Research Assessment Exercise 2020
Panel 4 – Electrical & Electronic Engineering
Panel-specific Guidelines on
Assessment Criteria and Working Methods
(September 2018)

Content:

Introduction

1. This document sets out the assessment criteria and working methods that the Electrical & Electronic Engineering Panel of the Research Assessment Exercise (RAE) 2020 will apply. It should be read alongside the General Panel Guidelines of the exercise. The provisions set out in this document serve as further elaboration and amplification on the assessment criteria and working methods as applied to the Electrical & Electronic Engineering Panel. In areas where no additional information has been specified, the provisions in the General Panel Guidelines will prevail and apply in the assessment process of the Panel. These guidelines do not replace or supersede the requirements for submissions that are set out in the Guidance Notes for the RAE 2020.

2. This document describes the criteria and methods for assessing submissions in the Electrical & Electronic Engineering Panel. It provides guidance on the type of information required in the submissions. It also provides a single, consistent set of criteria that will be applied by the Panel and sub-group(s)/sub-panel(s), if any, when undertaking the assessment having regard to any differences in the nature of discipline of respective unit of assessment (UoA) under purview. It also provides a common approach to the working methods applied within the Panel.

Section A: Submissions

UoA under the Panel

3. The Electrical & Electronic Engineering Panel will assess universities' submissions from UoA 12 electrical & electronic engineering.

4. The Panel expects to receive submissions whose primary research focus falls within the remit of the above UoA. The UoA under the Panel's remit covers the full spectrum of the basic and applied research related to Electrical & Electronic Engineering.

Inter-disciplinary Research

5. The Panel also recognises that individual UoAs do not have firm or rigidly definable boundaries, and that certain aspects of research are naturally inter-disciplinary or span the boundaries between individual UoAs, whether within the Panel or across panels. The Panel will adopt the arrangements for assessing inter-disciplinary submissions as set out in paragraphs 39-40 of the General Panel Guidelines.

6. Areas of inter-disciplinary research that are relevant to the Panel include, but are not restricted to, computer engineering, bio-medical engineering, bio-mechanical engineering and materials research.

Assignment of Eligible Academic Staff in Each UoA

7. Pursuant to paragraphs 7-11 of the General Panel Guidelines, the Electrical & Electronic Engineering Panel expects to receive information on the sub-discipline to which each research output belongs.

List of Sub-disciplines

Research Areas	Sub-disciplines
12a electrical engineering	12a-01 electrical power systems
	12a-02 electrical machines, power electronics, and drives
	12a-03 other

Research Areas	Sub-disciplines
12b electronic engineering	12b-01 communications
	12b-02 signal processing
	12b-03 control
	12b-04 microelectronics
	12b-05 computer engineering
	12b-06 sensors
	12b-07 other

8. It is critical that research outputs are assessed by the most appropriate panel. If a panel suspects any anomaly regarding universities' assignment of eligible academic staff (and therefore their outputs) to research area(s) and UoA(s) under its remit, it will follow the procedures for re-assignment of the eligible staff according to paragraphs 10-11 of the General Panel Guidelines. The Panel also recognises its responsibility to handle submissions arising from any re-assignment of eligible academic staff to the Panel.

University's Research Strategy Statement

9. Following paragraphs 2.16-2.18 and Appendix B of the Guidance Notes and paragraph 15 of the General Panel Guidelines, the Research Strategy Statement submitted by each university will provide contextual information for the Panel when assessing the submissions. These Statements will not be assessed, but may help the Panel to understand better the material that is presented in each submission, particularly insofar as UoAs refer to the overall position of their university. The Statements will also help the University Grants Committee (UGC) when viewing the quality profiles of the universities as a whole upon completion of the RAE 2020.

10. *(Template paragraph deleted)*

Section B: Assessment Criteria: Research Outputs

Output Types

11. The Electrical & Electronic Engineering Panel will consider the eligibility of research outputs as described in paragraphs 16-18 of the General Panel Guidelines, paragraphs 5.7-5.11 and Appendix F of the Guidance Notes.

12. The Panel will assess the quality of each eligible output on its own merits and not in terms of its publication category, medium or language of publication. The Panel will examine each item in detail and will not assess outputs mechanistically according to the publication venue. The Panel recognises that there can be work of the highest quality in various output forms, and no distinction will be made between types of output submitted nor whether the output has been made available electronically or in a physical form.

13. Forms of research outputs that are admissible and specifically relevant to the Electrical & Electronic Engineering Panel include the following –

- published papers in peer-reviewed journals.
- peer-reviewed published conference papers.

Other forms of research output are also admissible, but will be regarded as non-traditional research outputs, for which additional information must be provided, in accordance with paragraph 35 of the General Panel Guidelines. This should not be regarded as an exhaustive list. Equally, there is no implication of priority or importance in the ordering of examples in this list –

- books, book chapters and research monographs.
- new materials, devices, products and processes.
- awarded patents.
- review articles.
- software, computer code and algorithms.
- standards documents.
- technical reports.

Please note the requirements for an abstract that includes a clear indication of what new insights or innovation are presented in outputs, as at paragraph 18 of the General Panel Guidelines.

14. Research outputs will be assessed for the quality of original research they include. Accordingly, the Panel will expect submitted review articles to contain a significant component of unpublished research or new insight. Such outputs will be judged only on the extent of their original research or novelty of insight. That said, the Panel recognises that

the process of peer review entails careful refereeing of papers submitted to academic publishing outlets.

15. *(Template paragraph deleted)*

Double-weighting of Research Outputs

16. Paragraphs 29-31 of the General Panel Guidelines indicate that in exceptional cases a submitting university may request that outputs of extended scale and scope be double-weighted in the assessment. However, given the publication patterns in Electrical & Electronic Engineering, this Panel does not expect to receive any items proposed for double-weighting.

17. *(Template paragraph deleted)*

Co-authored/Co-produced Outputs

18. The Panel affirms the principles and arrangements on assessing co-authored/co-produced research outputs as set out in paragraphs 32-34 of the General Panel Guidelines.

19. The Panel will consider co-authorship to be a normal element of research activity in Electrical & Electronic Engineering and will expect all named co-authors to have made a significant contribution to the research process leading to the output concerned. In judging the quality of an output, the Panel will not give any weighting to the position of the co-author in the authorship list.

Non-traditional Outputs

20. The Panel will handle research outputs in non-traditional form according to paragraphs 35-37 of the General Panel Guidelines. The Panel expects to receive additional information about each non-traditional output in terms of its novelty, method used to ensure academic rigour in the production of the output, deliverables, and dissemination method.

Criteria and Quality Levels for Assessing Research Outputs

21. Panel members will use their professional judgement with reference to international standards in assessing research outputs.

22. In assessing outputs, the Panel will look for evidence of originality, significance and rigour, and will grade each output into one of the five

categories of quality level as set out in paragraph 19 of the General Panel Guidelines. The generic description of the quality levels as set out in paragraph 20 of the General Panel Guidelines will be applied in the Panel's assessment.

23. The Electrical & Electronic Engineering Panel provides the following amplifications on the criteria of assessing research outputs –

- originality: will be understood as the extent to which the output introduces a new way of thinking about a subject.
- significance: will be understood as the extent to which the output has exerted, or has the potential to exert, an influence on the academic field.
- rigour: will be understood in terms of the intellectual precision, robustness and appropriateness of the concepts and methodologies deployed within the output.

24. In addition, the Panel provides the following advice on their understanding of the quality definitions adopted for assessing research outputs –

The Panel will take into consideration the following characteristics in particular –

- scientific rigour and excellence with regard to the design, research method, execution and analysis of the work.
- whether or not the output has been subject to peer-review.
- significant addition to knowledge and to the conceptual framework of the field.
- potential and actual significance of the research, both within and beyond the field concerned.
- the scale, challenge and intellectual difficulty posed by the research.
- the logical coherence of argument.
- contribution to theory-building.
- significance of the work to advance knowledge, skills, understanding and scholarship in theory, practice, education, management and/or policy.

Metrics/Citation Data

25. Pursuant to paragraph 24 of the General Panel Guidelines, the Panel acknowledges that metrics and citation data may serve as advisory or secondary information, and that they should not be used in any algorithmic or deterministic way for the evaluation of research quality.

26. The Electrical & Electronic Engineering Panel will not refer to metrics or citation data in Panel meetings when reaching its final judgement on the quality of submitted research outputs. The Panel is aware of the limitations of citation data, in particular their variability within as well as between disciplines, and the need to consider that some excellent work takes time to demonstrate its full achievements. However, individual panel members may informally use metrics or citation data when forming their individual view of each output they score.

Additional Information on Research Outputs

27. Other than the information required on research outputs as specified in the Guidance Notes, and unless specifically required by the Panel during the assessment process, no other information should be provided, and the Panel will take no account of any such information if submitted.

Section C: Assessment Criteria: Research Impact

Range of Impacts

28. The Electrical & Electronic Engineering Panel will accept submissions on research impacts that meet the generic definition and criteria as set out in paragraphs 47-48 of the General Panel Guidelines.

29. The Panel will assess the quality of all eligible impact submissions based on their merits on equal footing with no consideration given to the differences among submitting universities/units in terms of staff size, resources and histories. The Panel recognises that impacts within its remit can be manifested in various ways and may occur in a wide range of spheres whether locally, regionally or internationally.

30. Examples are provided to illustrate the range of potential impacts from research across the Electrical & Electronic Engineering Panel in Table A. These examples are indicative only, and are not exhaustive or

exclusive. Equally, there is no implication of priority or importance in the ordering of examples in the list.

31. Universities are expected to submit their strongest impact cases and not to align submitted cases specifically with the particular types of impact listed in Table A, as an impact case may describe more than one type of impact.

Table A: Examples of Impact may include the following but not exhaustive

Impacts on the economy	• Gains in productivity have been realised as a result of research-led practices. • A spin-out or new business has been created, established its viability, or generated revenue or profits. • Contributing to economic prosperity, innovation and entrepreneurial activities. • The introduction of new products or processes.
Impacts on the environment	• The management of an environment risk or hazard has changed. • The management or conservation of natural resources (e.g. water) has been influenced or changed. • Changes in practices or policies affecting biodiversity.
Impacts on health	• A new device, diagnostic or medical technology has been adopted. • Decisions by health service or regulatory authority have been informed by research. • Development or adoption of new indicators of health or well-being.

Impacts on public policy and services	• Policy decisions or changes to legislation, regulations or guidelines have been informed by research. • Policy or public debate has been stimulated or informed by research evidence. • Influencing the work of public or non-governmental organisations.

(Note: Other examples of research impact as assessed in other jurisdictions may be accessible online such as <http://results.ref.ac.uk/Results/SelectUoa> from the United Kingdom.)

Impact Overview Statement

32. Following paragraphs 7.7 (a) and (b), 7.8 and Appendix G of the Guidance Notes and also paragraph 49 of the General Panel Guidelines, submitting units are required to describe how they have sought to enable and/or facilitate achievement of impact arising from their research during the assessment period, and how they are developing and adapting their plans to ensure that they continue to do so. This is distinct from the environment overview statement, which should describe how the units support the conduct and production of research.

33. The impact overview statement should include relevant illustrative explanations with examples and traceable references where possible, rather than broad, general statements. The Panel expects the impact overview statement to include –

- context
- approach to impact
- strategy and plans for supporting impact
- relationship to the case studies

Impact Case Study(ies)

34. Following paragraphs 7.7 (c) and (d), 7.9-7.10 and Appendix H of the Guidance Notes and also paragraph 51 of the General Panel Guidelines, submitting units are required to provide a narrative account in each case study that should be coherent, clearly explaining the relationship between the research and impact(s), and the nature of the changes or benefits arising.

35. Each impact case study should include appropriate evidence and indicators that support the claims for the impact achieved, including who and what has/have benefitted. Individual case studies may draw on various evidence and indicators, which may take different forms depending on the type of impact.

36. Examples are provided in Table B to illustrate potential evidence or indicators that may be mostly relevant to the Electrical & Electronic Engineering Panel. These examples are not intended to be exhaustive. Equally, there is no implication of priority or importance in the ordering of examples in the list.

Table B: Examples of Evidence or Indicators for Impact

Quantitative indicators	• Quantitative data relating to cost-effectiveness. • Performance measures (e.g. sales, turnover, profits associated). • Audience or attendance figures.
Documentary evidence	• Documented changes to public policy / legislation / regulations / guidelines. • New professional codes and standards. • Licences awarded and brought to market.
Engagements	• Commercial adoption of new technology, process, knowledge or concept. • Application or incorporation in professional best practice, training and continuing development materials. • Evidence of policy or public debate.
Independent testimony	• Formal acknowledgements of and/or evaluations by relevant beneficiaries, bodies and organisations.
Reviews and citations	• Citations and reviews outside the academic literature, e.g. in policy, regulatory, practice documents. • Citations in media.

(Note: Other examples of evidence or indicators for research impact in other jurisdictions may be accessible online such as <http://results.ref.ac.uk/Results/SelectUoa> from the United Kingdom.)

37. The Panel provides the following advice on particular aspects of impact case studies –

- Impact case studies should be interpreted as illustrating the impact that has arisen from a well-defined piece of research. In some circumstances a particular piece of research has had impact in several distinct areas, for example with different companies or products. Submitting units are encouraged to illustrate the breadth of the impact by including more than one example.

Underpinning Research

38. The Panel acknowledges the level of quality required for research underpinning impact cases, i.e. equivalent to at least 2 star (2*) or international standing, as stipulated in the General Panel Guidelines. Where necessary, the Panel will review the outputs concerned in order to ensure the quality of the research is of at least 2 star (2*).

39. Provided that the Panel is satisfied that the 2 star (2*) quality threshold has been met, the quality of the underpinning research will not be taken into account in the assessment of the quality of impact. Underpinning research referenced in a case study may also be submitted for assessment under the research output element. The evaluation of the outputs concerned under the impact element is a separate assessment only for assuring the threshold of underpinning research. In this case, the guidance on output types and criteria for assessing research outputs as stipulated in paragraphs 11-15, 21-24 above would apply.

Criteria and Quality Levels for Assessing Research Impact

40. Panels will exercise their expert judgement in assessing the quality of each impact submission, and will not judge in terms of the type of research underpinning the impact cases.

41. In assessing impacts, the Panel will look for evidence of reach and significance, and will grade each impact submission as a whole and give a rating using one or more of the five categories of quality level following paragraphs 53-55 of the General Panel Guidelines. In respect of the Electrical & Electronic Engineering Panel, the criteria of reach and significance will be understood as follows –

- reach: the extent and diversity of the communities, individuals, organisations that have benefitted or been positively affected from the impact. For example, the Panel will evaluate the extent to which society as a whole, communities or individuals have benefitted from the introduction of a new product.
- significance: the degree of beneficial effects to the economy, the environment, or society as a whole or in part, both locally and internationally.

42. The Panel will make an overall judgement about the reach and significance of impacts, rather than assessing each criterion separately. The criteria will be applied in the assessment of the research impact regardless of the domain to which the impact relates. In addition, the Panel understands the quality standards for assessing research impact as defined in paragraph 55 of the General Panel Guidelines.

Section D: Assessment Criteria: Research Environment

Research Environment

43. The Electrical & Electronic Engineering Panel will accept submissions on research environment according to paragraphs 57-58 of the General Panel Guidelines. The Panel recognises that excellent research can be undertaken in a wide variety of research structures and environments. The Panel has no pre-formed view of the ideal size or organisational structure for a research environment. The Panel will assess each submission based on what has been presented in relation to the efforts of the submitting unit in providing and maintaining a healthy environment.

44. *(Template paragraph deleted)*

Environment Overview Statement

45. Following paragraphs 9.6 (a) and (b), 9.7 and Appendix I of the Guidance Notes, and also paragraph 59 of the General Panel Guidelines, submitting units are required to describe how they have supported the conduct and production of research. This is distinct from the impact overview statement, which should describe how the units encourage and facilitate the achievement of research impact.

46. Within the terms of the Guidance Notes, the Electrical & Electronic Engineering Panel will expect in particular to see the following in the environment overview statement –

- overview: submission in this part is expected to briefly describe the organisation and structure of the unit, which research groups are covered in the submission and how research is structured across the submitting unit.
- research strategy: evidence of the achievement of strategic aims for research during the assessment period, and details of future strategic aims and goals for research; how these relate to the structure described above; and how they will be taken forward; methods for monitoring attainment of targets; new and developing initiatives not yet producing visible outcomes but of strategic importance; identification of priority developmental areas for the unit, including research topics, funding streams, postgraduate research activity, facilities, staffing, administration and management.
- people: staffing policy and evidence of its effectiveness; how individuals at the beginning of their research careers are being supported and integrated into the research culture of the submitting unit; information on postgraduate recruitment, training and support mechanisms; mechanisms by which standards of research quality and integrity are maintained, for example ethics procedures and authorship. Evidence of attention to achieving a suitable level of diversity in the make-up of a research environment will be regarded positively.
- income: information on research funding portfolio; evidence of successful generation of research income; major and prestigious grant awards made by external bodies on a competitive basis.
- infrastructure and facilities: provision and operation of research infrastructure and facilities, including special equipment, library, technical support, space and facilities for research groups and research students; information on joint-university or cross-institution shared or collaborative use of research infrastructure.
- collaborations: information on support for and exemplars of research collaborations; mechanisms to promote collaborative research at local and international level; support for inter-

disciplinary research collaborations; research collaboration with research users.

- esteem: prestigious/competitive research fellowships held by individual researchers; external prizes and awards in recognition of research achievement.
- contribution to the discipline or research base: exemplars of leadership in the academic community such as advisory board membership; participation in the peer-review process for grants committees or editorial boards.

Environment Data

47. Following paragraphs 9.6 (c) and (d), 9.8 and Appendix J of the Guidance Notes, and also paragraph 60 of the General Panel Guidelines, submitting units are required to provide environment data in conjunction with the environment overview statement. The Panel will consider the environment data within the context of the information provided in the environment overview statement, and within the context of the disciplines concerned.

48. Data on "staff employed by the university proper" and "graduates of research postgraduate programmes" will be used to inform the Panel's assessment in relation to "people" (section (3) (i) and (ii)). Data on "on-going research grants/contracts" will be used to inform the Panel's assessment on "income" (section (4)). All types of research income will be treated equally by the Panel. Additional quantitative data or indicators that are particularly relevant to the Panel are indicated in paragraph 46 above. Such additional information should be submitted within the appropriate section(s) of the environment overview statement.

Criteria and Quality Levels for Assessing Research Environment

49. Panels will exercise their expert judgement in assessing the merits of each environment submission, and will not judge automatically in terms of the scale of research environment concerned.

50. In assessing environment, the Panel will consider research environment in terms of vitality and sustainability, including its contribution to the vitality and sustainability of the wider discipline or research base. The Panel will grade each environment submission as a whole with a profile rating using one or more of five categories of quality

level as set out in paragraphs 62-64 of the General Panel Guidelines. There is no weighting attached to individual aspects in the assessment.

51. The Electrical & Electronic Engineering Panel provides the following amplifications to supplement the generic criteria for assessing research environment –

- vitality: the extent to which a unit provides an encouraging and facilitating environment for research, has an effective strategic plan, is engaged with the regional and international research community, is able to attract excellent postgraduate and postdoctoral researchers through a worldwide reputation.
- sustainability: 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.

52. The Panel will make an overall judgement about the vitality and sustainability of research environments, rather than assessing each criterion separately.

Section E : Working Methods

Use of Sub-Group(s)/Sub-Panel(s)

53. There will not be any sub-group or sub-panel formed under the Electrical & Electronic Engineering Panel.

Allocation of Work in the Assessment Process

54. The Convenor, consulting the Deputy Convenor and other panel members, as appropriate, will allocate work to members and, if necessary, impact assessors and/or external reviewers in light of their expertise and workload. In allocating the work, the Convenor will also take into account any potential conflicts of interest of respective panel members and assessors. All panel members will take account of the requirements of the General Panel Guidelines to ensure that the exercise is conducted fairly and equitably.

55. Panel members will examine the submitted outputs in detail, and put forward a recommendation to the Panel for a collective decision on the final grading. To ensure fairness and consistency, each research output will

be assessed in detail by at least two members, one of whom should be a non-local member to the extent possible. For UoA(s) which is(are) only housed at one or two local universities, submissions will be assigned to at least one non-local member in order to ensure fair and impartial assessment. Final grading on research outputs will be decided by the Panel as a whole.

56. Subject to conflicts of interest of individual members, the impact and environment submissions will be assessed by members of the whole Panel and the final grading of individual submissions will be a collective decision of the Panel.

Cross-Panel Referrals

57. This Panel will follow the procedures in paragraphs 41-43 of the General Panel Guidelines when initiating referrals to other panels and assessing submissions cross-referred by another panel.

58. *(Template paragraph deleted)*

59. *(Template paragraph deleted)*

External Advice

60. This Panel will follow the procedure in paragraph 66 of the General Panel Guidelines when referral to external reviewers for expert advice becomes necessary for panel assessment. External reviews may be sought in the cases for which members of the Panel do not have the necessary expertise such as outputs in foreign language.

Trial Assessment

61. With reference to paragraphs 89-91 of the General Panel Guidelines, the Panel will conduct a trial assessment using a sample of submissions selected from universities' submissions. These sample submissions will be assessed by all members of the Panel. Members will share among themselves any important observations in the assessment to ensure fairness and consistency in the actual assessment. Submissions used for the trial assessment will be assessed afresh during the main assessment period regardless of their assessment results during the trial. The Panel will decide on the sample size after the submissions are received.

Panel Feedback Report

62. With reference to paragraph 71 and Appendices E and F of the General Panel Guidelines, the Panel will provide feedback to the UGC after the assessment process. Non-local panel members will be involved in offering comments for an impressionistic international comparison. The Convenor on behalf of the whole panel will submit the panel feedback report to the UGC by 10 November 2020.