Royal Academy of Engineering/The Leverhulme Trust Research Fellowships

Applicant Guidance Notes Round 2023/24
Deadline: 4pm Wednesday 15 November 2023

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Introduction

The RAEng/Leverhulme Trust Research Fellowship scheme allows early- to mid-career academics to concentrate on research.

The Fellowship covers a maximum of **£55,000** for the salary costs of a replacement academic who will cover the Awardee's teaching and administrative duties for up to one year.

The fellowships provide engineering academics with an opportunity to reinvigorate their research careers, enhance their current research interests or start new lines of research without teaching or administrative constraints.

These Fellowships also provide:

- early- to mid-career academics with an opportunity to enhance their current research interests and initiating new lines of research by relieving them of their teaching and administrative duties.
- a support fund of up to £2,500 for miscellaneous research costs incurred by the awardee, including conference attendance and public engagement activities.

These Fellowships are funded by The Leverhulme Trust.

The Leverhulme Trust

The Leverhulme Trust was established by the will of William Hesketh Lever, the founder of Lever Brothers. Since 1925 the Trust has supported grants and scholarships for research and education. Today, The Leverhulme Trust is one of the largest all-subject providers of research funding in the UK, distributing over £60 million a year. The Trust provides funding across academic disciplines, supporting talented individuals in arts, sciences, engineering, and social sciences to realise their personal vision in research and professional training.

Eligibility criteria

- Applicants should hold a permanent academic position at a UK university at lecturer, senior lecturer, or reader level (or equivalent).
- Applicants must be teaching an engineering discipline at undergraduate or postgraduate level.
- Applicants must be able to demonstrate a significant administrative workload, which prevents them from dedicating as much time to research as they would like, and that they, therefore, merit being relieved of their teaching and administrative duties.
- The proposed research project can be in any engineering discipline. Engineering is defined in its broadest sense, encompassing a wide range of diverse fields, including computer science and materials. If you are unsure whether your project is in an engineering area, please contact **Research Team.**
- Awardees are required to devote all their working time to the Fellowship as this is a full-time award, but awardees can still spend a maximum of four hours per week on teaching and administrative duties if they so wish.
- Awards can be held on a part-time basis, please refer to the section on Part-time and flexible working below for more details.
- Any applications that are incomplete or do not adhere to the guidelines will be rejected.

Diversity and inclusion

The Royal Academy of Engineering is committed to diversity and inclusion and welcomes applications from all underrepresented groups across engineering. It is the Academy's policy to ensure that no applicant is disadvantaged or receives less favourable treatment because of age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex or sexual orientation.

Applicants will be asked to elaborate on what diversity and inclusion means to them, and what you and your team are doing to address it. You will consider your team, collaborators and universities, the implications on your research design and topic, and the overall contribution this will have on your success.

Access Mentoring support

The Academy aims to provide additional support to applicants from groups that are persistently underrepresented within UK engineering through the grant application process. This **positive action** will contribute to improving diversity in the talent pipeline and widening the diversity of applicants and awardees within the Academy's research grant schemes.

To be eligible for Access Mentoring support, applicants must meet the eligibility criteria of the RAEng/Leverhulme Trust Research Fellowships scheme, and must be either:

- **women**
- **Black people, including those with any mixed ethnicity with Black ethnic background(s)**
- **disabled people**

The Academy accepts applicants' self-declaration on the above identified underrepresented groups under the host institution's guidance.

Access Mentoring is a resource limited opportunity. Applicants do not need to wait until the deadline to submit their application and can be matched with a mentor as soon as the application is approved. Early submission is encouraged. For more information on Access Mentoring please **see guidance**.

Part-time and flexible working

The Academy wants to support applicants to achieve a balance between their personal and work demands, and is happy to discuss individual requirements and consider part time and other flexible working arrangements.

RAEng/Leverhulme Trust Research Fellowships can be held part time, but must be the only form of employment. The request for a part-time RAEng/Leverhulme Trust Research Fellowship (at no less than 60% of full-time equivalent) must be clearly stated within the application.

Use of AI

- Taking Responsibility for Content: Applicants are fully responsible for all the content presented in their grant applications. The grant process does not penalise the use of generative AI tools, but it is imperative to ensure that the application reflects the applicant's own voice and ideas. For applicants whose first language is not English, machine translation may be used, but care should still be taken to ensure the accuracy of this translation, especially for technical vocabulary.

- Rigorous Approach: Applicants should exercise caution when using generative AI tools to avoid the inclusion of 'hallucinated' references or factual errors. These often become more common when up to date content on a very specific topic is required, which is typical for most of our application areas. Such inaccuracies will be perceived as indications of a lack of rigor and will negatively impact the assessment of the application.

- Partial Use of AI Tools: It is not acceptable to solely rely on generative AI tools to write the entire grant application from start to finish. While these tools may be used to assist in various aspects, the application must primarily represent the applicant's own work.

- Plagiarism Considerations: Applicants should be aware that the output generated by some AI tools may utilize ideas from other human authors without proper referencing. As this is considered a form of plagiarism, it is essential to ensure that all sources are appropriately attributed.

- Proper Acknowledgement of AI Usage: Applicants must provide clear acknowledgement if they have used generative AI tools in the process of writing their grant applications. This includes disclosing the name of the tool used and describing how it was utilized. The following style should be employed for referencing. If the applicant's home institution has an alternative preferred style, they should in general use the Academy's or seek permission in advance for variation :

  I acknowledge the use of [insert AI system(s), version number and link] to generate materials for background research, styling, proofreading, etc.

  I acknowledge the use of [insert AI system(s), version number and link] to generate materials that were included within my final assessment in modified form.

- Applicant declaration within GMS: These will standardly include explicit statements that the ideas presented are the applicant's own and not plagiarised or containing intellectual property they do not have rights to use, and that all contributions have been appropriately referenced or credited including the use of any machine intelligence tools used in developing the application. An inaccurate declaration will be grounds for immediate rejection of the application and potentially exclusion of the applicant and their organisation from future opportunities. (Please see paragraph 3, guidelines for Assessors.)

Submission deadline

The scheme has one round of applications each year. The submission deadline for this round of applications is **4pm** on **Wednesday 15 November 2023.** Incomplete applications or applications submitted after this date/time will not be accepted.

Further queries

If you have any further questions or queries related to this scheme, please refer to the **FAQs** section on our website or email the Programme Manager at **research@raeng.org.uk**

How to apply

All applications must be submitted via the Academy's online grants system available here: **https://grants.raeng.org.uk** (you can click on the link or copy and paste it in your browser).

All applicants must first register and provide some basic log-in details to create a profile. Before completing the application form, applicants are asked to complete a **Diversity Monitoring Form** to help the Academy monitor and assess its **equality, diversity and inclusion policy**. The information will be treated as strictly confidential, non-attributable and only reported when collated. It is gathered, stored, and used in compliance with the Academy's Privacy Notice in line with the General Data Protection Regulations 2018. The information will only be used for statistical purposes with access restricted to staff involved in processing and monitoring the data. It will not be seen by anyone involved in any selection processes. No information will be published or used in any way that identifies individuals. The Academy will retain personal information as per our Data Retention Policy.

The application should be submitted by the applicant. We recommend leaving plenty of time to complete the application form ahead of the deadline and reviewing your application prior to submission.

A summary of the 'Guidance Notes' is imbedded within the system itself, however the guidance given below is more detailed, so we recommend you keep this document to hand when completing the application form.

Many of the questions have prescribed word limits, which are designed to keep your answers focused and to give you an indication of the level of detail we require. In such cases the number of words you have used will be displayed beneath the question and updated in real time. Applicants can download a PDF of their application after submission, which is recommended for reference. If you have any questions concerning the application or the online grants system, please email the **Research Team.**

Completing the application form

After logging in to the online grants system and selecting the RAEng/Leverhulme Trust Research Fellowships in the 'Start Application' section, you should be presented with the 'Instructions' screen. Here you will see some general instructions on how to use the system as well as links to each of the eight sections of the application form, given below:

1. Applicant and university details
2. Project details
3. Case for support
4. Future plans
5. Relief from activities during the Fellowship
6. Support requested
7. Marketing and notifications
8. Statement of support and declaration

At any stage in the application process, you can save your work and return later. You can answer the questions in any order you like so you may freely skip some sections to return to later if you so wish. It is therefore worth viewing the application early on for an indication of what is required, and you should also ensure that you have all the necessary documentation when you start completing the application, such as a copy of your CV and letters of support.

Applicant and university details

Q. Applicant name and contact details
Please provide your name, job title and preferred contact details. Some of your details and those of your institution should be automatically generated by the system, as you provided these at registration. Please ensure the contact email address is correct and will be valid for the entirety of the application process as this will be the main method of communication regarding the application.

Q. List of courses taught?
Please list the engineering courses you currently teach.

Q. Is your current position permanent?
Please state if you hold a permanent academic position. You must hold a permanent position at lecturer, senior lecturer, reader level (or equivalent) at the time of making the application to be eligible for this Fellowship.

Q. Applicant's CV

The format and content of your CV is left to your discretion. You do not need to include contact details as these are included earlier in the application. As a minimum, please include the following in your CV: your track record in research, list of key publications, conference presentations, students supervised, awards/prizes received (if any), and details of any successful grant applications.

Q. Host institution details

Please provide the contact details for your host organisation.

Q. Candidate's most significant achievements

Please describe three to five of your most significant achievements in your research career. We would like to emphasise that all achievements and outputs are welcome and considered valuable to the Academy, not just peer-reviewed publications. Outputs also include, and are not limited to: code, patents, spinout companies, events, public engagement, and policy impact.

Please briefly explain the significance of the achievement in a way that will explain it to a researcher from your discipline who may not be familiar with latest work in the particular field.

The Academy's research programmes are aligned with the principles of the Declaration on Research Assessment (**DORA**). If research articles published in peer-reviewed journals are to be included in an application, we would therefore like to emphasise that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published.

Project details

Here you will provide a few summary details of the application.

Q. Project title

Your project title should not be longer than 10 words and should be understandable to a non-specialist reader. The essence of the research should be captured in the title and should be as informative as possible.

Q. Abstract

Describe the research and expected outcomes in terms that can be understood by a non-specialist reader. Demonstrate a knowledge and understanding of past and current work in the subject area both in the UK and abroad. There is a maximum of 300 words for this section.

Q. Project start date

Please enter your proposed start date. Note: all Fellowships awarded in this round must start between **1 August 2024** and **1 October 2024.**

Q. Project end date
Please enter your proposed Fellowship end date. All Fellowships last between one academic term and one year. Requests for a Fellowship shorter than one academic term will not be accepted.

Q. Please provide the general subject area relating to the project
Select one field from the list below that most closely matches the general subject area of your project:
1 Civil, construction and environmental
2 Materials and mining
3 Chemical and process
4 Aerospace
5 Transport and mechanical
6 Manufacturing and design
7 Electrical and electronic
8 Energy and power
9 Medical and bioengineering
10 Computing and communications

Q. Please provide keywords relating to the project
You can then add two additional keywords to further define the area of your project. For example: lasers, optoelectronics. This will help us identify suitable reviewers for this application.

Q. List of collaborations
List the names of all external organisations that you will be collaborating with as part of the project (note: we only require a list of names, not a detailed description in this section). As well as demonstrating your collaborative intentions, this will help us avoid any conflicts of interest during the assessment process. You have 50 words in this section.

Case for support

Q. Why are you applying for this Fellowship?
Please explain why you need relief from your teaching and administrative duties to concentrate on research. Include any relevant examples of duties to demonstrate this. What will be the expected key deliverables if you are awarded the Fellowship? A maximum of 200 words is available for this section.

Q. Goals and objectives
Please state the goals and objectives for the project, in order of priority. Please note that should you be awarded a Fellowship your performance will be assessed against these objectives. You have 200 words to complete this section.

Q. Research programme and methodology

Describe the programme of work, indicating the research to be undertaken and the methodology to be used in pursuit of the research. You should include details on how novel, realistic/ambitious the project is and include milestones by which to measure progress. You have 1,000 words in total.

Q. Gantt chart

Upload a Gantt chart or equivalent to illustrate the timeline for the proposed research programme for the duration of the Fellowship.

Q. Reference (Optional)

Use this section to upload a list of the relevant material referred to in your application. The images/diagrams should be collated and uploaded as a single PDF in the order you wish them to be viewed.

Q. Timelines and novelty

Explain why the proposed project is of sufficient novelty to warrant consideration for a RAEng/Leverhulme Trust Research Fellowship. You have 200 words to complete this section.

Q. Choice of host institution

Provide justification for your choice of host institution, for example facilities and personnel available etc. You have 100 words to complete this section.

Q. Academy's strategic goals (optional)

How do you align with our strategic priorities? Note this is not an assessment criterion and is for staff use only. We want to understand the extent to which our programmes meet our strategic aims, your answer will not influence the decision and applications are judged purely on merit. The strategic plan is available on our website **here**.

Q. Diversity and inclusion

The Royal Academy of Engineering strives to create cultures in which everyone can thrive, and we believe that diverse perspectives enrich our collective performance.

What does diversity and inclusion mean to you, and what are you (and your team, if applicable) doing to address it. Consider your team, collaborators and universities, the implications on your research design and topic and the overall contribution this will have on your success. You have 250 words in total.

Q. Impact of COVID-19 (optional)

The Academy understands that the impact of the coronavirus pandemic on researchers and their work will be varied. Please provide a summary of how the pandemic has affected your research activities.

This can include but is not limited to the following: pause on experiments/ research plans, reduced ability to work due to additional caring responsibilities, delays in publishing/submitting a key paper(s) (please note pre-prints can be included in your publications list).

Future plans

Q. Ambitions and future plans

Describe your future career plans and ambitions (for the next five years), including anticipated team size, recognition and how you expect to progress after the Fellowship. You have 200 words to complete this section.

Q. Collaborations

Describe in detail any existing and future collaborations and how these will contribute to and enhance the project. You also have an option (if required) to upload letters of support from your collaborators, collated as a single document. You have 200 words to complete this section.

Q. Letters of support from collaborators (optional)

You can upload letter(s) of support from your collaborators, collated as a single document.

Q. Beneficiaries and impact

What are the benefits of this research? Quantify the extent of the benefits and the potential beneficiaries. If the benefits do not directly relate to wealth creation and/or to improving the quality of life, give details of other beneficiaries and explain their importance. You should also indicate when these impacts are likely to accrue.

Beneficiaries should extend to a wider community than those of the applicant's immediate professional circle. Specific beneficiaries might be companies or public sector, researchers in other disciplines, academic institutions, and society at large. What plans are there for public dissemination and engagement? If there is no specific beneficiary but the output may have general relevance to a specific sector of industry, science or engineering, then an indication of how this might be relevant should be given. You have 200 words to complete this section.

Q. Exploitation

Describe the ways you plan to exploit your research, including the industry and public- sector partners that you will seek collaborations with to achieve this. In the previous question you explained what the benefits of the research are, here you should explain how you will ensure the benefits and impacts mentioned above will be achieved.

Identify what mechanisms are in place for identification, protection and subsequent exploitation of any deliverable that may arise from the research. You should also indicate when these routes to exploitation are likely to be implemented, including if this will be after the period of the Fellowship itself. You have 150 words to complete this section.

Relief from activities during the Fellowship

Q. Activity Summary

Outline your current administrative and teaching commitments that you are seeking relief from.

Q. Research Activity

Please state your existing commitments which you will continue to perform during the award.

Support requested

Q. Costs table

Please enter the gross salary, corresponding to the **first spinal point** of the university's lecturer pay scale. This includes pension, NI and anticipated pay awards for the duration of the Fellowship. These funds will be used to support the replacement academic, who is expected to be at an early-career stage.

Support fund: the maximum allowable request from the support fund is £2,500. These funds will contribute towards the awardee's research costs, such as travel, conferences, subsistence, access to specialist facilities, computer software and laboratory consumables. NB: computers are not eligible.

Note: Any funds requested must be spent within the Fellowship period. Any unspent funds should be reported and returned to the Academy.

Q. Justification of costs

Please enter the gross salary, corresponding to the first spinal point of the university's lecturer

Marketing and notifications

This section is optional and any information provided will help the Academy to understand which of our marketing materials and methods are most successful, so enabling us to improve our future communications activities.

Statement of support and declaration

This section seeks confirmation that the applicant, applicant's head of department and the university have provided accurate information and will update the Academy of any material changes that may affect the award.

Q. **Letter of support from the head of department**
The letter should be on headed paper, no longer than two pages, signed by the author and uploaded by the applicant as a PDF.

The letter should include the below points:

- A clear statement about the university's willingness to completely release the candidate from all their teaching and administrative duties during the term of the award should the candidate be successful.

- The university's willingness to support the Fellowship together with an explanation of the reasons why the applicant is a suitable candidate for the award.

- Comments on the suitability of the proposed research activities and the tasks outlined in the case for support.

- Information about the applicant's teaching (and teaching-related) duties and their workload together with a statement on how the applicant's teaching load will be covered in their absence.

- Ideal person specification of an early-career academic who can cover the applicant's administrative/teaching duties and relieve them from these commitments.

- **NB:** the Academy expects the host institution to be committed to, and provide support that aligns with, principles set out in The Concordat to Support the Career Development of Researchers and The Concordat for Engaging the Public with Research.

Q. **Impact of COVID-19 on the host university's support(Optional)**
The host university can use this letter of support to highlight the impact of the coronavirus pandemic on their support for the award if they wish. Reviewers and panel members will be advised to take into consideration the unequal impacts that COVID-19 related disruptions might have on the host university's support for the research fellowship.

Q. University declaration letter

The declaration from the applicant's university should be completed by an appropriate officer of the Central Research Office or equivalent (such as the body that administers grant applications).

The letter should be on university headed paper and should carry the signatory's name, position and the university's official stamp (if available).

The letter must confirm the application has been approved by the university, and must contain the **exact wording given in the box below**, as well as any further remarks the university wishes to make:

> On behalf of the university, I can confirm that I have read and accept the application guidance and other information regarding this award scheme that is provided on the Royal Academy of Engineering's website, and I also confirm that:
>
> 1. If awarded, the applicant will be given full access to the facilities, equipment, personnel and funding as required by the application.
>
> 2. The applicant will be employed by the university for the duration of the award.
>
> 3. The university will employ an early career academic to cover the teaching and administrative duties of the Awardee for the duration of the Fellowship.
>
> 4. The salary costs submitted in the application correspond to the first spinal point of the Lecturer pay scale at the university, and the funds will only be used to cover the salary of the replacement academic. Any shortfall in funding discovered after the award has been made will be covered by the university.
>
> 5. This Fellowship is not a sabbatical and if awarded, will not affect the applicant's eligibility for a sabbatical.
>
> 6. I am authorised to approve the submission of applications for funding.

Q. Applicant declaration

This section will ask the applicant to confirm that all the information they have submitted in their application is accurate and that they will update the Academy of any changes that may affect the project. The Applicants must provide clear acknowledgement if they have used generative AI tools in the process of writing their grant applications. This includes disclosing the name of the tool used and describing how it was utilized.

This section will also ask the applicant to acknowledge that the Academy will disclose the information contained within this application to external parties for the purpose of assessing the case.

Assessment of applications

A Selection Panel composed primarily of Fellows of the Royal Academy of Engineering will review the applications. The panel members will be selected to represent the engineering disciplines required. Each application will be reviewed by two members of the panel.

A Selection Panel meeting will be held in March 2024, to discuss the applications and make awards (note: unlike our other Fellowship schemes there is no interview stage in this selection process). A senior representative from The Leverhulme Trust will also be invited to attend.

Applicants will be notified of the outcome of the assessment by the programme manager normally within one month of the date of the panel meeting.

In assessing the applications, the panel will consider several factors. These include:

1. Is the candidate suitable for a RAEng/Leverhulme Trust Research Fellowship? Does the candidate demonstrate quality, experience, scientific insight/ originality and independence in their research from their CV?

2. Quality of the applicant's proposed research project. This includes ambition, novelty and timeliness of the research project. Does the applicant make a strong case for relief from teaching and administrative activities to be able to dedicate to the Fellowship if awarded? Please note that the 'Relief from activities during the Fellowship' section is located towards the end of the application.

3. Host institution's support letter and level of commitment, including the identification of the beneficiaries of this research and how they will benefit. Extent of industrial involvement in the project and any societal or economic benefits arising from the research project? Please note that any letters from collaborators are optional to include.

4. How is the applicant expected to progress after the Fellowship, and the related long-term benefits. How the applicant will build upon any existing or future collaborations. Has the applicant thought through the proposed dissemination, what are the plans for public engagement?

5. Please note that letters of support from any external collaborators are not mandatory but the selection panel does consider them.

Declaration on Research Assessment (DORA)

The Academy's research programmes are aligned with **DORA**, which is a set of principles aiming to improve the ways in which the output of research is evaluated by funding agencies, academic institutions, and other parties. The outputs from research are many and varied, and as a funder of engineering research the Academy needs to assess the quality and impact of these outputs in order to make awards. It is imperative that research output is measured accurately and evaluated wisely.

In the assessment of research output, we would like to emphasise that all outputs are welcome and considered valuable to the Academy. Outputs can include open data sets, software, publications, commercial, entrepreneurial, or industrial products, clinical practice developments, educational products, policy publications, evidence synthesis pieces, and conference publications. With regard to research articles published in peer-reviewed journals, the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published.

We value and appreciate the time and effort that reviewers give to support our research programmes. A good, helpful review for the Academy is one that assesses research on its own merits rather than by surrogate measures, such as on the basis of the journal in which research is published.

Why applications are unsuccessful

Competitors	Not knowing and acknowledging competitors.
Vision	Vision and ambition not clearly explained.
Novelty	Proposal lacking novelty, or not articulating how the proposed work will address a novel research question.
Realistic	Unrealistic in terms of overstating potential impact. But also, milestones, resources, and the applicant's ability.
Communication	Poor communication skills, both written and verbal. Inconsistent/unclear information provided in the application form.

Timeline

The overall schedule for this round of applications will be as follows:

September 2023	November 2023	November 2023 to February 2024	April 2024
Scheme opens for applications **Tuesday 5 September 2023**	Submission deadline is **4pm Wednesday 15 November 2023**	Applications sent to the Selection Panel for review	All applicants informed of the outcome of their application

Annex 1 – Subject category

1) **Civil, construction and environmental**
   Including aspects of civil and structural engineering; construction materials; earthquakes; wind and fire engineering; building engineering physics; construction management; numerical modelling; environmental engineering; water resources and flooding; offshore and coastal engineering; hydraulics; climate change and sustainability; waste management; geotechnical engineering; geomatics/surveying.

2) **Materials and mining**
   Including metallurgy; metal forming; corrosion; failure analysis; structural integrity; non-destructive testing; inspection technologies; failure prevention; fabrication and repair technologies; welding and joining technologies; discovery and development of mineral resources; extraction and processing of minerals; mining engineering; materials performance; materials research; plastics and composites; structural materials (excluding materials specifically covered elsewhere).

3) **Chemical and process**
   Including all aspects of chemical and process engineering; aspects of fuel technology; oil; coal and gas technologies; carbon; carbon sequestration; clean technology; combustion; catalysis; particulates; food processing; fermentation processes; pharmaceutical engineering; biotechnological processes.

4) **Aerospace**
   Including all aspects of aeronautical engineering and aerospace manufacturing; turbomachinery and aerothermal engineering; avionics; radar systems; antennae; satellite systems; autonomous systems; aspects of systems engineering; airlines; materials for aerospace.

5) Transport and mechanical
Including all aspects of mechanical engineering; automotive; rail and marine engineering; transportation infrastructure; engines; turbomachinery; mechatronics; acoustics and vibrations; ultra-sonics; heat and thermodynamics; fluid dynamics.

6) Manufacturing and design
Including manufacturing management and manufacturing process innovation; manufacturing business improvement and re-engineering; CAD/CAM; robotics for manufacturing; engineering design.

7) Electrical and electronic
Including electrical, electronic and control engineering; design for electronics; aspects of nanotechnology and semiconductor engineering; lasers; optoelectronics; photonics; microwave engineering; instrumentation; display technology; solid state electronics.

8) Energy and power
Including energy technologies; electric power and energy systems engineering; nuclear and renewable energy generation; energy infrastructure; management of energy and energy resources for generation, storage, and transmission; distribution and conversion of electric energy and power; electricity supply and energy conservation; hydrogen power; fuel cells.

9) Medical and bioengineering
Including all aspects of medical and biomedical engineering; orthotics; prosthetics; ultrasound for medicine; medical scanning and imaging; drug delivery; biomedical materials; tissue engineering; medical devices; medical robotics and computer assisted surgery.

10) Computing and communications
Including computational and software engineering; informatics; web and data science; telecommunications; mobile telephony; broadband; wireless spectrum; signal processing; television, film, and broadcasting; computer and video games; special effects.