About the Council for the Mathematical Sciences (CMS)

The CMS (www.cms.ac.uk) was established in 2001 by the Institute of Mathematics and its Applications (IMA), the London Mathematical Society (LMS) and the Royal Statistical Society (RSS). They were joined in 2008 by the Edinburgh Mathematical Society (EMS) and the Operational Research Society (ORS). The CMS provides an authoritative and objective body that exists to develop, influence and respond to UK policy issues that affect the Mathematical Sciences in higher education and research, and therefore the UK economy and society in general.

- The IMA is the UK's learned and professional society for mathematics and its applications and has around 5,000 members.
- The LMS was founded in 1865 and has as its purpose the advancement, dissemination and promotion of mathematical knowledge in the UK and worldwide.
- The RSS, founded in 1834, aims to nurture and promote statistics, encouraging statistical knowledge and disseminating good practice in society at large.
- The EMS was founded in 1883 and has around 450 members. Its aims are the promotion and extension of the Mathematical Sciences, particularly in Scotland.
- The ORS is the world's oldest-established learned society catering to the Operational Research profession, with 3,000 members in 53 countries.

Lord Stern's review of the Research Excellence Framework - response form

The call for evidence is available at: www.gov.uk/government/consultations/research-excellence-framework-review-call-for-evidence

The closing date for responses is **Thursday 24 March 2016**.

Please return completed forms to:

Hannah Ledger
Research Strategy Unit
Department for Business, Innovation and Skills
1 Victoria Street
London
SW1H 0ET

Email: REFreview@bis.gsi.gov.uk

access to information regimes. Please see the consultation document for further information.

If you want information, including personal data, that you provide to be treated as confidential, please explain to us below why you regard the information you have provided as confidential. If we receive a request for disclosure of the information, we shall take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the department.

I want my response to be treated as confidential ☐

Comments:

Questions

Name of Organisation (if applicable): Council for the Mathematical Sciences

Please check the box that best describes you as a respondent to this consultation

	Respondent type
☐	Alternative higher education provider (with designated courses)
☐	Alternative higher education provider (no designated courses)
☐	Awarding organisation
☐	Business/Employer
☐	Central government
☐	Charity or social enterprise
☐	Further Education College
☐	Higher Education Institution
☐	Individual (Please describe any particular relevant interest; teaching staff, student, etc.)
☐	Legal representative
☐	Local Government
☐	Professional Body
☐	Representative Body
☐	Research Council
☐	Trade union or staff association
☐	Other (please describe)

Section 1

The primary purpose of the REF is to inform the allocation of quality-related research funding (QR).

1. What changes to existing processes could more efficiently or more accurately assess the outputs, impacts and contexts of research in order to allocate QR? Should the definition of impact be broadened or refined? Is there scope for more or different use of metrics in any areas?

   Please tell us your thoughts in no more than 500 words:

   Mathematics is an underpinning discipline. As such, we believe that a significant part of the impact of research in the mathematical sciences is not captured by the definition of impact used in REF2014. That definition excluded impacts within the higher education sector on the basis that this was assessed within the 'outputs' and 'environment' elements of the REF.

   There are numerous examples, however, where developments in mathematics have had transformational effects on other academic disciplines. Here are three examples from across the spectrum of the mathematical sciences. Each example demonstrates impact which is profound, long-term and heavily diffuse, features common to much research in the mathematical sciences.

   1 Finite element analysis, initially developed in the 1950s and still a rich topic of research, is now ubiquitous in many branches of engineering and therefore underpins much of the impact that is claimed there.
   2 Google's PageRank algorithm was developed in the 1990s, bringing together fundamental mathematical ideas from linear algebra, graph theory and probability theory which were initially formulated in the 19th century and extended continuously since then, combining them to solve a problem which did not even exist until very recently. It led to the creation of Google and over US$300 million for Stanford. It has had a profound impact on the lives of billions of people.
   3 Sir David Cox's seminal paper on "Regression models and life-table" (*Journal of the Royal Statistical Society. Series B (Methodological)*, Vol. 34, No. 2 (1972), pp. 187-220) kick-started modern research in survival analysis and, through its impact on clinical research (Cox was awarded the **Charles F. Kettering Prize** for "the most outstanding recent contribution to the diagnosis or treatment of cancer" in 1990) extended the lives of millions.

   In his review of the UK Research Councils, Sir Paul Nurse (p. 7) reflects that "more consideration needs to be given to highly significant scholarly impact". We support this view.

   Nurse also notes that in research funding decisions (p. 9), "high quality peer review plays a central role". We strongly support the view that peer review should be central to all aspects of the REF.

   Nevertheless, in order to minimise the burden of the REF, consideration should be given as to whether there is a role for metrics to help to inform some aspects of the

assessment process. The available metrics are more sophisticated than when this question was considered prior to REF2014. However, the normal expectation of key metrics such as grant income and citations varies enormously across different disciplines. Hence we would strongly advocate a subject-specific approach to this, developed in consultation with subject specialists. It is important that the REF commands the respect of the research community and a one-size-fits-all approach to metrics would put this at risk. Subpanels should be transparent about which metrics if any they propose to use, and how they will be used.

2. If REF is mainly a tool to allocate QR at institutional level, what is the benefit of organising an exercise over as many Units of Assessment as in REF 2014, or in having returns linking outputs to particular investigators? Would there be advantages in reporting on some dimensions of the REF (e.g. impact and/or environment) at a more aggregate or institutional level?

   Please tell us your thoughts in no more than 500 words:

   There should be a single Unit of Assessment for the mathematical sciences, as in REF2014. All aspects of the assessment should be carried out at the level of the UoA rather than at the level of the institution because that is the level at which peer review expertise lies, and most research is conducted.

   In REF2014, the environment scores correlated strongly with the size of the submission, as the attached set of plots makes clear. We would therefore question the need for having a qualitative assessment of research environment. Removing this element from the assessment would help alleviate the administrative burden of the REF.

Section 2

While the primary purpose of REF is QR resource allocation, data collected through the REF and results of REF assessments can also inform disciplinary, institutional and UK-wide decision making.

3. What use is made of the information gathered through REF in decision making and strategic planning in your organisation? What information could be more useful? Does REF information duplicate or take priority over other management information?

   Please tell us your thoughts in no more than 500 words:

   No comment – not relevant to CMS.

4. What data should REF collect to be of greater support to Government and research funders in driving research excellence and productivity?

   Please tell us your thoughts in no more than 500 words:

   No comment.

Section 3

The incentive effects of the REF shape academic behaviour, such as through the introduction of the impact criteria.

5. How might the REF be further refined or used by Government to incentivise constructive and creative behaviours such as promoting interdisciplinary research, collaboration between universities, and/or collaboration between universities and other public or private sector bodies?

   Please tell us your thoughts in no more than 500 words:

   Our strongly held view is that REF should remain a means of assessing research quality to ensure a fair and efficient distribution of QR, and should not be used as a tool for incentivizing particular behaviours.

   Assessing the quality of interdisciplinary research is an issue which needs to be addressed in the design of the REF and is of particular importance to the mathematical sciences in view of their exceptionally wide reach, as noted earlier. It is difficult to find peer reviewers with the appropriate expertise within any one panel, and a formal mechanism should be established for assessing research outputs explicitly flagged as inter-disciplinary.

   We strongly advise the panel to consider the findings of the 2015 report *Evaluating Interdisciplinary Research: a practical guide*: https://www.dur.ac.uk/resources/ias/publications/StrangandMcLeish.EvaluatingInterdisciplinaryResearch.July2015_2.pdf

Section 4

Previous studies have focused on the costs of REF with respect to the time and resources needed for the submission and assessment processes. The Review is also interested in views and any associated evidence that the REF influences, positively or negatively, the research and career choices of individuals, or the development of academic disciplines. It is also interested in views on how it might encourage institutions to `game-play' and thereby limit the aggregate value of the exercise.

6. In your view how does the REF process influence, positively or negatively, the choices of individual researchers and / or higher education institutions? What are the reasons for this and what are the effects? How do such effects of the REF compare with effects of other drivers in the system (e.g. success for individuals in international career markets, or for universities in global rankings)? What suggestions would you have to restrict gaming the system?

   Please tell us your thoughts in no more than 500 words:

   The REF, along with its predecessors, has had a positive effect on UK academia by encouraging HEIs to hire top quality research talent from around the world, greatly enhancing the research environment. However, the game playing that it has encouraged has had a negative impact. Research is a long-term endeavour, whereas many of the tactics employed by universities to maximise return through the REF run counter to this. We would support efforts to produce a system that minimized the opportunities for short-term tactical game playing.

   Ideas that might be considered include:

   - including research outputs from all research-active academic staff who were in employment between REF2014 and REF2021;
   - allowing the inclusion of any number of outputs (between 0 and 4). The volume measure in the QR funding calculation would then be 0.25 x the total number of outputs, rather than the total FTE;
   - weighting the value of the outputs by the fraction of the REF period that the individual was employed at the institution.

   In REF2014, the need to include one impact case study (ICS) per 10 FTEs led to the exclusion of individuals from submissions in cases where it was judged that the number of high-quality ICSs was not sufficient to allow for their inclusion. In cases where a significant fraction of research-active individuals was excluded, the resulting REF profile gives a misleading picture of that unit.

7. In your view how does the REF process influence the development of academic disciplines or impact upon other areas of scholarly activity relative to other factors? What changes would create or sustain positive influences in the future?

   Please tell us your thoughts in no more than 500 words:

   The assessment of the Environment in REF2014 in the mathematical sciences is widely regarded as having unfairly favoured large departments. There is a danger that such scoring will lead to ever greater concentration of mathematical sciences research in the UK, and consequently the most inspirational HE teaching, in a few locations, with large areas of the country short of such provision. As noted by Nurse (p.9): "Diversity should be protected in researchers, approaches and locations - recognising that novel approaches and solutions…sometimes emerge more readily outside the mainstream. The best research should be funded wherever it is found".

   Our suggestion to deal with this problem is that the environment part of the REF assessment be removed. As noted earlier, in REF2014 the environment scores related more to the quantity than to the quality of submitted research.

   Two further points, made earlier in our return but pertinent to Question 7 and so restated here, are:

   - The difficulty of fairly assessing interdisciplinary research remains a serious problem which needs to be addressed, as the failure to do so risks driving researchers away from engaging across subject boundaries.
   - Much of the profound societal and economic impact of the mathematical sciences operates across very long time scales and through long chains of connected impacts, many of these intermediate links being through other academic sciences. The REF's definition of impact should be modified to take account of this.

Section 5

Much of REF focuses on the retrospective analysis of success achieved by institutions either through output or impact. Yet the resources provided anticipate continued success based on that track record. Are there means of better addressing forward-looking institutional plans and priorities, and how these might feed in to national policy?

8. How can the REF better address the future plans of institutions and how they will utilise QR funding obtained through the exercise?

   Please tell us your thoughts in no more than 500 words:

   The REF should not attempt to assess future plans, at either the UoA or institutional level. This would lead to a much more subjective process, and would greatly increase the burden on both those writing and those assessing the submissions.

Final thoughts

The Review is keen to hear of creative ideas and insights and to be open in its approach.

9. Are there additional issues you would like to bring to the attention of the Review?

   Please tell us your thoughts in no more than 500 words:

   Nurse (p. 15) notes the importance `…for society more generally to maintain trust in the research endeavour. Effective communication, dialogue and engagement with the public are essential functions of the Research Councils…' While Nurse is writing about RCUK funding, the points should apply equally to QR-supported research. REF should therefore recognize the value and importance of these activities and encourage and assess them accordingly by broadening the definition of impact to include public engagement activities which are based broadly on the research expertise and standing of members of the submitting UoA, rather than being necessarily tied to specific research outputs.