International Review of Mathematical Sciences
EPSRC Action Plan

Recommendation	Relevant stakeholders to engage	Response and/or proposed actions
R-1 To research funders: To preserve and strengthen the international excellence of mathematical sciences research (Finding F-1) in light of Finding F-2 (the UK's diverse and distributed research community), it is essential to have flexible funding structures that support excellent researchers wherever they are located, and that encourage long-term interactions and collaborations among excellent researchers in diverse areas, in groups of diverse sizes, at geographically distributed institutions of all sizes. Sections 4, 13, 15.2 and 16.2.2.	Other research councils Universities Research community	EPSRC will encourage researchers to make further use of the flexibility to support long-term interactions and collaborations on standard EPSRC applications. In general, EPSRC funding can support work across institutions. In cases where there has been a restriction to one department in the past (e.g. Mathematical Sciences Platform Grants), this will not be the case in the future. . The EPSRC mission as a national research funder is to support excellent research irrespective of location, and encourage collaboration where appropriate, in contrast to the responsibilities of others eg Funding Councils. We will continue to encourage the mathematical sciences community to explore how it can work together to sustain the excellence of UK mathematics, making full use of the flexibility that exists with EPSRC funding. The EPSRC Mathematical Sciences capability theme currently supports 131 multi-institution grants out of a total of 535 grants (24%). We would like to see this number increase. **Action** • We will aim to provide appropriate support that allows the very best researchers to work together wherever they are based and encourage collaboration between institutions, especially in strategically important areas, both with respect to research and training. We will engage with the community and stakeholders in determining what these strategically important areas are.

R-2. To research funders, learned societies and the mathematical sciences community: Open, frank and timely communication between EPSRC and the mathematical sciences community is extremely important. In light of Finding F-6, the panel strongly recommends the establishment, as soon as possible, of a new structure for communication between EPSRC and the mathematical sciences community. A joint effort between EPSRC and leadership of the learned societies is an obvious way to begin to define such a structure. Section 12.	Learned societies Research community	EPSRC agrees that open, frank and timely communication between the mathematical sciences community and ourselves is extremely important. **Action** • EPSRC will work with the learned societies and HODOMS, and will also where appropriate contact heads of department directly, to create a two-way flow of information. We will hold timely and regular meetings with CMS, and we will identify areas of mutual interest for working groups with CMS and other stakeholders and seek to agree a forward agenda of strategic topics. We will also undertake activities to engage with the broader community eg Young Researchers in Mathematics and Research Leaders, and continue to work with the Mathematical Sciences Strategic Advisory Team to ensure we retain an over view of mathematical sciences, key issues and opportunities. • Given the important role that the Mathematical Sciences SAT performs we will ensure that its selection process and working is as open and as transparent as possible, so that advice and decision making is understood.
R-3. To research funders, institutes and learned societies, and the mathematical sciences community: Activities such as workshops, possibly arranged by the institutes or learned societies, should continue to be organised in order to encourage and enhance connections within the mathematical sciences, with academic colleagues in other areas and with industrial collaborators, and to involve the mathematical sciences community in proposed or contemplated major research initiatives. Sections 3.2, 14.1.1 and 14.2.	Other research councils Learned societies Isaac Newton Institute Research community Industrial Maths KTN	EPSRC agrees that workshops and other activities to encourage and enhance connections are of great value. Building connections within and beyond Mathematical Sciences is a key part of our strategy. The current EPSRC portfolio includes a significant investment in 'connectivity' activities, including the Isaac Newton Institute, Durham and Warwick Symposia, the ICMS, workshops and networks. Funding for workshops and other similar activities to promote connectivity around a particular project can be included on any EPSRC research application.

		Action • EPSRC will review its current 'connectivity investments', to assess whether they provide the right level and type of support to enhance connections and that they are well linked with EPSRC objectives to enhance connections between mathematical sciences, other disciplines and the EPSRC challenge themes, industry and other users.
R-4. To research funders, universities and the mathematical sciences community: Strong efforts should be made to ensure that UK PhD training meets the highest international standards. This recommendation relies on the provision of PhD student funding during an adequate period of training. Section 16.3.	Other research councils Universities Research community Industry and public employers of PhD students	Both the quality and breadth of PhD training was discussed by the International Review panel. EPSRC recognises that this is a long-standing concern, and not unique to the mathematical science, despite considerable efforts to address it. **Action** • This needs broader consideration to understand the wider context and any issues specific to the mathematical sciences. EPSRC will draw on advice from a range of stakeholders with a view to encouraging a joined up and collaborative approach to any changes which it is agreed are needed. This will help to inform EPSRC future provision in the context of the roles and responsibilities of others.

R-5. To universities, funders of PhD research and the mathematical sciences community: To complement existing EPSRC programmes that support PhD education (such as Taught Course Centres and Centres for Doctoral Training), UK universities should consider establishing, as a norm, a PhD programme that begins with a special one-year research Master's degree, followed by three years of PhD education and training. Sections 16.2.2 and 16.2.4.	As above	EPSRC has recently agreed to provide further funding for Taught Course Centres, to enable the centres to move towards self sustainability over the next few years, and has recently contacted all Heads of Mathematical Sciences and allied departments to ensure that the benefits of broadening training are widely available to PhD students. EPSRC funding can be used for research masters via the Doctoral Training Grant to Universities or Centres for Doctoral Training in the context of an integrated PhD programme. EPSRC funding already permits 4 year PhD programmes. EPSRC's statement of expectations explains that "EPSRC advocates greater emphasis being placed on the quality of PhD training provided; thus quality of provision to EPSRC funded students should not be sacrificed to maximise numbers, particularly where flexible use of DTA funds is concerned. Where a four year programme is employed, the additional time should be used to enhance the overall training experience rather than only to maximise research outputs." **Action** • EPSRC will continue to monitor the Taught Course Centres and Centres for Doctoral Training and encourage collaboration between them, including taking account of lessons learned and agreed best practice in shaping future support for postgraduate training. The Funding environment is not solely the responsibility of the Research Councils and Funding Council policies are relevant to this recommendation.

R-6. To research funders, industry, universities and the mathematical sciences community: In addition to existing programmes that connect industry and mathematical sciences research, long-term collaborations focussing on basic research driven by industrial challenges should be explicitly encouraged. These collaborations should include multi-year, close relationships that involve academics and one or more financially committed industrial partners, as well as graduate education in the theory and methods needed to solve industrial problems. Companies of all sizes should take full advantage of the Industrial Mathematics Knowledge Transfer Network. Larger companies should explore establishing long-term strategic relationships with universities. Sections 11.2 and 11.3.	Other research councils Research community Universities Industry – through our strategic partners Industrial Maths KTN TSB	EPSRC agrees that close collaborations with industrial partners are highly beneficial both in terms of ensuring rapid impact of the research, and stimulating new research ideas. As a consequence, there are already many opportunities to develop and support collaborations between industry and mathematical sciences research, including project partners on research grants, CASE awards and through activities such as workshops to provide pathways to impact. Many large companies are now developing strategic relationships with universities. EPSRC also has a number of strategic partnerships with research users, and our future strategy is to support multi-company, sector-wide or multi-sector partnerships that will require input from a number of disciplines. There will be new opportunities for industry and mathematical sciences researchers to engage through specific activities to enhance collaborations around EPSRC challenge themes. **Action:** • EPSRC will monitor and publish the level of interaction with industry with EPSRC-funded Mathematical Sciences research. We will continue to promote the benefits of working with industry and other users and also explore new opportunities for engagement, in particular working with the Industrial Mathematics KTN, to stimulate new long term research informed by user needs.
R-7. To universities, industry, the mathematical sciences community and research funders: Arrangements should be explored to create appropriate roles within academia for experts from industry so that universities can benefit from their technical knowledge and experience in collaboration. Section 11.3.	Research community Universities Industry – through our strategic partners Industrial Maths KTN Royal Society Other Research Councils	EPSRC agrees that providing industry experts with roles in academia is very beneficial, and we would encourage it. EPSRC contributes to the Royal Society scheme which awards industry fellowships which allow scientists in industry to work on a collaborative project within an academic organisation. Our new fellowship framework provides more flexibility to support experts who are new to the university system. We will promote the value of this type of engagement to universities and our Strategic Partners.

		Action • We will discuss this recommendation with the Industrial Mathematics KTN and with universities to understand how EPSRC can help encourage greater engagement of technical experts with research and teaching activities in universities.
R-8. To research funders: The review panels for multidisciplinary proposals whose topics include the mathematical sciences should include members with expertise in both multidisciplinary research and relevant areas of the mathematical sciences. Sections 14.1.1 and 14.1.2. A separate panel is desirable for reviewing proposals in operational research and statistics. Sections 14.1.2, 5.11 and 15.2.	Peer review college Research community	EPSRC recognises that there are concerns over the peer review of multi-disciplinary proposals. All EPSRC peer review panels include a suitable range of expertise to cover the proposals being assessed, and some panel members will have experience of multidisciplinary research. We require Panel members to act as generous generalists drawing on referee expertise in formulating their advice. **Action:** • We will monitor the success of proposals from different disciplines and themes. • We will continue to ensure that panels receive suitable briefing, and we will continue to encourage referees to identify their expertise and take a broad view. We will not be convening a separate panel for operational research and statistics since we need to assess all proposals together in order to ensure we retain an integrated view of our support for the mathematical sciences and shape capability in mathematical sciences most effectively.
R-9. To universities and research funders: In statistics, decisive action is needed to enhance the ability of small departments to compete on the international level for new faculty. A more flexible grant structure such as the one proposed in Recommendation R-1 would help to address this issue. Section 15.1.	Other research councils Research community Universities Research users Learned societies HEFCE?	Statistics research and postgraduate training is a priority area for action to shape future capability. **Action:** • We are working with the RSS who are carrying out a project on the future of statistics as an academic discipline in the UK. We will investigate the 'people pipeline' in Statistics to understand how we can ensure that there is a good supply of future

		international leaders in statistics in the UK, to ensure they are well connected to the numerous application areas, and to understand how this contributes to shaping the UK statistics capability. • We are setting up a cross-council task force to co-ordinate support for Statistics across the research councils and will discuss with Funding Councils in the context of their responsibilities from Strategically Important & Vulnerable subjects.
R-10. To universities: Strong statistics research and teaching programmes should be supported at a large number of UK universities. Section 15.2.		This recommendation is directed to universities and therefore EPSRC has no comments.
R-11. To research funders, the mathematical sciences community and universities: Urgent action should be taken to improve participation of women in the mathematical sciences community, with special reference to EPSRC's strategy for developing leaders. Section 16.5.	Other research councils Research community Universities Learned societies	EPSRC agrees that participation of women in the mathematical sciences is a concern but this is not unique to the mathematical sciences. We are in discussion with Universities, the RCUK Research Careers and Diversity unit and the LMS Women in Mathematics Committee to ensure we are well positioned to provide support for women in mathematical sciences and to encourage greater participation and representation. **Action** • EPSRC will ask the universities it supports what steps they intend to take to enhance the diversity of EPSRC-sponsored leaders • EPSRC will work through relevant channels to formalise the requirement to demonstrate progress in improving participation if necessary
R-12. To EPSRC: After enough time has passed, EPSRC should assess and analyse the outcomes of the variety of institutes and centres that are intended to further multidisciplinary and industrial collaborations involving the mathematical sciences. Section 14.3.		EPSRC agrees that the outcomes of these centres should be assessed, and we plan to undertake such an assessment of the impact of these activities. **Action** • EPSRC will review the outcomes of strategic funding and ensure that lessons learned are widely disseminated and inform future strategy as appropriate**.**