WILL CAVENDISH, GLOBAL HEAD OF DIGITAL SERVICES, ARUP

As Arup’s Global Digital Services Leader, Will is responsible from drawing together the very best in technology, design and engineering to redefine the built environment with their clients.

Previously he was Strategy Lead, Applied at DeeMind, responsible for understanding the ground-breaking developments taking place in Artificial Intelligence, and working with key partners to apply them for public good in areas such as health and energy. Prior to this, he was the Director General for Innovation, Growth and Technology at the Department of Health; Director General, International Energy and Climate Change at DECC, and Head of the Prime Minister’s Implementation Unit, working directly with David Cameron and Nick Clegg.

SUMMARY OF EVIDENCE

1. Arup believes that Artificial Intelligence, including Machine Learning, could have a significant role to play in transforming first the performance and then the design of the UK’s infrastructure.

The most immediate opportunities lie in using ML to improve the efficiency and effectiveness of infrastructure build, operations and maintenance – such as more efficient construction projects; improved supply chain optimisation; better and cheaper asset management; predictive asset repairs and wider maintenance; and transport, energy and water system optimisation.

However, over time and as new AI methodologies are developed, we see AI as having more pervasive impacts still – for example, in discovering completely new materials; or finding new designs for different infrastructures and the places and cities in which they operate.

And infrastructure designers, owners, operators and regulators will need to better understand AI as it becomes pervasive in the technologies that surround infrastructure – such as drones, connected and autonomous vehicles, 3D printing, robotics and the like.

2. Arup has an active internal research programme in AI, and is already using a range of ML tools and techniques in our infrastructure work.

For example, in remote inspection and maintenance of pipelines; in the detection of cracks in bridges and tunnels and corrosion on steel structures; in pedestrian and traffic management; in rail schedule optimisation; in flood risk management; in construction clash detection; and others beside.
We are also developing AI/ML approaches to simulation that could reduce resource requirements massively, enabling bolder designs and decision-making. Simulations are used to understand the performance and impact of proposed designs, for example in our work on High-Speed Rail.

3. **However, currently deployable ML technologies mostly rely on large scale, labelled data sets for training and validating models.** The limited availability of such data sets is currently the most significant factor limiting the development and deployment of AI to improve the UK’s infrastructure.

Overcoming this will need sustained action, including:
- Comprehensive digitisation of the measuring and control systems that run the UK’s infrastructure, so that digital data are both created and captured
- Standardised and interoperable approaches to data formats, data definitions, infrastructure-specific software and so, so that this digital data can actually be used
- Mandating these approaches in all newly built UK infrastructure
- More importantly, committing to a very significant investment programme to digitise the UK’s very substantial infrastructure that is already built
- New funding models that support the digisation of infrastructure and the creation of these data sets; and new access and charging models based on an open access approach to these infrastructure data pools.

Tackling this is an top priority, as the UK is not in the lead but rather is falling behind other countries in the development and deployment of AI to both improve and transform infrastructure.

4. **Beyond tackling the digitisation and data challenge, there are a range of other key issues at the moment that need addressing.**

There are, briefly:
- Ensuring the nationwide deployment of the advanced broadband and mobile infrastructure that underpins digital and AI systems
- A shortage of data science skills
- Insufficient understanding of AI at a practical level in government, in regulators and in the wider public sector
- The need for more widespread and cheaper access to advanced compute facilities
- The development of better whole system understanding, models and resilience approaches, given that a digital and AI-led infrastructure could lead to more tightly-coupled infrastructure systems which is likely to increase rather than reduce infrastructure resilient risks.

5. **Finally, the agenda should focus not on AI per se, but rather the benefits that it can bring to the UK in terms of better services and a more prosperous economy; and the need to ensure this is done in a way which is ethical, safe and fair.**