

Royal Statistical Society response to the call for evidence on the Nurse Review of Research Councils

The Royal Statistical Society (RSS), as one of the constituent societies of the Council for the Mathematical Sciences (CMS), contributed fully to the production of the CMS response to this call for evidence, and fully endorses that response. This RSS response is in agreement with that of the CMS and echoes several of its points, adding some additional comments with regard to statistics.

1. Strategic decision-making

The Royal Statistical Society (RSS), as one of the constituent societies of the Council for the Mathematical Sciences (CMS), contributed fully to the production of the CMS response to this call for evidence, and fully endorses that response. This RSS response is in agreement with that of the CMS and echoes several of its points, adding some additional comments with regard to statistics.

How should the Research Councils take account of wider national interests including regional balance and the local and national economic impact of applied research?

- Research Council budgets overall should not be depleted. Revenue spending since 2010 has been ring-fenced but decreasing in real terms. Evidence suggests that to be competitive with other advanced nations, the government should seek to increase overall expenditure on research and development from 1.7% (as last measured in 2012) to 3% of GDP. The average expenditure on R&D across the European Union (by government, business and charities) is between 2% and 3% of GDP and increasing, and this is also the case in the USA and in China (excluding Hong Kong).^{1, 2, 3} The UK should step up its investment to remain competitive overall.

Is the balance of funding well-judged between the support of individual investigators, support of teams and support of equipment and infrastructure?

- The government's strategy for revenue spending should be coupled to plans for capital spending, so that spending plans as a whole can be assessed and appropriately balanced. Some of that balance is missing at the present time. More revenue spending is needed to train and retain the best researchers, and to raise the standard and competitiveness of our research base overall. For example, the relative lack of post-doctoral training and fellowship money is a serious concern in terms of bringing on the next generation of mathematically trained researchers for a wide range of disciplines and industries.

¹ Eurostat Gross Expenditure on R&D data.

² OECD (2014) *Estimates of R&D expenditure growth in 2012* [PDF]. Available from: http://www.oecd.org/sti/inno/Note_MSTI2013_2.pdf [Accessed March 2015]

³ Allas, T. (2014) *Insights from international benchmarking of the UK science and innovation system* [PDF]. January 2014. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf [Accessed: April 2015]

What are the gaps or holes in the funded portfolios of the Research Councils?

- The rise of the data-led economy, and the worrying existence of major skills gaps in data-led industries, have drawn further attention to the need for statistical and data analytical skills in research and in industry.^{4, 5, 6} Statistical thinking and methods play a crucial enabling role across most broad areas of research in the natural and social sciences, engineering, health, environmental sustainability and elsewhere. The UK's data capability strategy recognised the need to address a deficit in data analytical skills, and commissioned a review by Universities UK on this topic.⁷ The review has found that mathematics and statistics support centres provide students, and sometimes staff, with much-needed guidance.⁸ Consultation by the Engineering and Physical Sciences Research Council (EPSRC) has also found that the use of statistics in other disciplines can be very poor, that staffing for this remains an issue, and that post-doctoral and early career fellowships are essential for retaining talent in the UK.⁹

2. Collaborations and partnerships

Are the right arrangements in place to ensure optimal funding for research that crosses disciplinary boundaries?

- To guide and complement the valuable activities of the different research councils, Research Councils UK should put approaches to statistics, information and data at the heart of what they do, and should make this subject to over-arching review. We propose this as part of CMS' broader proposals for more cross-council leadership to support collaborations with mathematical science across disciplines, rather than as an additional initiative. As with the rest of the mathematical sciences, leadership for statistics could be taken across RCUK, or alternatively by the Engineering and Physical Sciences Research Council (EPSRC), provided that the approach is sufficiently broad to take account of statistical needs across disciplines and across the Research Councils.
- Individual research councils should support better data and better analysis more rather than less, with a shared agenda across RCUK to strengthen this. EPSRC highly prioritises

⁴ European Commission (2015) Commission workshop identifies skills gap for big data analytics and explores possible solutions [online]. Available at: <http://ec.europa.eu/digital-agenda/en/news/commission-workshop-identifies-skills-gap-big-data-analytics-and-explores-possible-solutions> [Accessed: March 2015]

⁵ SAS / Tech Partnership (2014) *Big Data Analytics: Assessment of demand for labour and skills 2013-2020* [PDF]. Available at: https://www.thetechpartnership.com/globalassets/pdfs/bigdata_report_nov14.pdf [Accessed: March 2015]

⁶ Bakhshi, H. Mateos-Garcia, J. & Whitby, A. (2014) *Model workers: how leading companies are recruiting and managing their data talent* [PDF]. London: NESTA. Available from: http://www.nesta.org.uk/sites/default/files/model_workers_web_2.pdf [Accessed: March 2015]

⁷ Department for Business, Innovation & Skills (2013) *Seizing the data opportunity: a strategy for UK data capability* [PDF]. London: Crown Copyright. Available from: <https://www.gov.uk/government/publications/uk-data-capability-strategy> [Accessed: March 2015]

⁸ Universities UK (2015) [Forthcoming, title to be confirmed]

⁹ EPSRC Mathematical Sciences Theme (2015) *Statistics and Applied Probability Review Day, 18th June 2014: Report and Next Steps* [PDF]. Available from: <http://www.epsrc.ac.uk/newsevents/pubs/statistics-and-applied-probability-review-day-18th-june-2014-report-and-next-steps/> [Accessed: March 2015]

research to generate new statistical theories and methods, and also support innovative applications, funding the development of statistical methodology to underpin them. Other Research Councils, particularly for the biological and biomedical sciences, economic and social research, medical research, and the natural environment, also fund statistical research, innovative use of data and new statistical methodology in the disciplines they support.

3. Balance of funding portfolio

Are the divisions of scientific subject areas between the Research Councils appropriate?

- Research Councils need a strong agenda to advance the statistical theory and methodology that underpins data analysis. More of this type of work is needed to meet research and development needs. These methodological advances very often begin their development before a clear link to a specific area of application has been established. At present EPSRC take a lead in the theoretical and methodological development of the mathematical sciences. The funding and profile of this work should be raised and its importance to the development of other disciplines better addressed, in the cross-cutting strategy proposed above.
- It is becoming very widely accepted, in the context of data science and the data economy, that applied statistics and quantitative methods should play an important role across very many research themes. It is important to understand, however, that applied statistics must be grounded in statistical theory and methodology, and indeed involves methodology development for particular applications. Data science is an intrinsically interdisciplinary and cross-disciplinary enterprise and will thrive only if it embraces and cross-fertilises statistics, other mathematical sciences, computer science, and other disciplines.
- Despite the systems already in place to support funding applications that cross more than one Council, the perception in our community is that it remains relatively difficult to obtain funding for them. Given the importance of cross-disciplinary and interdisciplinary research to our society and economy, this issue must be addressed successfully. Models from other Research Councils that could be informative to the cross-cutting mathematical sciences research agenda is the policy of MRC and the National Institute for Health Research (NIHR) to collaborate on a cross-disciplinary funding strategy for the development of research methods that underpin discoveries in health.¹⁰ The Economic and Social Research Council has also been working in partnership to raise the level of quantitative skills across the social sciences, in an approach that other disciplines might also benefit from.

4. Effective ways of working

How can the RCs catalyse collaboration between institutions?

- The development of data infrastructure will be crucial to effective working, and Research Councils have a key part to play in this. The ethical governance of data sharing should also be provided for in a manner accessible to all researchers, so that the benefits of opening up access to data are widely seen to outweigh any risks. The Cabinet Office, the Economic

¹⁰ Medical Research Council (2015). Methodology research programme [online]. Available at: <http://www.mrc.ac.uk/funding/browse/methodology-research-programme/> [Accessed: March 2015]

and Social Research Council (ESRC), and the UK Statistics Authority have been leading initiatives to improve data sharing for research and statistics. Agreed infrastructural approaches to this should be taken forward on a longer-term basis.

- Mathematicians and statisticians should have a wider presence in research funding panels than at present. Research collaborations would then be better placed to develop theoretical and 'non routine' use of mathematics and statistics, which is under-addressed at present. . For statistics in particular, this would help to address the ubiquity of data across research, promote a more rational approach to the use of statistics, and avoid the mistaken notion that applied statistics consists solely of a fixed set of methods that can easily be deployed by staff with fairly low-level technical skills.¹¹ This would in turn send an important signal to our institutions that there is scope for cross-disciplinary work to advance theoretical and methodological research.
- While, as we have proposed above, there should be better co-ordination and review across all the Research Councils of activity in the mathematical sciences, we recognise that organisations in the academic community (such as ourselves) have a role to play in the co-ordination. The Royal Statistical Society endeavours to keep in touch with the research councils including EPSRC, ESRC, MRC, BBSRC and NERC, by way of regular meetings and discussion.

Response submitted 17 April 2015.

¹¹ Nuzzo, R. (2014) Scientific method: statistical errors [online article]. *Nature*, 12 February 2014. Available at: <http://www.nature.com/news/scientific-method-statistical-errors-1.14700> [Accessed: March 2015]