRIX Chair
17:05 Close & Departure

UK REVIEW OF AI: GROWING THE ARTIFICIAL INTELLIGENCE INDUSTRY IN THE UK

EXECUTIVE SUMMARY

Increased use of Artificial Intelligence (AI) can bring major social and economic benefits to the UK. With AI, computers can analyse and learn from information at higher accuracy and speed than humans can. AI offers massive gains in efficiency and performance to most or all industry sectors, from drug discovery to logistics. AI is software that can be integrated into existing processes, improving them, scaling them, and reducing their costs, by making or suggesting more accurate decisions through better use of information.

The Review outlines a vision for the UK to become the best place in the world for businesses developing and deploying AI to start, grow and thrive, and to realise all the benefits the technology offers.

The pioneering British computer scientist Alan Turing is widely regarded as launching and inspiring much of the development of AI. While other countries and international companies are investing heavily in AI development, the UK is still regarded as a centre of expertise, for the present at least. The UK Review recommends that more is done to build on Turing's legacy to ensure the UK remains among the leaders in AI.

Key factors have combined to increase the capability of AI in recent years, in particular:

- New and larger volumes of data
- Supply of experts with the specific high level skills
- Availability of increasingly powerful computing capacity.

The barriers to achieving performance have fallen significantly, and continue to fall. The Review has indicated that action in number of areas could deliver a step-change improvement in growth of UK AI. The report makes the 18 recommendations listed in full below, which describe how Government, industry and academia should work together to keep the UK among the world leaders in AI.

RECOMMENDATIONS

Recommendations to improve access to data

1. To facilitate the sharing of data between organisations holding data and organisations looking to use data to develop AI, Government and industry should deliver a programme to develop Data Trusts – proven and trusted frameworks and agreements – to ensure exchanges are secure and mutually beneficial.

2. To improve the availability of data for developing AI systems, Government should ensure that public funding for research explicitly ensures publication of underlying data in machine-readable formats with clear rights information, and open wherever possible.

3. To support text and data mining as a standard and essential tool for research, the UK should move towards establishing by default that for published research the right to read is also the right to mine data, where that does not result in products that substitute for the original works. Government should include potential uses of data for AI when assessing how to support for text and data mining.

Recommendations to improve supply of skills

4. Government, industry and academia must embrace the value and importance of a diverse workforce for AI, and should work together to break down stereotypes and broaden participation.

5. Industry should sponsor a major programme of students to pursue Masters level courses in AI, with an initial cohort of 300 students.

6. Universities should explore with employers and students the potential demand for one-year conversion Masters degrees in AI for graduates in subjects other than computing and data science.

7. Government and universities should create, at a minimum, an additional 200 PhD places dedicated to AI at leading universities. As the UK trains and attracts additional academic talent, this number should grow continually year on year.

8. Universities should encourage the development of advanced credit-bearing AI MOOCs and online Continuing Professional Development courses leading to MScs for people with STEM qualifications to gain more specialist knowledge.

9. An International fellowship programme for AI in the UK should be created in partnership with the Alan Turing Institute: the Turing AI Fellowships. This should be supported by a targeted fund for identifying and recruiting the best talent, and by ensuring that the UK is open to any and all of the eligible experts from around the world.

Recommendations to maximise UK AI research

10. The Alan Turing Institute should become the national institute for artificial intelligence and data science, becoming truly national and expanded beyond the current five universities, with a key stated aim that centres its mission on artificial intelligence.

11. Universities should use clear, accessible and where possible common policies and practices for licensing IP and forming spin-out companies.

12. The Alan Turing Institute, Engineering and Physical Sciences Research Council (EPSRC), Science and Technology Facilities Council (STFC) and Joint Information Systems Committee (JISC) should work together to coordinate demand for computing capacity for AI research, and negotiate for the UK research community.

Recommendations to support uptake of AI

13. Government should work with industry and experts to establish a UK AI Council to help coordinate and grow AI in the UK.

14. The Information Commissioner's Office and the Alan Turing Institute should develop a framework for explaining processes, services and decisions delivered by AI, to improve transparency and accountability.

15. The Department for International Trade should expand its current support programme for AI businesses.

16. TechUK should work with the Royal Academy of Engineering, the Digital Catapult, and key players in industry sectors, to develop practical guidance on the opportunities and challenges of successful adoption of AI across the UK economy.

17. Government, drawing on the expertise of the Government Digital Service, the Data Science Partnership and experts working with data in other Departments, should develop a programme of actions to prepare the public sector and spread best practice for applying AI to improve operations and services for citizens.

18. Government should ensure that challenges addressed by the Industrial Strategy Challenge Fund (ISCF) and Small Business Research Initiative (SBRI) are designed to attract and support applications of AI across the full range of challenge areas and set funded challenges which use public sector data for AI.

UK GOVERNMENT'S INDUSTRIAL STRATEGY: OVERVIEW

The UK Government's Industrial Strategy (UKIS), sets out a long-term vision for how Britain can build on its economic strengths, address its poor productivity performance, embrace technological change and boost the earning power of people across the UK. The objective is to improve living standards and economic growth by increasing productivity and driving growth across the whole of the UK.

As well as attempting to address the drivers of productivity the strategy sets out plans for a rapidly changing future, through shaping new markets and industries, and building on existing competitive strengths. The strategy is framed around addressing what is termed *Grand Challenges*:

1. **Artificial Intelligence and Data Economy** – putting the UK at the forefront of the artificial intelligence and data revolution
2. **Clean Growth** – maximising the advantages for UK industry from the global shift to clean growth;
3. **Ageing Society** – harnessing the power of innovation to help meet the needs of an ageing society;
4. **Future of Mobility** – becoming a world leader in the way people, goods and services move.

Each Grand Challenge represents an open invitation to business, academia and civil society to work and engage with the government to innovate, develop new technologies and ensure the UK seizes these global opportunities. It is anticipated that the UK Government will establish competitive funding streams and invite proposals and ideas to identify and subsequently support a range of high potential projects. Furthermore, each Grand Challenge will be have an appointed expert advisor from industry and academia, and will be led by a 'Business Champion'. These individuals will be responsible from engaging with a diverse range of industry voices and raising the profile of the challenge.

In the context of the 4 Grand Challenges, the White Paper focuses on the five foundations of productivity:

1. **Ideas** - The world's most innovative economy;
2. **People** - Good jobs and greater earning power for all;
3. **Infrastructure** - A major upgrade to the UK's infrastructure;
4. **Business Environment** - The best place to start and grow a business; and
5. **Places** - Prosperous communities across the UK.

Each foundation is supported by a range of key policies and interventions designed to provide businesses with certainty and reassurance that the UK will continue to have a competitive edge.

UK INDUSTRIAL STRATEGY: AI RELATED INTERVENTIONS

The UK Government wants to ensure that the UK is at the forefront of the AI and data revolution.

Embedding AI across the UK will create thousands of good quality jobs and drive economic growth. A recent study found digital technologies including AI created a net total of 80,000 new jobs annually across a population similar to the UK[1]. By one estimate, AI could add £232bn to the UK economy by 2030[2]

The UK starts from a position of strength. It is already a world leader in AI, with the building blocks to make significant advances. The UK has some of the best research institutions in the world and globally-recognised capability in AI-related disciplines, including maths, computer science, ethics and linguistics. The UK has substantial datasets in public institutions where AI can be explored safely and securely. The UK has great strengths in the underpinning technologies, from ARM's microchips to the microcomputers of Raspberry Pi. UK innovators push boundaries in robotics and the internet of things. These strengths are the result of academic excellence, research ingenuity, smart business decisions, and investment by government.

As with previous revolutionary technologies, these changes cannot be resisted and it would be irresponsible to fail to prepare. Meeting our Grand Challenge means maximising the opportunities created by AI and advanced data technologies, and responding to the potential impacts on society. It is a call for businesses, research institutions and the government to work together throughout the UK to invest in these technologies, encourage their adoption and set standards in secure, trusted use of data.

New measures to support Britain's world-leading AI sector were therefore announced last month as part of the UK Industrial Strategy to boost growth and deliver a thriving, outward-looking digital economy that works for everyone.

UK Industrial Strategy interventions include:

AI Sector Deal - Building on the UK Review of AI by Dame Wendy Hall and Jérôme Pesenti, Growing the Artificial Intelligence Industry in the UK, Government and the AI sector have agreed a Sector Deal to boost the UK's global position as a leader in developing AI technologies and will anchor the UK as the go-to place for AI innovation and investment

[1] Mckinsey (2017), 'Shaping the future of work in Europe's 9 digital front-runner countries' https://www.mckinsey.com/global-themes/europe/shaping-the-future-of-work-in-europes-nine-digital-front-runner-countries

[2] PwC (2017), 'Sizing the prize, PwC's Global Artificial Intelligence Study: Exploiting the AI Revolution' https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html

Industrial Strategy Challenge Fund - £1.7bn funding available including:

- £20m for AI to create Next Generation Services;
- £210m in 'Data to early diagnostics and precision medicine challenge';
- £33m Immersive tech – audience of the future

Skills

- Investment of £45m to support additional PhD's in AI and related disciplines
- Create a prestigious AI Fellowship Programme
- Create an industry funded Masters Programme
- Support industry to train cross-discipline professionals to apply AI in their specialist areas

Coordination & Uptake - For the economy to realise the benefits of AI, the sector and govt will establish an AI Council for UK which will be supported by a Govt Office for AI which will work initially with six priority sectors: Cybersecurity; Life Sciences; Construction; Manufacturing; Energy; and, AgriTech. There will also be an expansion of Tech City UK to become Tech Nation and a new GovTech Fund;

Machine Learning Garage - a new programme to be launched in January 2018 by the Digital Catapult to provide low-cost access to high-quality machine learning computation power for start-ups and support businesses of all sizes with expertise on cost-effective machine learning computation.

Centre for Data Ethics and Innovation - £9m investment ensure ethical, safe and innovative use of data, including AI

Strength in Place Fund - £115m to build on existing areas of excellence funding collaborative programmes proposed by universities, local employers, LEPs and their counterparts in the Devolved Administration i.e. Invest NI

Global Entrepreneur Programme - As the global market expands, government will increase its export support for AI and data businesses. The Global Entrepreneur Programme will look to increase its focus on attracting AI and data-led businesses to establish headquarters in the UK.

INDUSTRIAL STRATEGY CHALLENGE FUND

The Industrial Strategy Challenge Fund aims to bring together the UK's world leading research with business to meet the Grand Challenges and support sector productivity including through Sector Deals. The Fund was created to provide funding and support to UK businesses and researchers, part of the government's initial £4.7 billion increase in research and development over the next 4 years. £1bn of investment was announced in Wave 1 across the UK – focused on areas of strategic importance to the UK, including: the Faraday Battery Challenge to design, develop and manufacture batteries for the electrification of vehicles and efficient use of renewable energy; artificial intelligence and robotic systems for extreme environments; future satellites; and technologies for medicine manufacture.

To support UK priorities in key areas of innovation a further investment of £725m in the Industrial Strategy Challenge Fund over the next four years will be made. Eight Industrial Strategy Challenges in Wave 2 have now been announced aligned with the Grand Challenges and Sector Deals and two Pioneer Challenges to build industry engagement and readiness for future funding.

UK Government will run a third wave of Industrial Strategy Challenge Fund programmes, with UK Research and Innovation launching an expression of interest for potential challenges in 2018.

Healthy Ageing

1. Data to early diagnosis and precision medicine

"Data to early diagnosis and precision medicine, up to £210m – There are fatal diseases that take years to develop before they present symptoms. Developing effective treatments – such as for pancreatic cancer which develops on average 14 years before symptoms present - becomes progressively harder. The challenge is to combine the wealth of data created by UK researchers with real world evidence from our health service. That will allow industry to create new products and services that will diagnose diseases earlier and help clinicians choose the best treatment for individual patients. This will save lives and set the UK at the forefront of a growing global market in diagnostics."

The Challenge might focus on:

- **The use of large scale genomics to redefine disease and risk factors;**
- **Providing access to comprehensive, longitudinal, anonymised health data;**
- **Regional diagnostics hubs to allow access to samples to develop and test products;**
- **Establishing digital pathology to analyse digitised radiological images to secure an international lead in applying AI to analyse diagnostic medical images.**

2. Healthy Ageing

"By 2040, one in eight people in the UK will be aged over 75 – an increase from one in 12 today. Staying active, productive and independent is important to our increasing numbers of older people. The challenge is to innovate, so older people's aspirations are met and so better, more effective care supports an independent lifestyle as they age. By working together, the government and industry can address the challenges of ageing whilst capturing a growing global market."

The Challenge might explore the creation of development and demonstrator (Living Labs) centres in the UK that bring together dynamic new partnerships, including SMEs, retailers, technology companies, academics, care providers and local authorities.

Clean Growth

3. Energy Revolution

"Prospering from the energy revolution – Around 80 per cent of global energy use still comes from fossil fuels. To preserve a safe and stable climate, this has to change fast. Countries all over the world are moving to renewable energy, with investment more than doubling over the last decade. But for the majority of our energy to be clean and affordable, more intelligent systems. Smart systems can link energy supply, storage and use, and join up power, heating and transport to increase efficiency dramatically. By developing these world-leading systems in the UK, we can cut bills while creating high value jobs for the future."

The Challenge might look at delivering a Smart Energy Systems programme, comprising a series of local demonstrators across the UK.

4. Transforming Construction

"Transforming construction, up to £170m – The way we create our buildings has not changed substantially in 40 years and needs a drastic overhaul if it is to deliver the buildings that the UK needs. Construction is currently expensive and too many buildings waste energy. We need to transform construction so that we can create affordable places to live and work that are, safer, healthier and use less energy. By taking a lead in the UK, we can increase our ability to export. Global demand for efficient buildings is rising rapidly, driven by the pressures of urbanisation, affordability, and the need to cut emissions."

The challenge might focus on:

- **Establishing centres to develop and demonstrate the technologies and business models required, opening the construction market to new entrants;**
- **Helping to develop digitally designed, standardised components from which buildings can be manufactured and assembled; and**

- **Support the development of smart systems, innovative materials and clean energy generation technologies that will radically improve building performance.**

5. Transforming food production: from farm to fork

"The world will need 60 per cent more food by 2050 to allow us to feed 9 billion people, while demand for water is expected to rise by 20 per cent in the agriculture sector alone. For this to be possible, the way we produce our food needs to be significantly more efficient and sustainable.

By using precision technologies we can make that a reality: transform food production whilst reducing emissions, pollution, waste and soil erosion. By putting the UK at the forefront of this global revolution in farming, we will deliver benefits to farmers, the environment and consumers whilst driving growth, jobs and exports."

The Challenge might focus on:

- **The creation of Translation Hubs for collaborative research that will bring together businesses, farmers, academia and Centres for Agricultural Innovation;**
- **Flexible support for innovation accelerators, which will enable the commercial potential of ideas to be explored rapidly, and collaborative R&D projects;**
- **Support for demonstration projects; and**
- **Bilateral programmes with overseas partners to enable the development of technologies for export markets.**

Artificial Intelligence & Data Economy

6. Next Generation Services

"Next generation services, up to £20m– Services account for almost 80 per cent of the UK economy. As technologies like artificial intelligence and data analytics become ubiquitous, we need to ensure UK service sectors are primed. Pioneer funding will help service industries to identify how the application of these technologies can transform their operations. This will help to set UK service industries at the forefront of developing and using innovation."

The Challenge will start as a pioneer programme to understand where the new technologies are best applied with possible focus on:

- **A Research and Development programme to support collaborations between client organisations, leading UK financial and professional service companies, technology companies in the area of AI and applied research teams.**
- **Further elements may be considered in the next wave of the Industrial Strategy Challenge Fund.**

7. Audience of the Future

"Audience of the future, up to £33m – Immersive technologies such as virtual, augmented and mixed reality are changing how we experience the world around us – from entertainment and art to shops and classrooms. The challenge is to bring creative businesses, researchers and technologists together to create striking new experiences that are accessible to the general public. This can create the next generation of products, services and experiences that will capture the world's attention and position the UK as the global leader in immersive technologies."

The Challenge might focus on:

- **A public demonstrators programme to explore the immersive future of TV and film, entertainment and culture by creating new large-scale experiences and testing them with a mass audience to redefine what is creatively possible, capture audience data and explore new commercial models;**
- **A collaborative R&D programme to make the production of high quality content cheaper, faster and more accessible by driving immersive innovation, delivering vital insight into audience perceptions and behaviours and de-risking creative experimentation and investment; and**
- **An Industry Centre of Excellence (delivered in collaboration with the CI Clusters Programme) to work with the screen industries and develop cutting edge creative training and research programmes in immersive storytelling to ensure the UK creative workforce is the most skilled in the world in the use of immersive technologies.**

8. Quantum technology

"We will invest in pioneer funding for quantum technologies, up to £20m, recognising the impact this could have across a number of challenge areas. A new set of products from medical devices to sensors and safer communication systems may be possible using the emerging physical science known as quantum technology. The potential is huge but still largely in the lab environment. Pioneer funding will bring new disruptive businesses together with existing businesses to understand how this emerging technology can be turned into products that will underpin industry in the future."*

The Quantum Technology Challenge will build on the unique capabilities available in the UK, taking the best of UK science and putting it in the hands of businesses skilled in developing and manufacturing sensors, consumer electronics & digital services.

The first part of this challenge may focus on a pioneer investment to encourage business to start adopting and testing quantum technologies with possible further funding in future waves.