

Consultation on draft panel criteria and working methods

Part 2B: Draft statement of Main Panel B

Main Panel B covers the following sub-panels:

- 7 Earth Systems and Environmental Sciences**
- 8 Chemistry**
- 9 Physics**
- 10 Mathematical Sciences**
- 11 Computer Science and Informatics**
- 12 Aeronautical, Mechanical, Chemical and Manufacturing Engineering**
- 13 Electrical and Electronic Engineering, Metallurgy and Materials**
- 14 Civil and Construction Engineering**
- 15 General Engineering**

The following sections set out the criteria and working methods that Main Panel B and its sub-panels will apply in assessing submissions. These should be read alongside the guidance provided in REF 02.2011 'Assessment framework and guidance on submissions' (hereafter 'guidance on submissions') and the generic statement of criteria and working methods provided in Part 1 of this document.

Section 1: Submissions and units of assessment

Section 2: Assessment criteria: outputs

Section 3: Assessment criteria: impact

Section 4: Assessment criteria: environment

Section 5: Working methods

Section 1: Submissions and units of assessment

Introduction

1. The nine sub-panels that fall within Main Panel B invite submissions in units of assessment (UOAs) 7 to 15 as set out in the following paragraphs.
2. Sub-panels encourage submitting units to use research groups to assist both with the description of submissions by HEIs, and with the assessment of submissions by sub-panels.
 - a. Where research groups are used to structure the environment template (REF5) (paragraph 88a), staff should be allocated to research groups through the staff details form (REF1a).
 - b. Where an individual is a member of a single research group, it will be assumed that all of that individual's research outputs are associated with that group. Where an individual is a member of more than one research group, individual research outputs may be allocated to the appropriate groups through the research outputs form (REF2).

UOA descriptors and boundaries

UOA 7: Earth Systems and Environmental Sciences

3. The UOA includes earth, environmental and planetary sciences, including: geophysics; geochemistry; palaeontology; geology; mineral physics; evolution of planetary atmospheres, surfaces and interiors; earth surface processes; the physics, chemistry and biology of the environment including ecology; atmospheric, oceanic, freshwater, terrestrial and soil sciences; innovative measurement systems; global change; natural resources; natural hazards and environmental management.
4. The sub-panel expects submissions in this UOA from all areas of earth systems and environmental sciences, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research, and expects that submissions may contain work that contributes to this UOA and other cognate disciplines.

UOA 8: Chemistry

5. The UOA includes all areas of experimental and theoretical chemistry, including appropriate chemical areas of pharmacy, chemical engineering and materials science.
6. The sub-panel expects submissions in this UOA from all areas of chemistry, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research, and expects that submissions may contain work that contributes to this UOA and other disciplines, including those which have boundaries with this UOA, such as UOA 5

(Biological Sciences), UOA 7 (Earth Systems and Environmental Sciences), UOA 9 (Physics), and other cognate disciplines.

UOA 9: Physics

7. The UOA includes all areas of physics encompassing, but not limited to, theoretical, computational and experimental studies of: quantum physics; atomic, molecular and optical physics; plasma physics; fusion and energy; particle physics; nuclear physics; surface and interface physics; condensed matter and soft matter physics; biophysics; semiconductors, nanoscale physics, lasers, optoelectronics and photonics; magnetism, superconductivity and quantum fluids; fluid dynamics; statistical mechanics, chaotic and nonlinear systems; astronomy and astrophysics, planetary and atmospheric physics; cosmology and relativity; medical physics; applied physics; chemical physics; instrumentation; pedagogic research in physics.

8. The sub-panel expects submissions in this UOA from all areas of physics, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research, and expects that submissions may contain work that contributes to this UOA and other cognate disciplines.

UOA 10: Mathematical Sciences

9. The UOA includes pure and applied mathematics, statistics and operational research, including the development and application of these areas in the study of biological, physical and social sciences, commerce, engineering, finance, government, health, industry, medicine, and elsewhere.

10. It therefore includes: algebra; analysis; category theory; combinatorics; complexity theory; continuum mechanics and magneto-hydrodynamics; differential equations; dynamical systems and ergodic theory; environmental, financial, geophysical and industrial mathematics; geometry; integrable systems; mathematical biology; mathematical logic; mathematical methods; mathematical aspects of operational research including optimisation and stochastic modelling; mathematical physics; number theory; numerical analysis and scientific computing; operator theory and operator algebras; probability; statistical methodology and applications including biostatistics, data mining, environmental and social statistics, experimental design, mathematical statistics and statistical computing; topology. Although this list is necessarily incomplete, the sub-panel expects that the majority of submitted research will have made a direct contribution to the UOA as characterised above. It also expects to receive outputs concerning experimental, computational and other investigations related to mathematical models applied to problems outside mathematics.

11. The following boundaries with other UOAs should be noted. Physics outputs in which the primary research contribution is mathematical may be submitted in this UOA, and some research in actuarial sciences and demography falls within its remit. The sub-panel also expects outputs submitted in this UOA on the history of the mathematical sciences and outputs of an interdisciplinary nature in which the mathematical sciences

have a significant role. While it recognises that some applied statistics will be reported in media specialising in areas other than statistics, probability or operational research, research which is focused on business, management or economics should not normally be submitted in this UOA.

UOA 11: Computer Science and Informatics

12. The UOA includes the study of methods for acquiring, storing, processing, communicating and reasoning about information, and interactivity in natural and artificial systems, through the implementation, organisation and use of computer hardware, software and other resources. The subjects are characterised by the rigorous application of analysis, experimentation and design.

13. The sub-panel expects submissions in this UOA from all areas of computer science and informatics, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research in this area, and expects that submissions may contain outputs that make contributions to computer science, informatics, and other disciplines.

UOA 12: Aeronautical, Mechanical, Chemical and Manufacturing Engineering

14. The UOA includes engineering research in aeronautical, mechanical, chemical and manufacturing engineering. Topics may include, but are not limited to: acoustics; aerodynamics; automotive engineering; avionics; biochemical and biomedical engineering; computational methods; control; dynamics; engineering design; engineering management; environmental and systems engineering; failure analysis; food process engineering; fluid power; fluid mechanics; fluidics; fuel technology and energy engineering; heat transfer; manufacturing technology, processes and systems; physical ergonomics; materials; material processing; maritime engineering; mechanics; mechatronics; naval architecture; product design; product and process engineering; solid mechanics; sustainable engineering; thermodynamics; turbo-machinery and propulsion; and vibration. It also includes pedagogic research in aeronautical, mechanical, chemical and manufacturing engineering.

15. The sub-panel expects submissions in this UOA from all areas of aeronautical, mechanical, chemical and manufacturing engineering, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research in this area, and expects that submissions may contain outputs that make contributions to aeronautical, mechanical, chemical and manufacturing engineering and other disciplines, including those which have boundaries with this UOA, such as UOA 13 (Electrical and Electronic Engineering, Metallurgy and Materials) and UOA 15 (General Engineering).

UOA 13: Electrical and Electronic Engineering, Metallurgy and Materials

16. The UOA includes research carried out in all areas of electrical and electronic engineering, including but not limited to: communications; electronic materials and

devices; microelectromechanical systems (MEMS) and nanoelectronics; bioelectronics; electronic systems and circuits; optoelectronics and optical communications systems; communications and networks; multimedia; video and audio processing and coding; signal and image processing, modelling and estimation; radio frequency (RF) techniques up to terahertz; antennae and radar, measurement, instrumentation, sensors; control, robotics and systems engineering; electrical power systems, machines and drives; power electronics; computer and software engineering. It also includes research into both fundamental and applied aspects of the study of the structure, properties, manufacture, processing and applications (and their interrelationships) of all categories and forms of materials (such as metals, ceramics, polymers, composites, biomaterials, nanomaterials, natural materials and textiles). The UOA also includes pedagogic research into electrical and electronic engineering, metallurgy and materials.

17. The sub-panel expects submissions in this UOA from all areas of electrical and electronic engineering, metallurgy and materials, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research in this area, and expects that submissions may contain outputs that make contributions to electrical and electronic engineering, metallurgy and materials and other disciplines, including those which have boundaries with this UOA, such as UOA 8 (Chemistry), UOA 9 (Physics), UOA 11 (Computer Science and Informatics), UOA 12 (Aeronautical, Mechanical, Chemical and Manufacturing Engineering), UOA 14 (Civil and Construction Engineering), and UOA 15 (General Engineering).

UOA 14: Civil and Construction Engineering

18. The UOA includes research carried out in: construction; design; infrastructure; fluid mechanics; hydraulics and hydrology; computational mechanics and informatics; structures and materials; surveying; transportation; geotechnical and geo-environmental engineering; earthquake engineering; energy; environmental engineering (including air, water, waste and contamination); offshore and coastal engineering; extreme events; impact of and adaptability to climate change; sustainability; building physics; management, safety and risk assessment aspects of the above. It also includes pedagogic research in civil and construction engineering.

19. The sub-panel expects submissions in this UOA from all areas of civil and construction engineering, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research in this area, and expects that submissions may contain outputs that make contributions to civil and construction engineering and other disciplines, including those which have boundaries with this UOA, such as UOA 7 (Earth Systems and Environmental Sciences) and UOA 16 (Architecture, Built Environment and Planning).

UOA 15: General Engineering

20. The UOA includes multidisciplinary and interdisciplinary engineering research in fields such as medical engineering, bioengineering, environmental engineering, offshore technology, renewable energy/energy conversion, spacecraft engineering, control systems engineering and industrial studies. The UOA also includes mineral and mining engineering and pedagogic research in engineering.

21. The sub-panel also welcomes submissions from single organisational units within institutions that include activities spanning two or more of the other three UOAs in the fields of engineering: UOA 12 (Aeronautical, Mechanical, Chemical and Manufacturing Engineering), UOA 13 (Electrical and Electronic Engineering, Metallurgy and Materials), and UOA 14 (Civil and Construction Engineering). However, for submissions of this nature, the sub-panel will cross-refer any outputs that they consider to be more expertly assessed by other sub-panels in the fields of engineering.

22. The sub-panel expects submissions in this UOA from all areas of general engineering, as defined above, and expects that the majority of the research activity submitted will have made a direct contribution to the UOA as characterised in the UOA descriptor. It recognises and welcomes, however, the increasingly interdisciplinary nature of research in this area, and expects that submissions may contain outputs that make contributions to general engineering and other disciplines, including those which have boundaries with this UOA, such as those UOAs within the remit of Main Panel B.

Pedagogic research

23. Pedagogic research may be submitted in Main Panel B UOAs or in UOA 25 (Education), as deemed appropriate by submitting HEIs. Main Panel B will have at least two sub-panel members or assessors who will have expertise in pedagogy. Generally, research on pedagogy and educational issues relating to their particular subject disciplines within higher education (HE) will be assessed either by the sub-panel for the UOA in which it is submitted, or by one of the sub-panel members or assessors with expertise in pedagogy referred to above, who will work across several Main Panel B sub-panels. Research on more general educational issues in HE or on education in other sectors may be submitted in UOA 25 (Education) or may be cross-referred by the receiving sub-panel to Sub-panel 25. The only exception to these arrangements is for Sub-panel 10 (Mathematical Sciences), where all pedagogic research will be cross-referred to Sub-panel 25 (Education).

Cross-boundary submissions and cross-referral

24. The main panel recognises the diverse nature of the disciplines that it covers and that aspects of research in those areas are naturally multidisciplinary or interdisciplinary. The main panel and all of its sub-panels welcome the submission of coherent bodies of multidisciplinary and interdisciplinary research which span the boundaries between the areas of research set out in a UOA descriptor and one or more other UOAs, whether within Main Panel B or other main panel areas.

25. The main and sub-panels' arrangements for assessing multidisciplinary and interdisciplinary work, and work which spans UOA boundaries, are described in paragraphs 96 to 96 under Section 5: Working methods.

26. Sub-panels expect these working methods to allow them to assess the majority of multidisciplinary and interdisciplinary work submitted in their UOAs. However, exceptionally, parts of submissions may be cross-referred to other sub-panels in Main Panel B or to sub-panels outside Main Panel B. Both the submitting HEI and the sub-panel for the UOA in which the submission is made may make a request to cross-refer parts of submissions.

Multiple submissions

27. As set out in 'guidance on submissions' (paragraphs 50 to 52), institutions may exceptionally, and only with prior permission from the REF manager, make more than one submission (multiple submissions) in the same UOA. Institutions may request a multiple submission where a sub-panel considers there is a case for multiple submissions in its UOA, given the nature of the disciplines covered.

28. Sub-panels 7, 8, 9 10, 11, 14 and 15 do not consider that there is a case for multiple submissions in their UOAs, based on the nature of the disciplines covered, and do not expect to receive requests for multiple submission in these UOAs.

29. Sub-panels 12 and 13 consider that there is a case, based on the nature of the disciplines covered by their UOAs, for multiple submissions in these UOAs and would expect to receive requests.

30. Where an institution requests a multiple submission, the REF manager, in consultation with the relevant sub-panel chair, will decide to grant permission **only** where a convincing case is made that:

- a. The bodies of research to be listed in each proposed submission fall within the scope of the UOA but are clearly academically distinct from each other, and
- b. the research environments of each proposed submitted unit are clearly separate and distinct, without significant overlap in their research or staffing strategies, infrastructure, facilities or other aspects to be described in the textual parts of submissions.

31. The normal expectation is that it will be difficult for convincing cases to be made for multiple submissions with a small number of staff, typically less than 10 Category A full-time equivalents (FTEs). Administrative convenience of the submitting institution, or its preference for separate assessment outcomes, will not be factors.

32. In addition to the arrangements above, requests for multiple submissions may be granted if an institution involved in a joint submission wishes to make an additional individual submission in that UOA, or where HEIs have merged after 1 July 2011, as set out in 'guidance on submissions' (sub-paragraphs 50a and 50c).

Section 2: Assessment criteria: outputs

Criteria and level definitions

Interpretation of generic criteria

33. In relation to the assessment of outputs, the criteria of originality, significance and rigour will be interpreted as follows:

- **Originality** will be understood as the extent to which the output introduces a new way of thinking about a subject, or is distinctive or transformative compared with previous work in an academic field.
- **Significance** will be understood as the extent to which the work has exerted, or is likely to exert, a significant influence on an academic field or practical applications.
- **Rigour** will be understood as the extent to which the purpose of the work is clearly articulated, an appropriate methodology for the research area has been adopted, and compelling evidence presented to show that the purpose has been achieved.

34. Where appropriate to the output type, sub-panels may consider editorial and refereeing standards as part of the indication of rigour, but the absence of these standards will not be taken to mean an absence of rigour.

35. Some sub-panels will use citation information, where available, as part of the indication of academic significance to inform their assessment of output quality. Arrangements are discussed at paragraphs 60 to 64.

Interpretation of generic level definitions

36. In the context of the application of quality levels, sub-panels will take a holistic view of the originality, significance and rigour of an output.

a. In assessing work as being **four star** (work that is world leading in terms of originality, significance and rigour), sub-panels will expect to see evidence of, or potential for, some of the following characteristics:

- agenda-setting
- research that is leading or at the forefront of the research area
- great novelty in developing new thinking, new techniques or novel results
- major influence on a research theme or field
- developing new paradigms or new concepts for research
- major changes in policy or practice
- major influence on processes, production and management
- major influence on user engagement.

b. In assessing work as being **three star** (work that is internationally excellent in terms of originality, significance and rigour but which falls short of the highest standards of excellence), sub-panels will expect to see evidence of, or potential for, some of the following characteristics:

- makes important contributions to the field at an international standard
- contributes important knowledge, ideas and techniques which are likely to have a lasting influence, but are not necessarily leading to fundamental new concepts
- significant changes to policies or practices
- significant influence on processes, production and management
- significant influence on user engagement.

c. In assessing work as being **two star** (work that is recognised internationally in terms of originality, significance and rigour), sub-panels will expect to see evidence of, or potential for, some of the following characteristics:

- provides useful knowledge to the field, but lacks the potential for lasting influence
- involves incremental advances, which might include new knowledge which conforms with existing ideas and paradigms, or model calculations using established techniques or approaches
- influence outside the UK
- influence on policy or practice
- influence on processes, production and management
- influence on user engagement.

d. In assessing work as being **one star** (work that is recognised nationally in terms of originality, significance and rigour), sub-panels will expect to see evidence of, or potential for, some of the following characteristics:

- useful but unlikely to have more than a minor influence in the field
- influential at a national level
- minor influence on policy or practice
- minor influence on processes, production and management
- minor influence on user engagement.

e. Research will be graded as 'unclassified' if it falls below the quality levels described above or does not meet the definition of research used for the REF.

Types of research output

37. All forms of research output will be considered equitably in terms of the assessment, with no distinction being made between the types of output submitted, nor whether the output has been made available electronically or in a physical form.

38. The main panel welcomes all forms of output submitted to its sub-panels, including:

- books, book chapters and research monographs
- conference contributions and reports
- new materials, devices, products and processes
- patents
- published papers in peer-reviewed journals
- software, computer code and algorithms
- standards documents
- technical reports, including confidential reports.

39. These are provided as examples of outputs that might be specifically relevant to Main Panel B but should not be regarded as an exhaustive list.

40. In relation to all forms of output, submitting HEIs should be mindful that the purpose of the assessment of research outputs is to assess the quality of original research reported. In particular, sub-panels will accept the submission of review articles only where they contain a significant component of unpublished research or new insight. Such outputs will be judged **only** on original research or new insights reported.

Co-authored outputs

41. All sub-panels expect that an author who has claimed co-authorship of an output will have made a substantial contribution to it, and may request audit information to substantiate this. Neither the order of authorship nor the number of authors will be considered important.

42. With the exception of the arrangements for Sub-panel 9 (Physics), detailed at paragraph 44, sub-panels do not require the submission of textual information about individual co-authors' contributions to co-authored outputs. These sub-panels will not take account of the individual author's contribution to an output in assessing the output, judging each output on its merits independent of authorship arrangements.

43. A co-authored output may not be listed against more than one member of staff returned within the same submission, irrespective of the number of submitted staff in that submission who are co-authors of the output. A co-authored output may be listed in different submissions, either from the same or from different HEIs.

44. **There is an exception in Sub-panel 9 (Physics) for outputs with five or more co-authors.** In physics, large numbers of co-authors may contribute to research outputs, therefore for outputs with five or more co-authors submitted in UOA 9 (Physics), specific information is required about the author's contribution (maximum 100 words) to allow the sub-panel to assess the nature of that contribution to the output. Once the sub-panel has determined that the author's contribution is a significant contribution to the research content of the output, it will assess the quality of the output as a whole, taking no further regard of the individual author's contribution. Outputs for which the panel considers that the author has not made a significant research contribution will be graded as

'unclassified'. HEIs should note that this information is not required for research outputs with fewer than five co-authors; if submitted, the sub-panel will take no account of such statements.

Double-weighted outputs

45. Sub-panels recognise that there may be some very exceptional cases where the intellectual scope of a research output and the scale of the research effort it captures are considerably greater than the disciplinary norm, thereby limiting the capacity of an individual researcher to produce four single outputs within the assessment period. Sub-panels will consider requests for such outputs to be double-weighted in the assessment, in other words for it to count as two outputs in both a submission in a UOA and in the calculation of the outputs quality profile.

46. Without privileging any particular form of research or type of output, the sub-panels anticipate double-weighting work deriving from substantial academic investment. Such investment might be understood in terms of (but is not limited to) the length of research time it took to produce; the ambition of the project; the scale of creative and imaginative thinking.

47. An HEI may request that an output is treated as double-weighted using a supporting statement to justify the claim (maximum 100 words). Considering the patterns of publication across Main Panel B's areas of activity, sub-panels expect that such requests will occur only very exceptionally. Sub-panels will assess the claim for double-weighting separately from assessing the quality of the submitted work.

48. In requesting double-weighting of an individual's output, HEIs should reduce the number of outputs submitted for that individual by one per double-weighting request. As the number of outputs assessed cannot amount to more than four per FTE submitted, no more than two outputs per individual may be submitted for double-weighting.

49. No reserves may be submitted for Main Panel B sub-panels. If a request for double-weighting is not accepted by a sub-panel, then the 'missing' output will be graded as 'unclassified'.

50. Sub-panels will only double-weight outputs identified by the submitting institution, and will not double-weight any output that has not been so identified in the submission.

Additional information on outputs

Clarification of research process and/or content

51. For non-text, or practice-based outputs (including patents, software and standards documents) all sub-panels require the submission of a description of the research process and content, where this is not evident within the output (maximum 300 words).

52. For reviews, sub-panels welcome the identification of the original research or new insights reported, to assist with the assessment of research quality (maximum 300 words).

Additional factual information

53. Additional to paragraphs 51 and 52 above, some sub-panels (detailed at paragraph 56) invite factual information to be provided about the significance of an output that is not evident within the output itself (maximum 100 words). This could include, for example, additional evidence about how an output has gained recognition, led to further developments, or has been applied.

54. HEIs are instructed to ensure that such evidence is succinct, verifiable, and externally referenced where appropriate. Where claims are made relating to the industrial significance of the output, the name and contact details of a senior industrialist must be given to allow verification of claims. Information provided should not comprise a synopsis of the output or a volunteered opinion as to the quality of the output, and information provided that is of this nature will be disregarded. It is expected that in most cases, sufficient information will be provided in significantly fewer words than the 100 word limit.

55. Information provided must not include citation data: any panels that make use of citation data will be provided with the data by the REF team. Sub-panels will take no account of any citation data provided directly by the HEI. Information not relating to the significance of the output, for example co-author contribution (other than as requested in paragraph 44), should not be included, and sub-panels will take no account of any such information submitted.

56. The requirements for provision in REF2 of additional factual evidence about significance of research outputs (maximum 100 words) vary by sub-panel and are as follows:

- a. Sub-panels 7, 8, 9 and 10 do not wish to receive additional information in this category and, if received, will take no account of any statement in this category.
- b. Sub-panels 11, 12, 13, 14 and 15 would welcome inclusion of relevant and verifiable information for all outputs, wherever available.

Outputs with material in common

57. 'Guidance on submissions' (paragraph 113) sets out the general arrangements for the submission of research outputs that include significant material in common with an output published prior to the beginning of the REF publication period, 1 January 2008. Panels will apply the general principle that where such outputs are submitted to the REF, the panels will assess the original content or new insights reported in the output. If the previously published output was submitted to RAE2008, sub-panels will assess **only** the distinct content, including original research or new insights, reported in the output submitted to the REF.

58. In applying this general principle, the panels recognise there may be some forms of outputs that would not be considered by the panels as representing the published version of the work, for example, preliminary findings disseminated to a limited audience, technical reports, or some forms of conference contributions. Where an output submitted

to the REF contains material that was previously shared in such a way, the output will be assessed in full.

59. HEIs should provide details of any outputs published prior to the REF publication period which have material in common with an output submitted to the REF, and, where appropriate, provide information on how far the original work has been revised to incorporate new findings, including identification of the new research or new insights reported, additional to the earlier published output (maximum 300 words).

Citation data

60. Sub-panels 7, 8, 9 and 11 will make use of citation data, where it is available, as part of the indication of academic significance to inform their assessment of output quality.

61. Where available, the REF team will provide citation counts (at a pre-determined date) for research outputs submitted in the UOAs identified in paragraph 60. These sub-panels will also receive discipline-specific contextual information about citation rates for each year of the assessment period to inform, if appropriate, the interpretation of citation data.

62. In addition to the citation data provided by the REF team, Sub-panel 11 only intends to make use of Google Scholar as a further source of citation information.

63. For the sub-panels identified in paragraph 60, citation data will inform the assessment as follows:

- a. Where available, citation data will form part of the process of assessment of academic significance. It will be used as one element to inform peer-review judgements made about academic significance and will not be used as a primary tool in the assessment.
- b. The absence of citation data for an output will not be taken to mean an absence of academic significance.
- c. Sub-panels will be mindful that for some forms of output (for example relating to applied research) and for recent outputs citation data may be an unreliable indicator. Sub-panels will take due regard of the potential equalities implications of using citation data.
- d. Except for reference to Google Scholar by Sub-panel 11 (as set out at paragraph 62), the sub-panels will use only the citation data provided by the REF team and will not refer to any additional sources of bibliometric analysis including journal impact factors.

64. Sub-panels 10, 12, 13, 14 and 15 will not receive nor make use of citation data, or any other form of bibliometric analysis including journal impact factors.

Section 3: Assessment criteria: impact

Range of impacts

65. The main panel welcomes case studies describing impacts that have provided benefits to one or more areas of culture, the economy, the environment¹, health, public policy and services, quality of life, or society, whether locally, regionally, nationally or internationally.

66. A single body of research work may underpin impact which provides benefits in more than one area. An impact case study may therefore describe more than one type of impact arising from such bodies of work; for example, a new drug can generate both health and economic impact, and a new energy technology can generate both environmental and economic impact.

67. An indicative list of potential types of impact is provided in Table 1. These are categorised according to the different domains that sub-panels expect to see in submitted case studies, with an indicative list of examples of impact for each type. In making use of this to assist with the preparation of submissions, HEIs should note that:

a. The list of types and examples of impacts is not intended to be exhaustive, and some examples are relevant to more than one type of impact. Sub-panels wish to encourage HEIs to submit case studies describing any impacts that meet the general definition given in the 'guidance on submissions' (Annex C).

b. HEIs are **not** expected to align submitted case studies specifically with the particular types of impact defined in the list in Table 1.

68. All types of impact will be considered equitably in terms of the assessment of the reach and significance achieved during the assessment period. The sub-panels expect institutions to submit their strongest case studies, regardless of the types of impact that they describe.

69. HEIs are reminded that impacts on research or the advancement of academic knowledge within the higher education sector (whether in the UK or internationally), and impacts on students, teaching or other activities within the submitting HEI, **are excluded**. Other impacts within the higher education sector, including on teaching or students, **are included** where they extend significantly beyond the submitting HEI. For example, the take-up by the HE sector of products arising from research such as open source software would only be eligible as examples of impact, where there is also some evidenced impact within the HE sector that goes beyond academic research or the advancement of knowledge, where it extends significantly beyond the submitting HEI, or where there is evidenced impact on non-academic beneficiaries.

¹ References to 'environment' throughout the document refer to both the natural and built environments, unless otherwise specified.

Table 1 Types of impact

Type of impact	Examples of impact
<p>Economic impacts Impacts where the beneficiaries may include businesses, either new or established, or other types of organisation which undertake activity that may create wealth</p>	<ul style="list-style-type: none"> • The performance of an existing business has been improved, through the introduction of new, or the improvement of existing, products, processes or services; the adoption of new, updated or enhanced technical standards and/or protocols, or the enhancement of strategy, operations or management practices. • A spin-out or new business has been created, established its viability, or generated revenue or profits. • A new business sector or activity has been created. • A business or sector has adopted a new or significantly changed technology or process, including through acquisition and/or joint venture. • Industry (including overseas industry) or other organisations or charitable foundations have invested in their own research and development. • Performance has been improved, or new or changed technologies or processes adopted, in companies or other organisations through highly skilled people having taken up specialist roles that draws on their research, or through the provision of consultancy or training that draws on their research.
<p>Impacts on public policy and services Impacts where the beneficiaries may include government, non-governmental organisations (NGOs), charities and public sector organisations and society, either as a whole or groups of individuals in society</p>	<ul style="list-style-type: none"> • A policy has been implemented (including those realised through changes to legislation) or the delivery of a public service has changed. • (Sections of) the public have benefitted from public service improvements. • In delivering a public service, a new technology or process has been adopted or an existing technology or process improved. • Policy debate has been stimulated or informed by research evidence. • Policy decisions or changes to legislation, regulations or guidelines have been informed by research evidence. • Changes to education or the school curriculum have been informed by research. • Risks to national security have been reduced. • International development has been informed by research.
<p>Impacts on society, culture and creativity</p>	<ul style="list-style-type: none"> • Public debate has been stimulated or informed by research.

Type of impact	Examples of impact
<p>Impacts where the beneficiaries may include individuals, groups of individuals, organisations or communities whose knowledge, behaviours, creative practices and other activity have been influenced</p>	<ul style="list-style-type: none"> • Public interest and engagement in science and engineering has been stimulated, including through the enhancement of science and engineering-related education in schools. • The awareness, attitudes or understanding of (sections of) the public have been informed by engaging them with research of social or cultural significance. • The work of an NGO, charitable or other organisation, including international agencies or institutions, has been influenced by the research. • Research has contributed to community regeneration.
<p>Health impacts Impacts where the beneficiaries may include individuals (including groups of individuals) whose health outcomes have been improved or whose quality of life has been enhanced (or potential harm mitigated) through the application of enhanced healthcare for individuals or public health activities</p>	<ul style="list-style-type: none"> • A new drug, treatment or therapy, diagnostic or medical technology has been developed, trialled with patients, or adopted. • Patient health outcomes have improved through, for example, the availability of new drug, treatment or therapy, diagnostic or medical technology, changes to patient care practices, or changes to clinical or healthcare guidelines. • Public health and quality of life has been enhanced through, for example, enhanced public awareness of a health risk, enhanced disease prevention or, in developing countries, improved water quality or access to healthcare. • Decisions by a health service or regulatory authority have been informed by research. • The costs of treatment or healthcare have reduced. • Quality of life in a developed or developing country has been improved by new products or processes.
<p>Impacts on practitioners and professional services Impacts where beneficiaries may include organisations or individuals involved in the development of and delivery of professional services</p>	<ul style="list-style-type: none"> • Changes to professional standards, guidelines or training have been informed by research. • Practitioners/professionals/lawyers have used research findings in the conduct of their work. • The quality or efficiency or productivity of a professional service has improved. • Professional bodies and learned societies have used research to define best practice. • Practices have changed, or new or improved processes have been adopted, in companies or other organisations, through the provision of training or consultancy. • Forensic methods have been informed by research.
<p>Impacts on the environment Impacts where the key beneficiaries are the natural environment and/or</p>	<ul style="list-style-type: none"> • The environment has been improved through the introduction of new product(s), process(es) or service(s); the improvement of existing product(s), process(es) or

Type of impact	Examples of impact
the built environment, together with societies, individuals or groups of individuals who benefit as a result	<p>services; or the enhancement of strategy, operations or management practices.</p> <ul style="list-style-type: none">• Policy debate on the environment, environmental policy decisions or planning decisions have been stimulated or informed by research and research evidence.• The management or conservation of natural resources, including issues around global competition for energy, water and food resources, has been influenced or changed.• The management of an environmental risk or hazard has changed.• The operations of a business or public service have been changed to achieve environmental (green) objectives.• Direct intervention, based on research evidence, has led to reduction in carbon dioxide or other environmentally damaging emissions.

Confidential impacts

70. All panel members, advisers, observers and others involved in the assessment process are bound by a confidentiality agreement. Therefore, with the agreement of the relevant organisation(s), HEIs may potentially submit an impact case study that contains, for example, commercially sensitive or policy restricted information. However, in some cases there may be main or sub-panel members or assessors who HEIs believe would have a commercial conflict of interest in assessing some case studies. HEIs should name such individuals when making submissions.

Highly confidential or sensitive impacts

71. The panel recognises there may be instances where research has had impacts of a highly confidential nature, for example in relation to defence, national security or highly sensitive policy developments, about which only very limited information could be disclosed to the panel. The panel wishes to establish an appropriate process that would enable the assessment of such impacts, and proposes the following:

- a. The submitting HEI should request advance permission from the REF manager to submit such cases, by providing outline (unclassified) information about the broad nature of the impact and the level of security or other clearance that would be required by assessors or panel members.
- b. Permission to submit such cases would be granted where the REF team is able to identify and/or recruit panel members or assessors with appropriate clearance, and who would also take part in the sub-panel's impact calibration exercises and assess other (non-confidential) case studies.

- c. The HEI could submit such cases, clearly marked as highly confidential, and the full case study would only be seen by those sub-panel members/assessors with the appropriate clearance.
- d. HEIs should allow sufficient time for such case studies to go through the relevant organisation's internal release processes.

72. For impacts with highly sensitive commercial data, it may be necessary, in addition to the panel members' confidentiality arrangements, for a specific one-way non-disclosure agreement (NDA) to be signed by the HEI, the company concerned and the panel members or assessors who are selected to undertake the assessment. Again, in such cases, HEIs should seek prior permission from the REF manager to enable the appropriate NDA to be put in place.

Publication of case studies with confidential or highly confidential data

73. In all of the above cases, HEIs may indicate which parts of the case study should be omitted from the published data, as set out in paragraph 36 of the 'guidance on submissions'.

Impacts arising from public engagement activity

74. Public engagement is an activity that may enhance or extend the impact of research. Sub-panels will welcome case studies that include impact achieved in this way, either as the main impact described or as one facet of a broader range of impacts.

75. Public engagement is a very broad area, not all of which is underpinned by research. Case studies which include impacts that derive from public engagement must:

- a. Be directly connected to specific research or a body of research carried out in the unit, and explain clearly which particular aspects of the research underpinned the engagement activity and contributed to the impact claimed.
- b. Include evidence of the reach of the impact. This should extend beyond simply providing the numbers of people engaged and may also, for example, include:
 - information about the types of audience
 - whether there was secondary reach, for example from follow-up or media coverage
 - other quantitative indicators such as evidence of sales, downloads of linked resources, and/or access to web content.
- c. Include evidence of the significance of the impact. This should include a description of the social, cultural or other significance of the research insights with which the public have engaged. Examples of the evidence that might be provided for this include:
 - evaluation data

- user feedback or testimony
- critical external reviews of the engagement activity
- evidence of third party involvement, for example how collaborators have modified their practices, contributions (cash or in-kind) by third parties to enhance services or support for the public, or evidence of funds from third parties to enhance or extend the engagement activity
- evidence of sustainability, through, for example, a sustained or ongoing engagement with a group, a significant increase in participation in events or programmes, continuing sales, downloads, or use of resources.

Case studies: evidence

Evidence of impact

76. Each case study must provide a clear and coherent narrative that includes an account of who or what constituency, group, sector, organisation and so on, has benefitted, been influenced, or acted upon. Evidence appropriate to the type(s) of impact described should be provided to support the claims made of the nature and extent of the impact, in terms of its reach and significance.

77. Evidence may take many different forms depending on type of impact(s) reported. Wherever possible, quantitative indicators should be included. Sources that could verify key evidence and indicators provided in the case study should be included in section 5 of the impact case study template.

78. The list of examples of types of evidence and indicators in Table 2 provides a guide to potential evidence or indicators that may be most relevant to each of the types of impact described in Table 1. However, HEIs should note that:

- a. This is not intended to be exhaustive.
- b. Some indicators may be relevant to more than one type of impact.
- c. Sub-panels will consider any appropriate evidence that is verifiable.
- d. Sub-panels recognise the varying degrees to which evidence and indicator information may be available to HEIs.

Table 2 Types of evidence and indicators of impact

Type of impact	Examples of evidence or indicators
Economic impacts	<ul style="list-style-type: none">• Business performance measures, for example, sales, turnover, profits or employment associated with new or improved products, processes or services.• Licences awarded and brought to market.• Jobs created or protected.• Investment funding raised from UK and/or non UK agencies (venture capital/Business Angel, and so on) for start-up

Type of impact	Examples of evidence or indicators
	<p>businesses and new activities of existing businesses.</p> <ul style="list-style-type: none"> • Evidence of critical impact on particular projects, products and processes confirmed by independent authoritative evidence, which should be financial where possible. • Priority shifts in expenditure profiles or quantifiable reallocation of corporate, non-profit or public budgets.
Impacts on public policy and services	<ul style="list-style-type: none"> • Documented evidence of policy debate (for example, in Parliament, the media, material produced by NGOs). • Documented evidence of changes to public policy/legislation/regulations/guidelines. • Measures of improved public services, including, where appropriate, quantitative information; such information may relate for example to the quality, accessibility or cost-effectiveness of public services. • Documented evidence of changes to international development policies. • Measures of improved international welfare or inclusion.
Impacts on society, culture and creativity	<ul style="list-style-type: none"> • Visitor or audience numbers or feedback. • Critical reviews in the media. • Evidence of public debate in the media. • Evidence of sustained and ongoing engagement with a group. • Measures of increased attainment and/or measures of improved engagement with science in non-HE education.
Health impacts	<ul style="list-style-type: none"> • Evidence from clinical trials. • Measures of improved patient outcomes, public health or health services. • Documented changes to clinical guidelines. • Evidence of take-up and use of new or improved products and processes that improve quality of life in developing countries.
Impacts on practitioners and professional services	<ul style="list-style-type: none"> • Traceable reference to inclusion of research in national or international industry standards or authoritative guidance. • Traceable references by practitioners to research papers that describe their use and the impact of the research. • New or modified professional standards and codes of practice. • New or modified technical standards or protocols. • Documented changes in knowledge, capability or behaviours of individuals benefiting from training.

Type of impact	Examples of evidence or indicators
Impacts on the environment	<ul style="list-style-type: none"> • Sales of new products or improvements in existing products that bring quantifiable environmental benefits. • Traceable impacts on particular projects or processes which bring environmental benefits. • Evidence of generic environmental impact across a sector, confirmed by independent authoritative evidence. • Documented case-specific improvements to environment-related issues. • Traceable reference to inclusion of research into government policy papers, legislation and industry guidance. • Traceable reference to impact of research in planning decision outcomes. • Policy documentation.

Underpinning research

79. As described in the impact case study template ('guidance on submissions', Annex G) HEIs should provide in section 3 up to six key references to research that underpins the impact described in the case study. These may include any type of output that is the product of research. HEIs should identify up to three of these references that best indicate the quality of the underpinning research. The sub-panels will use this information to determine whether the quality threshold, defined as research that is predominantly at least equivalent to two star, has been met.

Impact template

80. 'Guidance on submissions' (paragraphs 149 to 155) sets out the structure of the generic impact template that seeks information on each of the four headings a to d. The information under headings a and d is intended to provide contextual information for the sub-panels in assessing the case studies, and will not be assessed in forming the impact sub-profiles.

81. The sub-panels will welcome the following information in each section. Where possible, relevant illustrative examples with traceable references should be given, rather than broad general statements.

a. **Context:**

- Describe the main non-academic user groups, beneficiaries or audiences for the unit's research.
- Describe the main types of impact specifically relevant to the unit's research, and how these relate to the range of research activity or research groups in the unit.

b. **Approach to impact:** Describe the unit's approach to its interaction with non-academic users, beneficiaries or audiences and to achieving impacts from its research, during the period 2008 to 2013. This could include details of, for example:

- How staff in the unit interacted with, engaged with or developed relationships with key users, beneficiaries or audiences to develop impact from the research carried out in the unit².
- Evidence of the nature of those relationships and interactions. This may include, for example, participation in schemes such as Research Council knowledge exchange schemes and industrial doctoral training centres, and interactions through training provided or consultancy undertaken, where these have led to beneficial relationships.
- Evidence of follow-through from these activities to identify resulting impacts.
- Evidence of an agile approach to opportunities.
- How the unit specifically supported and enabled staff to achieve impact from their research.
- How the unit made use of institutional facilities, expertise or resources in undertaking these activities.
- Other mechanisms deployed by the unit to support and enable impact.

c. **Current and future strategy and plans:** Describe how the unit is developing its strategy for achieving impact, including its goals for supporting and enabling impact from its research in the future.

d. **Relationship to the case studies:** The sub-panels do not expect that submitted case studies will necessarily have arisen out of the approaches to achieving impacts described above for the period 2008 to 2013. However, where this is relevant, they would welcome details of, for example, how particular case studies exemplify aspects of the approach, or how particular case studies informed the development of the unit's approach.

Impact criteria and sub-profiles

82. In relation to the assessment of impact in both the case studies and the impact template, the criteria of **reach** and **significance** will be interpreted as follows:

- **Reach** is the extent and breadth of the beneficiaries of the impact.
- **Significance** is the degree to which the impact has enabled, enriched, influenced, informed or changed the products, services, performance, practices, policies or understanding of commerce, industry or other organisations, governments, communities or individuals.

² Note that within the environment template, submissions should explain research collaborations with users, and how their relationships/interactions inform the development of the unit's research activity/strategy.

83. In applying the criteria, the panels will use the level definitions in 'guidance on submissions' (Annex A, Table A3).

84. HEIs may submit case studies describing impacts at any stage of development or maturity. However, the assessment will be solely on the impact achieved during the assessment period, regardless of its stage of maturity. No account will be taken of anticipated or future potential impact, and therefore early stage or interim impacts might not score as highly as more mature impacts.

85. Each impact case study within a submission will be assessed, and each will carry equal weight within the impact sub-profile for the submission. The impact case studies will collectively contribute 80 per cent to the impact sub-profile for the submission.

86. The impact template will be assessed holistically, according to the extent to which the unit's approach described in sections b and d of the template is conducive to achieving impacts of reach and significance. The impact template will contribute 20 per cent to the impact sub-profile for the submission. Sections a and d of the template will provide context for the sub-panel in assessing this element of the submission and will not be assessed.

Section 4: Assessment criteria: environment

Environment template

87. 'Guidance on submissions' (paragraph 183) sets out the structure of the environment template (REF5).

88. Sub-panels would welcome the following information in sections a to e of REF5:

- a. **Overview:** This will provide context for the sub-panel in assessing the submission, and will not be assessed.
 - Submitting units should describe how research is structured across the unit, including, where appropriate, what research groups or sub-units are covered by the submission. Given that there is no expectation that the environment element of submissions will relate to a single coherent organisational unit, groups may be organisational units such as departments or schools and/or research groups.
 - HEIs presenting staff in research groups should allocate staff to research groups in the staff details form (REF1a) of the submission. HEIs should note that staff may be allocated to more than one research group.
- b. **Research strategy:** Submitting units are invited to provide evidence of the achievement of strategic aims for research during the assessment period, as well as details of future strategic aims and goals for research; how these relate to the structure described above; and how they will be taken forward. This should include (but is not limited to):

- vision, including strategic plans
 - an evaluation of the submitting unit's current position with reference to the research position described in RAE 2008.
- c. **People:**
- i. **Staffing strategy and staff development:** Submitting units are invited to describe staffing strategy and staff development within the unit, including but not limited to:
- evidence of the how the staffing strategy relates to the unit's research strategy and physical infrastructure
 - evidence about career development support at **all** stages in research careers, including for research assistants, early career researchers and established academic staff
 - evidence about the implementation of the Concordat to Support the Career Development of Researchers
 - information on staff with personal research fellowships won in an open competition such as Royal Society University Research Fellowships
 - information on international staff appointments (incoming and outgoing), international recruitment and visiting scholars
 - evidence of how the submitting unit supports equalities and diversity.
- ii. **Research students:** Submitting units are invited to provide evidence of the quality of training and supervision of postgraduate research (PGR) students, including but not limited to:
- information on PGR recruitment such as approaches to recruitment, and any discipline-specific issues
 - information on training and support mechanisms
 - information on progress monitoring.
- d. **Income, infrastructure and facilities:** Submitting units are invited to provide evidence including (but not limited to):
- information on provision and operation of specialist infrastructure and facilities
 - evidence of investments (both current and planned) in infrastructure and facilities
 - information on the research funding portfolio, including future plans
 - information on consultancies and professional services.

e. **Collaboration and contribution to the discipline or research base:**

Submitting units are invited to provide evidence and information relating to contributions to the wider research base, including work with other researchers outside the submitted unit, whether locally, nationally or internationally, and indicators of wider influence or contributions to the discipline or research base. This may include (but is not limited to):

- information on support for and exemplars of research collaborations, including national or international research collaborations, with academic, industry and other bodies
- information on support for and exemplars of interdisciplinary research
- information on how research collaborations with research users, including industry users, have informed research activities and strategy
- exemplars of leadership in the academic community such as national or international advisory board membership; leadership roles in industry, commerce, Research Councils, learned societies or professional bodies; conference programme chairs; invited keynote lectures; election to membership or fellowship of learned societies; journal editorships; and fellowships, awards and prizes.

89. Requirements for additional quantitative data to be included in REF5 are described below (paragraphs 90 and 91).

Environment data

90. 'Guidance on submissions' (Part 3 Section 4) sets out standard quantitative data relating to the research environment to be included in submissions (REF4a/b/c). Sub-panels do not require quantitative data provided by HEIs in REF4a/b/c to be reported by research group.

91. Some sub-panels have identified additional quantitative indicators that are particularly relevant to the assessment of the vitality and sustainability of the research environment in their disciplines. These sub-panels request the following additional data items to be provided as part of the narrative submitted within the environment template (REF5), under the following section headings:

c. People:

i. Staffing strategy and staff development

- For **Sub-panels 7, 8, 9 and 11 only**, the FTE number of research assistants in the submitting unit (defined as research assistants in paragraph 80 of 'guidance on submissions', excluding individuals returned as Category A or registered as postgraduate research students) on 31 October 2013. This should be a single number. There is no requirement to distinguish between postgraduate and postdoctoral research assistants.

ii. Research students

- For **Sub-panels 8 and 11 only**, the FTE number of registered postgraduate research students in the submitting unit (using the HESA definition) on 31 July of each year during the assessment period 1 January 2008 – 31 July 2013.

d. Income, infrastructure and facilities:

- For **Sub-panel 9 only**, the FTE number of research technicians, scientific officers, and experimental officers in the submitting unit on 31 October 2013. This should be a single number.
- For **Sub-panel 9 only**, data on usage of major national and international facilities not supported by the Research Councils, which was awarded to a Principal Investigator in the submitted unit after competitive review by a panel of internationally recognised experts. The information should be provided in terms of the time awarded together with the total cost, if the latter is available.

Environment criteria and sub-profiles

92. In relation to the assessment of environment, the criteria of sustainability and vitality will be interpreted as follows:

- **Vitality** will be understood as consideration of the extent to which a unit provides an encouraging environment for research, has an effective strategy, is engaged with the national and international research and user communities, and is able to attract excellent postgraduate and postdoctoral researchers.
- **Sustainability** will be understood as consideration of leadership, vision for the future and investment in people and infrastructure and, where appropriate for the subject area, the extent to which activity is supported by a portfolio of research funding.

93. In applying both criteria, the panels will use the level definitions in 'guidance on submissions' (Annex A, Table A4) and will interpret 'environment' as relating to both the research environment within the submitting unit and its participation in, and contribution to, its subject discipline and academic community.

94. In considering each section of the environment template, sub-panels will take account of data reported in the template, as well as relevant parts of the standard data analyses. Sub-panels will attach the following weighting to the assessment of the components within the environment template in forming the environment sub-profile:

a. Overview	For information only
b. Strategy	20%
c. People	30%

d. Income, infrastructure and facilities	30%
e. Collaboration and contribution to the discipline	20%

Section 5: Working methods

Main panel working methods

95. The main panel will have oversight of sub-panel procedures through a variety of mechanisms described in the following paragraphs. The main panel has also agreed a common approach across its sub-panels to its working methods.

Arrangements for interdisciplinary research and cross-referrals

96. As stated in paragraph 24, the main panel recognises the diverse nature of the disciplines that it covers and that aspects of research in those areas are naturally multidisciplinary or interdisciplinary. The standards of excellence defined by the quality levels will be applied equally to research in new interdisciplinary areas and in established disciplines.

97. Across all UOAs, membership of the sub-panels includes individuals with experience of multidisciplinary and interdisciplinary work and of work which spans UOA boundaries. Sub-panels are confident that they can assess such work and that their memberships have broad-ranging experience to enable this. In addition, the following specific arrangements support the assessment of interdisciplinary and multidisciplinary work and work at UOA boundaries:

- a. Where required, additional assessors will be used to extend the breadth and depth of expertise on sub-panels. Assessors may be appointed to work with an individual sub-panel or with a group of sub-panels.
- b. Main panel international and user members have a range of multidisciplinary and interdisciplinary expertise and, where their expertise is relevant and additional to that on a sub-panel, they will provide assessment advice, across a number of sub-panels if appropriate.

98. The main panel will oversee the process for making cross-referral requests, with main and sub-panel chairs advising the REF manager who will decide on the requests. Where parts of submissions are cross-referred, advice will be sought and given on the basis of the assessment criteria for the UOA in which the work was originally submitted. The original sub-panel will specify the scope of advice that it is seeking, and will retain responsibility for recommending the quality profile.

99. In general, sub-panels will use cross-referral, particularly in relation to research outputs, only where, in the sub-panel's opinion, the sub-panel and its appointed assessors do not have the specific expertise to make the assessment.

Appointment of assessors

100. Upon receipt of institutions' submission intentions in early 2013, each sub-panel will seek to identify across all submissions:

- a. Potential interdisciplinary research that cannot be assessed within the sub-panel's existing expertise.
- b. Disciplinary areas where there may be gaps in the sub-panel's expertise or where the volume of outputs and/or impact case studies expected is such that it may lead to potential workload issues.

101. The sub-panel may then make a case to the main panel for the appointment of assessors, either for outputs or impact case studies or both. In judging all such requests the main panel will consider whether a demonstrable case has been made that the work could not be robustly assessed within the sub-panel without assessors, that the volume is too large or the subject matter inappropriate for cross-referral.

102. Assessors will participate fully in the assessment process, will receive appropriate briefings (including undertaking calibration exercises), will attend meetings as required, and will contribute to the development of the relevant assessment sub-profiles.

Adherence to the assessment criteria

103. The main panel will work with its sub-panels to ensure their adherence to the assessment criteria through the following mechanisms:

- a. The main panel chair will ask sub-panel chairs to provide progress reports. In order to ensure adherence to the equality and diversity measures set out in 'guidance on submissions', the reports will include a summary of the outcomes of the decisions made on clearly defined individual circumstances in order to monitor consistency of treatment across all the sub-panels.
- b. The main panel chair and other main panel members will attend some sub-panel meetings.

Consistent application of assessment standards across sub-panels

104. Each sub-panel will be expected to assign separate sub-profiles for research outputs, impact and the research environment. To ensure the standards for each element of the assessment are applied consistently across the sub-panels, the main panel will carry out the following calibration exercises:

- a. In December 2013 it will consider a sample of outputs across the range of the subject areas of the sub-panels and across a range of output types.
- b. Early in the assessment period, and before the commencement of the sub-panels assessment of impact:
 - consider a sample of submitted impact case studies, across the sub-panels and across a range of types of impact

- consider a sample of impact templates across the sub-panels.

105. Both the user and international members of the main panel will fully contribute to these exercises. This exercise will subsequently be used to inform sub-panel calibration exercises of outputs and impact.

106. The sub-panels will adopt a common sequence for the assessment of each of the elements, outputs, impact and environment, and will generate interim profiles that will be reviewed by the main panel for consistency, again making full use of the international members' knowledge of the international standards within the disciplines. The main panel will require that any substantial variations in the emerging quality profiles from each unit of assessment are investigated and understood before finally approving the quality profiles recommended by its sub-panels.

107. The sub-panels of Main Panel B will have common working methods that are in themselves designed to promote consistency.

Sub-panel working methods

Sub-panels' assessment expertise

108. Each sub-panel will ensure that submissions are assessed using appropriate expertise through the following approaches:

- a. It will examine submission intentions and the appointment of assessors, if required, early in 2013 for the assessment of outputs and/or impact case studies as outlined in paragraphs 100 to 102.
- b. It will examine the actual submissions early in the assessment phase in 2014 in order to confirm that the sub-panel and its appointed assessors have the expertise to assess the work submitted, or whether a case needs to be made to the main panel for the appointment of one or more further additional assessors or for the cross-referral of one or more outputs or impact case studies.
- c. The sub-panel chair, consulting with sub-panel members as appropriate, will subsequently allocate outputs and impact case studies to sub-panel members and appointed assessors appropriate to their expertise.

'User' members and assessors involvement in the assessment

109. Some panel members and assessors will be users of research. User members and user assessors will contribute fully to the assessment of impact. All members and assessors involved in assessing impact will take part in sub-panel calibration exercises of the assessment of the impact element of submissions, including both case studies and the impact template.

110. The sub-panel chair, consulting with sub-panel members as appropriate, will subsequently allocate the assessment of each impact case study to a balanced mix of academic and user members or assessors with appropriate expertise.

111. User assessors will play a full part in the impact assessment, will attend meetings of the sub-panel to discuss impact assessments, and will be fully involved in the development of the impact sub-profile for the submissions they have assessed.

112. The sub-panel chair may allocate the assessment of environment and/or outputs to user members in particular areas where their expertise may be appropriate. User members who assess outputs or environment will take part in the relevant sub-panel calibration exercises.

Consistency of assessment within the sub-panel

113. To ensure internal consistency of assessment, each sub-panel will adopt the approaches set out in paragraphs 114 to 116 below.

114. Calibration exercises, to ensure a common understanding of the quality levels:

- a. Following the main panel outputs calibration exercise, consideration of a sample of outputs across the range of submissions and across a range of output types.
- b. Early in the assessment period, following the main panel calibration exercise and before the commencement of the sub-panels' assessment of impact and environment:
 - consideration of a sample of submitted impact case studies, across a range of submissions and across a range of types of impact
 - consideration of a sample of impact templates across a range of submissions
 - consideration of a sample of environment statements across a range of submissions.

115. Common working practices, specifically that:

- a. Each output will be assessed by at least two people (members and/or assessors).
- b. The body of outputs in each submission will be assessed by a diversity of sub-panel members/assessors appropriate to the size of the submission.
- c. Each impact case study will be assessed by a sub-set of sub-panel members/assessors, always including both an academic and a user member.
- d. Each environment submission will be assessed by a group of the sub-panel members.
- e. Each impact template will be assessed by a group of sub-panel members/assessors.

116. During the assessment each sub-panel will use statistical methods as a check for the possibility of individual bias in scoring and re-calibrate when appropriate.

Ensuring submissions are examined in sufficient detail

117. Each sub-panel will examine each of the outputs submitted in sufficient detail to enable the development of a robust quality profile. In doing so panels will take into account additional information where provided, as described in paragraphs 51 to 56, but will not rely solely on the additional information in forming judgements about the quality of outputs.