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Response to the Department for Digital, Culture, Media and Sport (DCMS) Centre for Data Ethics and Innovation Consultation

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The National Physical Laboratory (NPL) is a world-leading National Measurement Institute and is responsible for measurement strategy and delivery in the UK. NPL is owned and funded (in part) by BEIS. NPL sits at the heart of the UK's National Measurement System (NMS) and works in partnership with government, academia, applied research labs and industry to deliver the greatest benefit for the UK and the world.

We conduct high-quality measurement science and provide products and services that enable businesses and public organisations to make reliable measurements and have confidence in the decisions they make based on the results. We support businesses to innovate, improve productivity and grow and enable public organisations to protect and improve the quality of life of the public.

Measurements and standards are key to an effective digital infrastructure; NPL works towards embedding measurement into processes using digital and data science to deliver confidence in the intelligent and effective use of data.

Below we set out NPL's responses to the questions that we consider most relevant to its area of expertise.

Executive summary

1. The National Physical Laboratory fully supports the proposed development of a Centre for Data Ethics and Innovation and looks forward to working with the Centre and offering its expertise.

2. A lot of work is taking place at a fast pace in this area and it will be important for the Centre to engage with its stakeholders and build on what has already been developed.

3. The Centre should ensure it addresses application areas where it will have the greatest societal impact. Such areas would include: healthcare, communications systems, policing and security, energy grid systems and power plants, transportation systems and autonomous vehicles (airborne and land based).

4. Action is needed to help the sector understand the reliability and quality of data in automated and autonomous systems. System integrity is particularly important in safety critical highly accountable areas such as smart-grid energy management or healthcare. The data and AI systems must be reliable and the process for making the decisions must be transparent, explainable and reproducible.

5. NPL believes that good regulation can enable better practice and be a positive driver for innovation. There is a unique opportunity for the UK to take the lead in the development of regulation in this area and encourage its adoption globally.

Q1. Do you agree with the proposed role and objectives for the Centre?

1. NPL fully supports the proposed development of a Centre for Data Ethics and Innovation. The data that the world generates is growing at an exponential rate, the potential uses and impacts of it, across many sectors are huge. It is essential as technology advances that we take the time to consider how to deal with the data that is created safely and ethically so that it can be utilised to maximum positive societal impact.

2. NPL agrees with the proposed role and objectives of the Centre.

Q2. How best can the Centre work with other institutions to ensure safe and ethical innovation in the use of data and AI? Which specific organisations or initiatives should it engage with?

12. All data starts with measurement. NPL has been working on developing good measurement practice to improve reproducibility of data generated in research. We have expertise in working with large datasets, understanding the uncertainty associated with data and improving the traceability of data, all of which helps to develop confidence in the data. Our planned research programmes will look at how we can extend our traditional metrology approaches into Artificial Intelligence (AI) and Machine Learning (ML); it is vital that the reliability and uncertainty of AI and ML approaches are well understood by user communities, which is far from the case at the moment. NPL's data science research programmes are focussed on ensuring that good practice is embedded into trusted digital infrastructures, ensuring that all data used to drive decisions is fully traceable and that the quality and uncertainty are well understood at all points in the data-stack.

13. NPL recently hosted a workshop, working with other National Measurement Institutes (NMI) and experts from the measurement and wider research communities investigating 'the role of metrology in the world of "Big Data"; with increasing digitization and increasing volumes of data leading to issues of confidence in industry and in research reproducibility'[1]. In outputs from the workshop, it was proposed that NMIs should work towards defining a framework for uncertainty, reliability, and provenance for machine learning. In addition NMIs should be a role model for the Findable Accessible Inter-operable & Re-useable (FAIR) principles, providing public access to data and methodologies to record data provenance.

14. There are a number of organisations that the Centre should engage with to ensure that it builds upon the best practice that is already being developed within the sector. The new Centre should ensure that it is reaching out all the laboratories that comprise the National Measurement System (NMS)[2]: NPL, LGC ltd, TUV SUD NEL, NGML and NIBSC. The Wellcome

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[1] Improving reproducibility in research workshop May 2018 : http://www.npl.co.uk/improving-reproducibility-in-research

[2] National Measurement System https://www.gov.uk/government/publications/national-measurement-system/uk-national-measurement-system

Trust and NHS work with large datasets relating to health and will have great repositories of expertise when dealing with the ethical issues associated with this.

15. The British Standards Institute (BSI) are working in this area and have developed a standard to provide guidelines for identifying potential ethical issues associated with growing use of robotics and autonomous systems in everyday life.[3] NPL sits on the BSI committee on AI, ART/1, and contributes to ISO (International Organisation for Standardisation) standards on AI.[4]

16. NPL looks forward to working with the Centre and offering its expertise in this area.

Q3. What activities should the Centre undertake? Do you agree with the types of activities proposed?

17. NPL agrees with the range of activities proposed, in addition we think that there needs to be a focus on frameworks for establishing and characterising data quality in all the key application areas. Understanding the uncertainty in data sets and the limitations of data and the ML and AI algorithms used is vital to ensuring that decisions are fit for purpose. For example the integrity needs for a safety critical system are far more onerous than those needed to manage an automated logistics and warehouse system. System integrity is particularly important in safety critical highly accountable areas such as smart-grid energy management or healthcare. Where decisions about patient treatments are being made based on data, the data and AI systems must be reliable and the process for making the decisions must be transparent, explainable and reproducible.

18. In addition where there is potential for use of data and AI in other fields, for example to develop schedules for policing deployment, the processes used must account for uncertainties in the data they draw upon, so there needs to be a framework for dealing with uncertainty associated with AI and other advanced algorithms. NPL are currently discussing how this should be approached with other NMIs across the globe, principally the National Institute of Standards and Technology (USA) and Physikalisch Technische Bundesanstalt (Germany).

Q4. Do you agree with the proposed areas and themes for the Centre to focus on? Within these or additional areas, where can the Centre add the most value?

19. The centre should ensure it addresses application areas and themes that could have profound implications for societal impact and safety critical systems, particularly where AI and data will be used to actively manage systems in real-time with little, or no, time for human intervention. Such areas would include energy grid systems and power plants (conventional, renewables, nuclear, etc.); transportation systems and autonomous vehicles (airborne and land based).

20. Healthcare, lifesciences and advanced manufacturing are clear areas where the Centre can provide a positive impact by shaping the policy and practice around the use of data and AI.

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[3] Information about the BSI Standard BS 8611
https://shop.bsigroup.com/ProductDetail?pid=000000000030320089
[4] International Organisation for Standardisation (ISO) https://www.iso.org/committee/6794475.html

There are numerous data and metadata standards in existence[5][6] or being developed, for example standards for medical data, and these could be used or adapted. Standards should, where appropriate, incorporate proper metrology (e.g. unambiguous expression of units of measurement). It is then important that there is wide engagement with and uptake of the standards

21. The Centre should identify key use cases that will help to drive policy and standards development.   All sectors should develop a framework for determining and understanding data quality, provenance, traceability and uncertainty, as this will be key to ensuring acceptance of these new technologies.

Q5. What priority projects should the Centre aim to deliver in its first two years, according to the criteria set out above?

22. The use of AI is growing rapidly in healthcare and lifesciences, NPL believes that this should be a priority area for the Centre. Action is needed to help the sector understand the reliability and quality of automated and autonomous systems before they become widely used in front-line clinical settings. Understanding the uncertainty associated with AI driven clinical decisions will be vital, in a similar way that clinicians can currently explain the risks associated with treatments.

23. Using AI to manage large complex systems-of-systems, such as in energy and transportation, and communications could undoubtedly provide huge benefits to society. Any failures would produce catastrophic societal effects. Again this is a rapidly growing area and the Centre should address this as a matter of priority to help ensure that automated systems are robust and that systems interact with other autonomous systems in a safe and reliable way.

24. Advanced Manufacturing is an area that could deliver some near-term successes for the sector. Working with both major manufacturing suppliers, their supply chains and new disruptive entrants (large and small) will be vital. The nature of supply chains in, for example, automotive, pharma and aerospace, present chances to identify needs and opportunities and also drive adoption of AI and autonomous systems. NPL's programmes are helping to shape this space[7].

25. AI is currently being rolled out in insurance, finance and banking. Ensuring the process of AI and data/machine-driven decisions are transparent and that rationales for decisions are explainable and sensible for individuals will have a big impact on whether the technology is acceptable to the general public.

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[5] Geophysics Standards : Unidata – data services and tools for geoscience
https://www.unidata.ucar.edu/software/netcdf/netcdf-4/newdocs/netcdf-c/

[6] Meteorology standards: http://www.wmo.int/pages/prog/www/WMOCodes/Guides/GRIB/GRIB1-Contents.html

[7] NPL advanced manufacturing http://ourfocus.npl.co.uk/advanced-manufacturing/

Q6. Do you agree the Centre should be placed on a statutory footing? What statutory powers does the Centre need?

26. As noted in the consultation it is important that the Centre does not "inadvertently constrain innovation in the use of data through regulation", however NPL believes that good regulation can enable better practice and be a positive driver for innovation. There is a unique opportunity for the UK to take the lead in the development of regulation in this area and encourage its adoption globally.

27. NPL believes that once the Centre is established it will need to engage with its stakeholders to develop the new guidance and standards. It will take time to develop all the standards required, as AI and data use is cross-sectoral. It will also take time for sectors to adapt to guidance and adopt new standards. We would foresee that initially the Centre would publish guidance, which once it is established as fit for purpose, would be translated by government into law.

28. There is an opportunity for government funded public bodies such as the NHS, defence sectors and police force to take the lead in the adoption of guidelines from the Centre, this could encourage take up from the wider market by requiring compliance from their supply chains.

29. Independence is vital for the success of the centre. The new Centre needs to ensure it maintains independence in the way it explores technological approaches [Appendix A.2.f] It may be better to act in an advisory and oversight capacity rather than to be too directly involved in the development of technological approaches.

Q7. In what ways can the Centre most effectively engage stakeholders, experts and the public? What specific mechanisms and tools should it use to maximise the breadth of input it secures in formulating its actions and advice?

30. We suggest the following mechanisms to engage stakeholders, experts and the public:

- Regional events for the public
- Presence at established STEM events such as the Big Bang Fair
- Regional workshops and events inviting identified experts and stakeholders to engage
- Open calls for input
- Use of online discussion forums
- Emails and direct communications with contacts
- Collating networks of experts
- Data from research funded by the public to be open access where appropriate

31. There are many bodies, such as NPL, that are driving the development of good practice guides and standards. It will be important for the Centre to carry out a

robust outreach and landscaping exercise to ensure that all of these bodies help shape future programmes.

Q8. How should the Centre deliver its recommendations to government? Should the Centre make its activities and recommendations public?

32. NPL believes that the Centre's activities and recommendations should be made public to ensure transparency, and build trust in the system. It is also important to have the publications made public to raise the profile of the Centre and enable the sharing of good ethical practice within data science and AI.

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