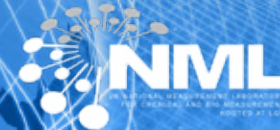


UK Chemical and Biological Measurement Strategy

2021 | 2025

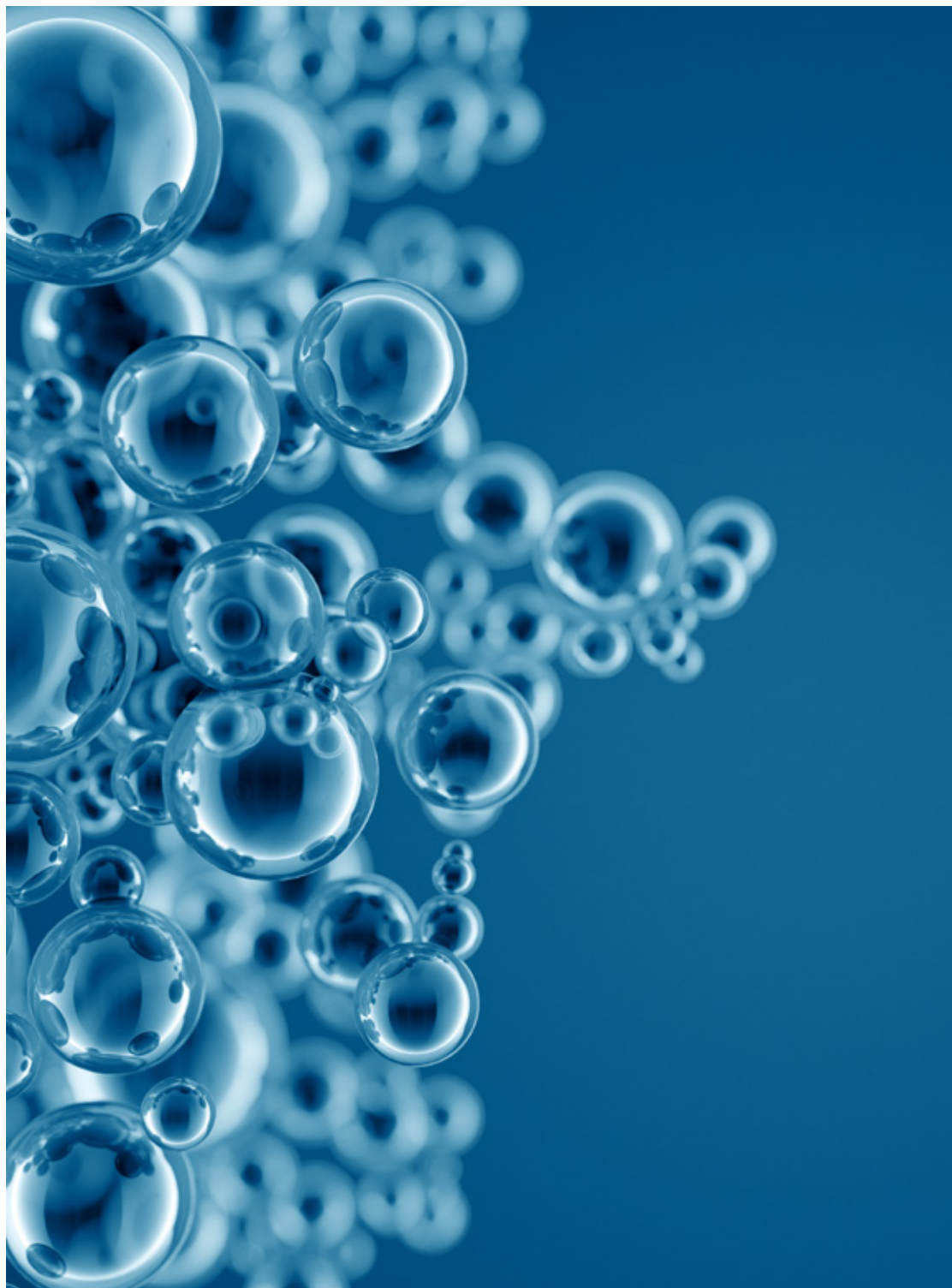



Department for
Business, Energy
& Industrial Strategy

FUNDED BY BEIS

Contents

Executive summary	3
The next 4 years; a new era for measurement	4
Vision	5
Who we are and what we do	6
Strategic objectives	8
1. Maintaining our international standing as a leading measurement institute	9
2. Maximising UK measurement infrastructure to address current and future challenges	10
3. Supporting businesses across the UK through better measurement	11
4. Growing impact from our collaborative knowledge sharing initiatives	12
Drivers and challenges	13
Wellbeing	14
Sustainability	15
Prosperity and productivity	15
Conclusion	16



Executive summary

At the National Measurement Laboratory (NML), hosted at LGC, we are proud of our heritage in providing world-leading measurement infrastructure capable of solving some of the most taxing current and emerging chemical and biological measurement challenges facing the world today. By doing so, we provide the much-needed support to government and industry decision-making that underpins enhanced productivity and seamless international trade, and helps protect us as consumers within the UK.

Our vision is to harness the opportunities that better measurement can deliver to make the UK healthier, wealthier and safer.

At the time of producing this forward strategy for our Chemical and Biological Metrology Programme – part of the portfolio of National Measurement System (NMS) activities that exist within the UK – measurement and testing has never before figured so highly in Government decision-making.

COVID-19 has acted as a catalyst for public-private partnership, the like of which has rarely been seen before in my lifetime; building on the science superpower provided by our universities and innovative companies. However, it has still challenged supply chains, working practices and application of measurement understanding. Added to this, completing EU Transition and complementary international trade deal discussions creates a complicated trade and regulatory environment, but one where opportunities await those willing to embrace them.

Our plans for the next four years are therefore ambitious, not incremental. They provide the foundations for the NML to take the necessary significant leap forwards in the application of our measurement capabilities, continuing to support today's UK measurement priorities but increasingly to address tomorrow's measurement technologies.

To deliver this, we will adopt a sizeable expansion programme for our strategic partnership-building, expanding our regional and devolved nations presence to work ever more closely with our network of stakeholders across the whole of the UK. Whilst continuing to serve our customer base through each of our defined chemical and biological measurement capabilities, we will harness our combined internal strengths around two core areas – clinical diagnostics and biomanufacturing control. We will need to continue to be an agile national facility and clear in our purpose in responding to the many conflicting challenges ahead to make this strategy a reality, but we have risen to such challenges before.

Julian Braybrook
Director, National Laboratories
and UK Government Chemist



The next 4 years; a new era for measurement

As we leave 2020 behind and move into 2021, the public perception of measurement and testing has changed considerably in light of COVID-19. In our response to the ongoing pandemic, the NML has demonstrated its utility as an agile national capability leading international standardisation of viral diagnostic testing, and supporting the NHS hospitals at the front-line in evaluating and implementing new molecular and chemical testing approaches. The pandemic still presents many challenges as we move to a new normal and we must consider the crucial role measurement will play in establishing effective biosecurity, vaccines and anti-viral medicines in supporting the government response.

Measurement can also play a vital role in supporting the economy back to health, and our partnership programmes (Analysis for Innovators (A4I), NHS-England's Knowledge Transfer Partnership (NHS-KTP) and Measurement for Recovery (M4R)) will continue to serve this unique role within the innovation landscape, providing access to world-leading measurement expertise and cutting-edge facilities to both business and public sector organisations across the UK. These programmes solve existing analysis or measurement problems, improve productivity, and provide assurance in the performance of new technologies and the associated confidence required for increased investment, reducing risk and driving innovation.

EU Transition will also present new measurement challenges, with the potential for divergence in legislation, compounded by the inability to continue to influence developing EU law and the potential barriers to sharing intelligence. Focussing on our national agenda does not mean negating our duties to represent UK chemical and biological measurement interests in international metrology and standardisation fora. As a national centre of excellence in measurement we can advise and support businesses and government on emerging legislation and standards, as well as aid in its effective implementation through our understanding of what is practically enforceable to ensure trade and the safety and security of the public. Measurement understanding will also be

required in supporting the development of new regulation and standards to facilitate digital transformation of the economy (industry 4.0).

The demand for and importance of chemical and biological measurement increases year on year to underpin understanding of the next technological development. For example, new gene-editing technologies or sequencing approaches offer massive advancements in healthcare and biomanufacturing. Sound biomeasurement is necessary to support emerging legislation and protect the public from some of the potential new threats these technologies can bring from a personal safety and national biosecurity point of view.

The environmental challenges we face today have enormous implications for our economy, society and politics. Measurement continues to be a vital component in environmental monitoring and climate research, one which will be required to achieve the government's target of net zero carbon emissions by 2050, leading to a cleaner, healthier and more sustainable UK.

This strategy document supports the National Measurement Laboratory core chemical and biological metrology programme specification for the period 2021-2025 (funded by Department for Business, Energy & Industrial Strategy (BEIS), and should be considered in conjunction with the UK Measurement Strategy 2021.

Vision

At the NML we will harness the opportunities that better measurement can deliver to make the UK healthier, wealthier and safer.

We will achieve this vision by focussing on **providing high quality world-leading measurement science**, to solve the measurement problems of today and tomorrow and thereby support government and industry, and protect consumers within the UK.

We will continue to represent the UK's interests internationally.

By ensuring **confidence and quality in measurement data**, we will:

Enhance the **wellbeing** of the nation, working in partnership across government, the NHS, industry and academia to facilitate better healthcare, and protect the safety and security of the public.

Help the economy recover swiftly from COVID-19 and support investment in R&D across the UK to 2.4% of GDP by 2027, by meeting the demand for better measurement to support and fast track innovation-based translational R&D with increased **productivity and prosperity benefits**.

Develop and apply our measurement expertise and associated skills initiatives to particularly address the identified measurement challenges in priority areas for the UK, such as the life sciences industries.

Safeguard **sustainability** of the world's resources by ensuring measurement methods are available for environmental monitoring to support legislation, assist climate research and drive green innovation to reduce climate change.

In summary, we will optimise the use of measurement as a core infrastructure technology ('infrastructure technology'), to support a **greener, safer, healthier and more prosperous future for the UK**.

Who we are and what we do

The NML, hosted at LGC, has been the Designated Institute for chemical and biological measurement within the UK, since 1988.

Over this time, we have established ourselves as one of the leading metrology institutes globally within our designation (as evidenced by international science performance and review).

We represent the UK in this capacity, both nationally and internationally, to develop and maintain a standardised measurement infrastructure, informing policy, standards and legislation.

We carry out measurement research, which results in us being able to offer measurement products and services, such as reference materials, calibration facilities and contract measurement solutions, as well as providing specialised advice, training and workshops and increasing the knowledge base through peer-review and trade publications and best practice guidance documents.

Through our engagement with government and other end users, our work supports standardisation of measurement, informs new and emerging legislation, supports effective technology transfer and encourages accelerated access, provides confidence in data and helps improve the UK skills base (see the value chain shown in Figure 1).

This work is funded by BEIS through a portfolio of programmes. The Chemical and Biological Metrology programme, with an average funding of £7m p.a., leverages a further £3m p.a. through collaborative measurement R&D, measurement services, reference materials and training.

We are one of the most diversely equipped measurement laboratories in the country, with more than 20 different types of mass spectrometers and 10 digital and real-time PCR systems.

Our main site in Teddington (South West London) comprises organic and inorganic chemistry, and molecular biology laboratories, while our cells laboratory is based at Fordham (Cambridgeshire). Through our partnerships with institutions and centres such as the University of Strathclyde (Joint Centre for Advanced Measurement Research and Health Translation), Leeds Nexus and University of Manchester Stoller Biomarker Discovery Centre we remain committed to supporting growth of local R&D capacity and capabilities.

This Programme is delivered by a team of 100 staff (96 FTE) comprising 75% PhD's, with around four staff members studying for a PhD at any one time. In addition, the NML supports MSc, PhD and post-doctoral students at UK universities and typically hosts up to 10 visiting secondments per year. Programme governance is provided on behalf of BEIS through an independent Programme Expert Group.

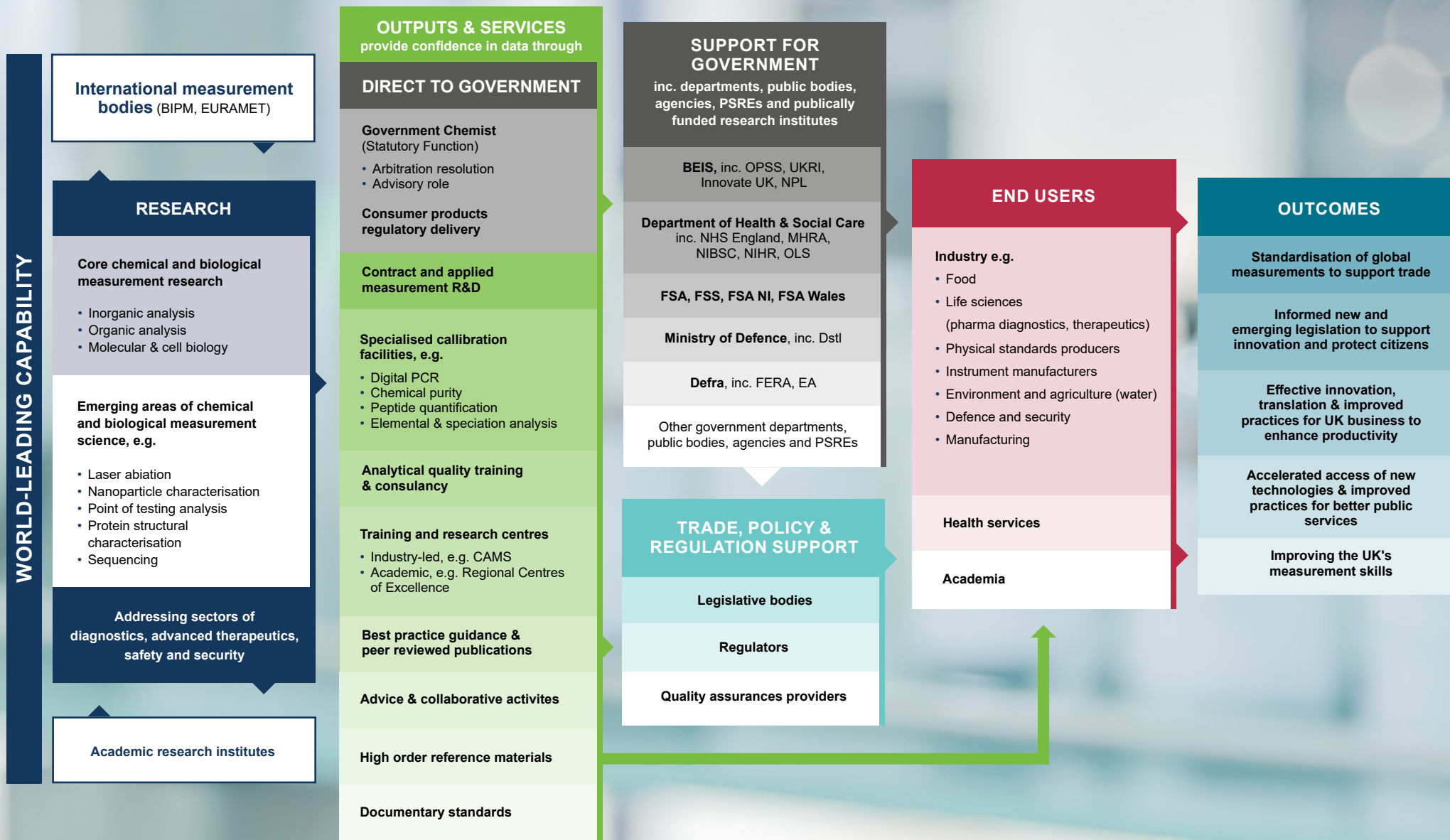


Figure 1. Value chain for the NML portfolio of programmes (Chemical and Biological Metrology and Government Chemist programmes)

Strategic objectives

- Maintaining our international standing as a leading measurement institute
- Maximising UK measurement infrastructure to address current and future challenges
- Supporting businesses across the UK through better measurement
- Growing impact from our collaborative knowledge sharing initiatives

Maintaining our international standing as a leading measurement institute

- Be forward-looking to build and maintain world-leading scientific capacity in the technology areas that will shape future industries, while at the same time operating with the agility necessary to address the UK's most immediate needs
- Invest in high-performing facilities, equipment, personnel and wider infrastructure to ensure our beneficiaries can continue to access the measurement infrastructure necessary to enhance their quality and competitiveness
- Continue to attract and invest in the best scientists, giving them opportunity to develop into experts through continued professional development involving formal training and informal national and international peer networking and collaboration
- Continue to enable international research partnerships, particularly post-EU Transition with countries where international trade deals are secured, whilst maintaining historic collaborations with strategic European partners by addressing joint priority areas¹
- Continue to lead and support key national and international standards-setting organisations
- Intensify the cooperation with academia across the UK, so as to maximise awareness and access to knowledge and expertise in newly-emerging technologies with potential application to our measurement areas and techniques. Specifically, build at least an additional three new national partnerships complementary to current capabilities in the areas of agri-food, manufacturing of advanced therapeutics and bio-nano systems.



¹ https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en



Maximising UK measurement infrastructure to address current and future challenges

- Implement an ongoing programme of horizon scanning activity, building on the success of the recent cross-NMS project supporting development of the UK Measurement Strategy 2021 to continually inform and validate future measurement activities, whilst ensuring our established measurement infrastructure remains fit-for-purpose and addresses our currently identified measurement challenges
- Leverage our established strengths to develop measurements, standards and guidelines for robustness and security of future generation clinical solutions. Specifically, we propose establishing a clinical diagnosis validation centre, building on our unique capabilities to expand our support for development of new tools for disease monitoring and surveillance.
- Identify the measurement needs required to support development of new technical standards and legislation, bringing together the business, regulatory and scientific metrology communities to align the measurement infrastructure with the standards and legislation, to ensure business-friendly approach that supports innovation (e.g. Regulation for the Fourth Industrial Revolution²). The NML will use a risk-based methodology to provide advice and leadership to influence and support new international regulation to support the UK as it transitions EU-Exit
- Leverage our established strengths to develop measurements, standards and guidelines for robustness and security of future generation bioproducts. Specifically, we propose creating a digital measurement technology centre to allow mechanistic understanding of product and process performance during adaptive manufacturing of advanced therapeutic solutions. We will support optimisation of simulation and predictive modelling frameworks based on structure-related prediction of behaviour to allow developers to build 'digital twin' systems and identify optimal manufacturing settings, resulting in reduced overall time to market for such bioproducts
- Maintain a balanced portfolio of reference materials (based on demand and impact of these materials versus cost to maintain) through consultation with stakeholders and utilising our continually expanding scope of accreditation and streamlined reference material production procedures
- Continue to expand our active collaborations with partner organisations within the UK and internationally to assign SI traceable reference values, especially in the biological area (e.g. External Quality Assurance providers, other reference materials producers and end-users).

² https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/807792/regulation-fourth-industrial-strategy-white-paper-web.pdf



Supporting businesses across the UK through better measurement

- Invest in developing the measurement capability needed to address the sector-specific challenges of the future, as well as address the measurement challenges in current priority areas for the UK², such as the life sciences³ and bioeconomy⁴. Particularly, support the Medicines Manufacturing Industry Partnership (MMIP) digital manufacturing and skills initiatives, TUV-NEL's Clean Fuels Metrology Centre and the Community for Analytical Measurement Science (CAMS)⁵ activities by providing advanced analytics and skills support
- Actively support emerging initiatives around increasing involvement of Public Sector Research Establishments (PSREs) and publicly-funded laboratories^{13,14,15} and investment in late stage development^{16,17} in the R&D pipeline, and the proposed UK Advanced Research Projects Agency (ARPA), as detailed in the UK Research and Development Roadmap¹⁸
- Provide the measurement support and advice to industry around EU Transition, to inform and enable the uptake of emerging legislation, through our involvement in trade organisations such as the BioIndustry Association (BIA), The Association of the British Pharmaceutical Industry (ABPI), British In Vitro Diagnostics Association (BIVDA) and advisory committees, such as the Synthetic Biology Leadership Council (SBLC) and UK Standards Liaison Group for Advanced Therapies (UK SLGAT).
- Extend access to our measurement capability, through an expansion programme aligned with local industrial strategies⁶ that will support innovation and productivity improvements⁷ and accelerate post-COVID recovery at the regional and Devolved Nation level ('so-called' levelling up)^{8, 9, 10, 11}
- Use leveraged income opportunities to grow our participation in industry partnership programmes (such as Innovate UK's Analysis for Innovators (A4I)¹², NIHR Accelerator; SIPF) to enable businesses to access our measurement facilities in support of increased confidence for innovation claims, enable efficiency savings (through better understanding of a product or process), and productivity and competitiveness improvements

² https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

³ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/650447/LifeSciencesIndustrialStrategy_acc2.pdf

⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/761856/181205_BEIS_Growing_the_Bioeconomy_Web_SP_.pdf

⁵ <https://cams-uk.co.uk/>

⁶ Greater Manchester Local Industrial Strategy. June 2019. <https://www.greatermanchester-ca.gov.uk/media/2132/gm-local-industrial-strategy-web.pdf>

⁷ UK Productivity: July to September 2019. Office of National Statistics. <https://www.ons.gov.uk/releases/ukproductivityjulytoseptember2019>

⁸ Place Matters – Innovation & Growth in the UK. Bruntwood Scitech. July 2020.

⁹ CaSE Report – The Power of Place. May 2020. <http://www.sciencecampaign.org.uk/resource/placereport.html>

¹⁰ UK2070 Commission: An inquiry into regional inequalities, towards a framework for action. February 2020 <http://uk2070.org.uk/wp-content/uploads/2020/02/UK2070-FINAL-REPORT.pdf>

¹¹ A Resurgence of the Regions: rebuilding innovation capacity across the whole UK, Richard Jones, May 2019 <http://www.softmachines.org/wordpress/?p=2340>

¹² <https://www.a4i.info/>

¹³ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/807792/regulation-fourth-industrial-strategy-white-paper-web.pdf

¹⁴ Realising our ambition through science-GO science and Treasury report;

¹⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844502/a_review_of_government_science_capability_2019.pdf

¹⁶ A more development-focused strategy for paving the way to Impact. AIRTO. March 2020. <http://www.airto.co.uk/wp-content/uploads/2020/03/AIRTO-More-D-Position-Statement-31-MARCH-2020-web.pdf>

¹⁷ The road to 2.4 per cent David Willetts December 2019, Transforming Britain's R&D performance <https://www.kcl.ac.uk/policy-institute/assets/the-road-to-2.4-per-cent.pdf>

¹⁸ <https://www.gov.uk/government/publications/uk-research-and-development-roadmap/uk-research-and-development-roadmap>

Growing impact from our collaborative knowledge sharing initiatives

- More than ever, national priorities require the united efforts of diverse participants and our unique convening power and technical independence to help bring those participants together to proactively develop the knowledge and skills exchange activities and tools that support industry workforce needs across the whole of the UK. Specifically, ensure that the knowledge and expertise generated through the CBM Programme is effectively shared with the relevant stakeholder communities through routes such as peer-reviewed publications, best practice guides, workshops and webinars. Particularly, attract, train and develop a workforce that supports industry needs and is equipped to address ever-changing modern-day measurement challenges
- Expand current portfolio of quality assured learning across disciplines and career lifespan in partnership with industry, UKRI-Research Councils and academia. Particularly, develop cohorts of students with an applied analytical and measurement science knowledge-base essential to the productivity and growth of the UK bioeconomy
- Develop appropriate blended-learning tools, moving to increase more flexible, online digital content to complement face-to-face learning. This requires adaptation of existing metrology and core laboratory skills materials, and development of new material, for professional interactive digital delivery, through sustainable delivery channels
- Work with funding and education bodies with sector-relevant academic and vocational skills experience to inform and support the development of national skills initiatives (post-16) through to higher education (degrees, placements, masters and PhDs) and continuing professional development
- Continue to grow our engagement with stakeholders to further increase awareness of the NML externally, through targeted activities and regular content focused around the impact and real-world benefit of the more effective use of the measurement infrastructure we provide across industry, healthcare and academia. Particularly, achieve improved website and enhanced social media presence
- Provide a balanced evidence base to demonstrate value for money and broader societal benefit across our portfolio of activities. This will be done through continued impact evaluation of our activities using approaches including case studies and user surveys, and expanded to include new models, such as health impacts or structured fieldwork, working in partnership with government, NMS laboratories, NHS England, and others as appropriate
- Extend our evaluation process, including our routes-to-impact framework, indicators, and peer-reviewed bench marking, to monitor programme progress and use this evidence to continue to improve the operation of the programme and support future strategic decision-making.



Drivers and challenges

The summary of the drivers and measurement challenges that follow are the result of a joint 18-month NMS horizon-scanning project¹⁹ led by NPL combined with an internal driver mapping exercise and SWOT analysis, using the methodology detailed in the GO Science Futures Toolkit. The process engaged senior external stakeholder consultation and prioritisation from across many sectors, and internal strategic mapping exercises addressing a 10-15 year time window.

The drivers, grouped under the themes of Wellbeing, Sustainability, and Prosperity & Productivity (Figure 2), along with the associated measurement challenges, shape the measurement capabilities being developed going forward.

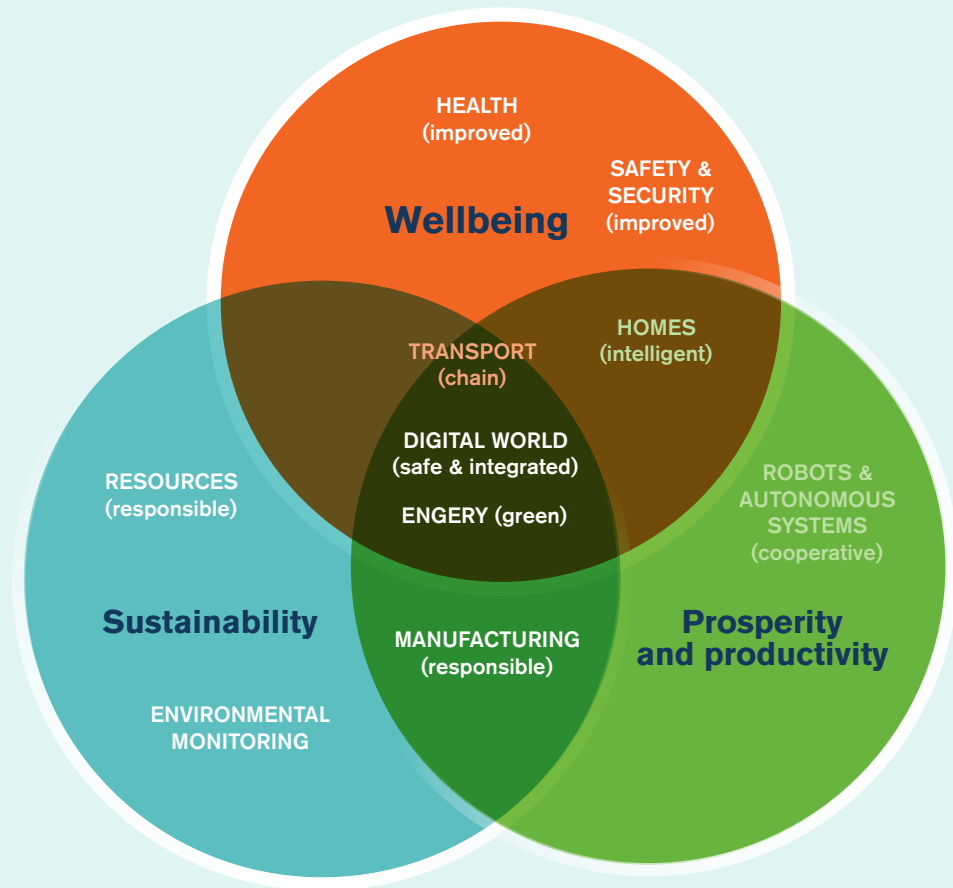


Figure 2. Grouped drivers with NML priorities shown in white bold

¹⁹ Technology and Measurement Foresighting. A vision of the 2030s shaped by metrology' (yet to be published).

Wellbeing

Health

Drivers

Advancing the detection and treatment/cure of:

- Infectious diseases including new pathogens, (emerging/re-emerging diseases/species jump) and antimicrobial/viral resistance.
- Non-communicable diseases – cancer, neurodegenerative diseases, heart disease, genetic disorders (e.g. Wilson's disease).

Measurement challenges

Diagnostics

- > Biomarker validation to enable the development of new clinical targets to fast track the development of new diagnostics
- > Support for the adoption of new technologies and methods, e.g. precision medicine, liquid biopsies, point of care, rapid non-invasive diagnostics, through best practice guides and enhanced understanding of robustness /sources of uncertainty.
- > Increase certainty in current diagnostic approaches through the provision of reference material/EQA value assignment to support the implementation of legislation (IVDR) and accreditation (Medical Laboratories ISO 15189) and best practice guidance

Treatments

- > Through a better understanding of measurement, support the development, manufacture and safe adoption of new therapeutic medicines (such as cell and gene therapies, bio-nanomedicines).

Approaches

- > Advancement of new measurement technologies to enable better understanding of new treatments and diagnostics such as tissue and single cell imaging, protein structural characterisation and trace diagnostics and multiplexed (fingerprinting) biomarkers.
- > Incorporate econometrics and wellbeing metrics into impact monitoring for, e.g. Patient Reported Outcome Measures (PROMs), to understand the benefits to patients and healthcare providers of better measurement.

Safety and security

Drivers

- With an ever-expanding variety and number of sources of food consumed in the UK and a potentially changing regulatory environment, we need to ensure consumers are protected.
- With many drivers for minimising the impact of human resources usage, we need to ensure this is not at the expense of consumer safety.
- Security; ensuring the best technology can be implemented for border control and policing purposes.
- Biosecurity surveillance as part of the management of pandemics, e.g. COVID-19 and to halt the threat from malevolent parties who may see fit to deploy biological materials (brought about through advances in technology).

Measurement challenges

To support consumer protection through development of new or improved methods to establish food safety, especially for challenging areas such as allergens. Advancement of recycling processes, whilst ensuring the safety of consumers, accurate detection of harmful contaminants, e.g. POPs.

Security/biosecurity supporting measurement approaches for the management of threats to people (including biological), industries or environment, which may be from foreign or endemic organisms, but can also extend to pandemic diseases and the threat of bioterrorism.



Sustainability

Environmental monitoring

Drivers

- Minimise human impact on the planet, though ensuring mechanisms are in place to be able to monitor the safe disposal of waste.

Technologies/measurement challenge

Development of improved methodologies for pollution monitoring, e.g. nanoparticle and plastic particulates.

Resources

Drivers

- Food authenticity and increasing food fraud in a global market
- Rise of vegetarianism/veganism

Technologies/measurement challenge²⁰

The use of point of use analysis technologies
Lack of trust in emerging technologies as well as the databases they use.

Prosperity and productivity

Advanced biomanufacturing

Drivers

- Economic growth, through new production mechanisms and novel products to market.

Technologies/measurement challenge

Through better measurement, help to streamline biomanufacturing (using living systems, particularly microorganisms and cell cultures, to produce biological molecules and materials on a commercial scale) and improve the quality and safety of products manufactured. Including: traditional bioprocessing through to engineering biology and CAR T etc. (medical treatments jointly badged as wellbeing).

²⁰ These technologies are addressed by the GC strategy and programme 2020-2023: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/843833/GC_Strategy_2020-2023_FINAL.pdf

Conclusion

This strategy lays out the foundations on which the National Measurement Laboratory for chemical and biological measurement can continue to be recognised globally as an agile, independent and high-performing national facility addressing the UK's most immediate challenges and can better provide forward-looking scientific capacity in the technology areas that will shape future industries.

Whilst continuing to serve our customer base through each of our defined chemical and biological measurement capabilities, we will harness our combined internal strengths around two core areas – clinical diagnostics and biomanufacturing control.

By further broadening our depth and range of measurement knowledge and expertise through key strategic investments and partnerships with the 'best in class' in complementary sectors across the whole of the UK, we can better deliver on our response to the conflicting challenges ahead and on making a real-world difference in terms of productivity, health and wellbeing.



Glossary of Acronyms

A4I	Analysis for Innovators	MHRA	Medicines and Healthcare products Regulatory Agency
ABPI	Association of the British Pharmaceutical Industry	MMIP	Medicines Manufacturing Industry Partnership
ARPA	UK Advanced Research Projects Agency	NHS KTP	NHS-England's Knowledge Transfer Partnership
BEIS	Department for Business, Energy & Industrial Strategy	NIBSC	National Institute for Biological Standards and Control
BIA	BioIndustry Association	NIHR	National Institute for Health Research
BIPM	International Bureau of Weights and Measures	NML	National Measurement Laboratory
BIVDA	British In Vitro Diagnostics Association	NMS	National Measurement System
CAMS	Community for Analytical Measurement Science	NPL	National Physical Laboratory
CAR T	Chimeric Antigen Receptor T cell (therapy)	OLS	Office for Life Sciences
CBM	Chemical and Bio-Measurement	OPSS	Office for Product Safety and Standards
Defra	Department for Environment, Food & Rural Affairs	PCR	Polymerase Chain Reaction
DNA	Deoxyribonucleic acid	POPs	Persistent Organic Pollutants
Dstl	Defence Science and Technology Laboratory	PROMs	Patient Reported Outcome Measures
EA	Environment Agency	PSREs	Public Sector Research Establishments
EQA	External Quality Assessment	R&D	Research & Development
EURAMET	European Association of National Metrology Institutes	SBLC	Synthetic Biology Leadership Council
Fera	Food and Environment Research Agency	SI	International System of Units
FSA	Food Standards Agency	SWOT	Strengths, Weaknesses, Opportunities, and Threats (analysis)
FSA NI	Food Standards Agency Northern Ireland	TUV-NEL	TUV- National Engineering Laboratory
FSA Wales	Food Standards Agency Wales	UK SLGAT	UK Standards Liaison Group for Advanced Therapies
FSS	Food Standards Scotland	UKRI	UK Research and Innovation
FTE	Full-time Equivalent		
GDP	Gross Domestic Product		
IVDR	In Vitro Diagnostic Regulation		
M4R	Measurement for Recovery		



LGC, Queens Road, Teddington, Middlesex TW11 0LY, UK
Tel: +44 (0)20 8943 7393
www.lgcgroup.com • Science for a safer world
www.lgcgroup.com/nml

Subject to Crown licence. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or any retrieval system, without the written permission of the copyright holder. © LGC Limited, 2021. All rights reserved. SI/88/CD/1019



 Department for
Business, Energy
& Industrial Strategy

FUNDED BY BEIS