

National Physical Laboratory response to the House of Commons Science and Technology Committee inquiry on the role of technology, research and innovation in the UK's economic recovery from COVID-19

Context to NPL's response

1. The National Physical Laboratory (NPL) is the UK's National Metrology Institute (NMI), responsible for developing and maintaining the nation's primary measurement standards on which all measurements rely. NPL is owned and funded (in part) by BEIS. NPL is a Public Sector Research Establishment (PSRE), which works in partnership with government, academia, applied research laboratories and industry to deliver the maximum societal and economic benefit for the UK and the world. The Research and Development Roadmap¹ recognises the important role that PSREs have to play in the research and innovation landscape and that there is an opportunity to further exploit their unique expertise and facilities.
2. NPL sits at the heart of the UK's National Measurement System (NMS) which maintains and develops the UK's national measurement infrastructure and delivers the UK Measurement Strategy on behalf of BEIS. As the UK's NMI we represent the UK within the international network of national metrology institutes.
3. Good measurement creates certainty in the quality and safety of new and existing products and processes, and boosts productivity by reducing waste, increasing efficiency and enabling confidence. Good measurement science also facilitates barrier-free trade and stimulates innovation; both vital aspects of the UK economy. As a consequence, metrology is key to both UK and global economic recovery from COVID-19.
4. Below we set out NPL's responses to the questions that we consider most relevant to its area of expertise.

What role can technology, research and innovation play in supporting the UK's economic recovery from COVID-19 and how can it best be supported in this?

5. The UK's world-leading science base must be further exploited to support the UK's economic recovery. We need to have the appropriate measurement infrastructure in place to support innovation. Providing businesses with quick access to this measurement expertise through programmes like Measurement for Recovery (M4R) (see paragraph 9 below) can help in translating research into commercial technologies, products and services.
6. COVID-19 has created a new normal in the UK, from home working to changing the ways the population travel and consume products and services. These changes largely rely upon

¹ HM Government (2020) UK Research and Development Roadmap https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/896799/UK_Research_and_Development_Roadmap.pdf

digitalisation and are accelerating the development of the fourth industrial revolution (Industry 4.0). The National Measurement System is looking at the measurement needs for digital transformation, so we can be confident in making use of new technologies and approaches that rely on quality assured data. The success of industry 4.0 relies on science and technology capabilities, and it is now vital for industry to adopt digital processes to remain competitive.

7. Concurrently, there is a global need for green recovery, prioritising carbon neutral industry and encouraging a lifestyle change among consumers. This will need an evidence based broad systems level approach, as the landscape is highly complex with many interdependencies.
8. Industry needs support from the science and technology communities to implement these changes and adapt. Without this, there is a risk that the UK falls behind on the international stage, fails to meet climate change targets, and businesses struggle to survive. To enable this, science institutes need to work closely with industry sharing their knowledge, expertise and facilities to support this change.
9. One example of this direct support for industry is through the Government funded Measurement for Recovery (M4R) scheme². M4R started in July 2020 as a direct response to supporting industry with challenges they are facing as a result of COVID-19 and is running until the end of 2020. This scheme will enable up to 400 businesses to access scientists, engineers and world-leading experts in testing and measurement from NPL and our partner National Measurement Laboratories³ that deliver the National Measurement System. Within the first 2 months of the programme there have been nearly 150 applications from businesses across the UK with representation in England, Scotland and Wales. The programme is open to UK companies needing measurement and analysis support to:
 - a) create new products and services in response to COVID-19
 - b) reduce costs and improve productivity
 - c) increase product reliability
 - d) meet standards and gain regulatory approval
 - e) investigate feasibility of concepts, validate products and processes

Early feedback from a sample set of companies involved shows that they expect their commercial opportunity to have increased as a result of M4R, anticipating an increase in sales and investment from their new products and processes which support the Covid-19 response effort. They have also told us that they have been able to reduce risks and save time in getting their products to market and speed up their timelines to obtain regulatory approval. Companies have also said that working with the experts on M4R has provided them with knowledge and results that has increased their confidence in their products and their credibility to external stakeholders.

10. Alongside direct support to help adaptation, as Industry 4.0 accelerates, business and society become increasingly dependent on digital enablement. Consequently, it is vital that

² <https://www.npl.co.uk/measurement-for-recovery>

³ <https://www.npl.co.uk/measurement-for-recovery/partners>

a reliable quality infrastructure is in place to support innovation and the generation of robust, accurate and reliable data in this digital world. After engagement with the community through workshops, NPL recently released a report on the needs for a digital infrastructure⁴, which identifies:

- a) There is need for an internationally accepted and standardised infrastructure for the provenance of data, digital calibration certificates and accepted ontologies for machine readable methods. These should be embedded within international standards and created through cross-disciplinary and cross-sectoral collaboration.
- b) As digital manufacturing, such as Industry 4.0, and artificial intelligence develop rapidly, these require machine readable methods and protocols as well as the transfer of digital calibration certificates.

11. Science and technology organisations must act quickly to make many changes, and public funded institutes such as NPL are now needed to provide the support necessary for this development to occur.

Does the current or post-COVID situation lead to any particular opportunities or challenges for economic growth driven by technology, research and innovation?

12. **Challenges:** The COVID-19 crisis has demonstrated the need for a first class, dynamic and adaptable science infrastructure, ready to support national needs. Due to the economic toll of the virus, there is a risk that in future, funding may be limited. There needs to be a continued commitment to funding science infrastructure⁵ and PSREs, as well as funding for research and science at all technology readiness levels to enable them to deliver economic benefit for the UK.
13. **Opportunities:** As industry are adapting to the challenges they face, many are having to become more innovative to survive. This means many are undertaking R&D and adopting new, digital processes and products. As more R&D is undertaken, there is a greater chance of meeting the 2.4% R&D investment target, whilst also achieving breakthrough innovation. This leads to greater competitiveness, boosting the economy, and breakthroughs often carry sector-wide spill over, elevating the performance of the entire sector, and beyond.
14. COVID -19 has put firmly into focus the need to embrace innovative solutions, and many sectors and organisations are now looking ahead to make bold leaps into digitisation. This will create new markets, boost productivity in many processes and bolster sectors which have not previously adopted these ways of working.
15. Lastly, there is an opportunity to use the re-assessment of the research and innovation landscape to implement an effective and well-designed ARPA system, as detailed in the Government's R&D roadmap NPL believe this system should build and enhance the existing

⁴ Bhandari, S; Croucher, D (2020) Reproducibility in research: the role of measurement science workshop. Recommendations for the infrastructure underpinning digital transformation.
<http://eprintspublications.npl.co.uk/8665/>

⁵ Brown, R. (2020) The importance of measurement infrastructure in economic recovery
<https://www.npl.co.uk/getattachment/about-us/Who-we-work-with/Government/NPL-evidence-and-analysis/Importance-of-the-measurement-infrastructure-Final.pdf.aspx?lang=en-GB>

infrastructure to remove red tape and fund projects from idea conception to commercialisation⁶. Taking the opportunity to make use of the broadest and most diverse community possible which includes the PSREs.

How have research and innovation in UK universities, businesses and other settings been affected by the COVID-19 pandemic, and how might they be affected by any lasting changes post-COVID?

16. NPL contacted more than 130 business which are customers or partners of NPL, and organisations who use or undertake innovation. Conversations with these businesses showed that, as a result of COVID-19, innovation was impacted in the short term due to:
17. **Difficulty maintaining social distancing and staffing numbers.** Many of the companies NPL contacted, have struggled to operate successfully in a socially distanced way, with space around laboratories and machinery sometimes narrow or enclosed. As organisations have fewer members of staff on site, fewer staff are available for in-lab, technical work, meaning some research projects have been delayed, or terminated.
18. Where lab-based projects and manufacturing continues, NPL has experienced enquiries about PPE compliance⁷ and how to separate staff safely without compromising the working environment. For example, companies are looking at constructing screens to separate workers, but in the electronics manufacturing environment these screens can conduct static electricity which is detrimental to their production process. Companies are also trying to reduce the “touch points”, employ digital non-contact measurements and not use hand tools. We are advising upon this and see a greater demand for remote inspection and accreditation approaches.
19. Some activity can be conducted remotely if the right digital infrastructure and processes are in place. Companies are looking for support to undertake digital transformation where it can help them to continue operations.
20. **How to start up technical operations and ensure compliance to Quality Systems⁸.** Many company’s production and processes have sat idle for numerous weeks and the return to production is not as simple as just switching machines back on. Equipment must be tested and calibrations must be undertaken to ensure machinery meets the requirements of the organisation’s quality system, and ultimately to provide quality assurance of the product or service to customers. NPL is already supporting some hospital departments with this – identifying criticality of individual pieces of equipment and developing a safe approach to get these re-started quickly whilst not compromising quality of service.

⁶ NPL response to the release of the R&D roadmap - <https://www.npl.co.uk/getattachment/about-us/Who-we-work-with/Government/Government-submissions/NPL-response-to-the-R-D-roadmap.pdf.aspx?lang=en-GB>

⁷ <https://www.npl.co.uk/coronavirus/ppe-testing-and-consultation-services>
<https://www.npl.co.uk/coronavirus/understanding-the-standards-for-ppe>

⁸ <https://www.npl.co.uk/products-services/consultancy/qms>

21. **Supporting funding applications.** Many companies who work with NPL are small, innovative and young. They are looking for funding opportunities as they require a cash injection to boost their current position. Moreover, they are looking to NPL to help validate claims about products and services. Having validation from respected organisations like NPL gives confidence to reviewers of applications for future funding, venture capitalists or marketing for product launches in an effort to increase sales and revenue.

Lasting changes:

22. **New product development and verification.** Companies need to innovate to survive the impact of COVID-19. Many are looking to diversify into new markets or modify products for current markets. They need support meeting new specifications and to have their claims validated by an independent authority to support their marketing and sales. Going through usual compliance routes might take too long, or there could be a new technology category where standards do not yet exist to adhere to. For example, a company looking to diversify to support the track and trace work needed to validate distance measurement claims made by other technology suppliers.
23. NPL has further been supporting several companies who have redirected their production to supplies required such as ventilators, face masks and visors. These reactive technical operations require knowledge, and NPL has worked to advise on the requirement to meet standards, for instance testing products to provide confidence to hospitals and creating interim standards for vital equipment where they do not exist.
24. **Evaluating supply chains.** Over the past few months, many companies have faced disruption to their supply chains. Companies need a fast approach to ensuring a new supplier is meeting the same level of specification that they are used to, before incorporating this into a production process. Companies are also looking to new innovative approaches to supply. For example, many are looking at additive manufacturing (3D printing) to produce components, but again they need to ensure that the specification and then performance meets the necessary requirements quickly.
25. The pandemic has severely **restricted the ability for international travel**. Whilst there has been a lot of innovative use of digital techniques, such as virtual meetings and conferences, collaborative activities have undoubtedly suffered. As the degree to which various countries are affected and the resulting restriction applied continues to change it is difficult to quantify the severity of this effect. Whilst established relationships can be maintained reasonably well through remote contact it is much harder to develop new relationships without the ability for face to face contact, so the longer-term consequences are likely to be greater than those in the short term.

How effective have measures adopted by the Government to support research and innovation, such as the support packages for innovative firms and university researchers, and the 'Ministerial University Research and Knowledge Exchange Sustainability Taskforce', been?

26. As noted in paragraph 9 – the Measurement for Recovery programme has been designed to support innovative businesses to enable them to access science and engineering expertise.

Early indicators show that the programme is well received, supporting businesses to reduce the time taken to get a product to market and gain regulatory approval.

In the context of the Government's 'Research and Development Roadmap', what shorter-term measures can best support UK research and innovation in recovering from the disruption of the COVID-19 pandemic and adapting to the post-COVID environment?

27. For funding proposals, require a clear demonstration of how measurement quality, comparability and confidence will be achieved.

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