ERC frontier research contribution to a Europe fit for the digital age

The European Research Council (ERC) follows a strictly bottom-up approach to funding research proposals, with excellence as the sole criterion for selection. The research that ERC grantees pursue, free of any thematic objectives, generates results that address a wide range of issues with significant socioeconomic, environmental and policy relevance. As a result, this rich and diverse portfolio of frontier research generates new knowledge and proposes concrete solutions for addressing some of the most pressing policy priorities of the European Commission. This is the case of the over 700 projects funded by the ERC, worth more than €1 billion, in the Horizon 2020 (H2020) Framework Programme (2014–2020) that are relevant for ‘Europe fit for the digital age’.
This fact sheet provides an overview of the projects relevant for the selected areas of the **Europe fit for the digital age**. The projects were funded under the Starting Grant (StG), Consolidator Grant (CoG), Advanced Grant (AdG) and Synergy Grant (SyG) schemes launched in the H2020 Framework Programme (2014–2020)*.

### Areas of interest for a Europe fit for the digital age

- Foundational developments for the digital age
- Advances in information and communication technologies
- Cryptography and security
- Artificial intelligence
- Quantum technologies
- Societal data science
- Digital health
- Other digital age-related research

### Distribution of ERC-funded projects in Horizon 2020

771 grantees lead 759 projects and are based in 22 EU Member States, 4 Associated Countries (ACs) and 2 non-EU/ACs.

#### Physical sciences and engineering
632 projects, €1226M

#### Life sciences
32 projects, €75M

#### Social sciences and humanities
93 projects, €165M

#### Non-EU/ACs

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of projects</th>
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<tbody>
<tr>
<td>Russia</td>
<td>5</td>
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<tr>
<td>Canada</td>
<td>7</td>
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<tr>
<td>India</td>
<td>7</td>
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<tr>
<td>United States</td>
<td>20</td>
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<tr>
<td>Australia</td>
<td>9</td>
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<tr>
<td>13 other non-EU/ACs</td>
<td>22</td>
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*Data as of December 2021*

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**Number of grantees with number per country**

- EU
- ACs
- Non-EU/ACs

**Host institutions with ≥16 funded projects**

- National Centre for Scientific Research (FR): 33
- National Institute for Research in Computer Science and Automatic Control (FR): 25
- Swiss Federal Institute of Technology Zurich (CH): 25
- Tel Aviv University (IL): 25
- Max Planck Society (DE): 17
- University of Oxford (UK): 17
- University of Cambridge (UK): 16
- University of Leuven (BE): 16

**Country of origin of grantees other than EU or ACs (≤4 grouped together)**

- Russia: 5
- Canada: 7
- India: 7
- Australia: 9
- United States: 20
- 13 other non-EU/ACs: 22
The scientific landscape of frontier research projects contributing to the selected Europe fit for the digital age areas.

The word clouds represent the most prevalent scientific fields in the pool of ERC projects identified as relevant for each of the selected areas of a Europe fit for the digital age. The total number of projects under each area as well as the budget are indicated.

15% of the 757 projects contribute to two or more of these areas.
Scientific synergies and methodological developments in the selected Europe fit for the digital age areas

Scientific synergies among Europe fit for the digital age areas

The nodes represent the selected areas of Europe fit for the digital age and their size is proportional to the number of projects. These areas are interconnected and the strength of this connection is represented by the thickness of the arc, which is proportional to the number of shared scientific fields. The most representative scientific fields for the main connections, highlighted with letters, are listed.

Methodological developments in projects contributing to the selected Europe fit for the digital age areas

The main methodological development in the projects relevant for the selected Europe fit for the digital age areas is in the field of *Computational modelling, simulations* with Artificial Intelligence and complex systems being the focus. Other prominent methodological developments are *Theoretical, mathematical methods* with a focus on digital methods and *Validation, demonstration, prototyping* with a focus on digital developments and applications.
**COMPUTED** drew on behavioural models from psychology to develop algorithms better suited to design user interfaces, therewith improving human-computer interaction.

Using the latest techniques in Big Data, Magdalena Wojcieszak’s **EXPO** project analyses how exposing people to *dissimilar views in the media* can be both risky and beneficial.

**BNYQ** is set to revolutionize the *analogue-to-digital conversion systems* with a crucial impact in day-to-day applications, including ultrasound imaging and radar detection.

**Tamed Cancer** is a pioneering project aiming at improving personalized therapies by developing robust algorithms. This breakthrough concept could *revitalize cancer treatment* by calculating optimal drug dosages.

**INTERACT** is developing new *interactive learning algorithms* to address sentences in text of speech that is often complex and compositional.

**CIRCUS** takes a comprehensive approach to cybersecurity. The team led by Karthik Bhargavan was able to improve the Transport Layer Security protocol *using downgrade cyber attacks simulations*.
Examples of ERC-funded projects contributing to the selected Europe fit for the digital age areas

**SOPHIA** aims to establish the scientific foundation for **securing software** against physical attacks, and discovered two new security vulnerabilities in computer processors, named Meltdown and Spectre, allowing unauthorised external access to personal data.

**Grenadyn** demonstrates that **assemblies of imperfect, dynamical nanodevices can self-learn through physical principles**, like biological neurons and synapses do. The team led by Julie Grollier will produce a chip and achieve state-of-the-art recognition rates on AI image benchmarks.

**SPRINT** made substantial advancements in **surface polaritronics and Terahertz Detection** with the ultimate goal to develop a new generation of passive mode-locked THz photonic laser resonators through the combination of quantum cascade laser technology with graphene.

**EAR** proposes models linking sound to disease diagnosis. The team led by Cecilia Mascolo launched an **app to identify symptoms through voices and coughs** to explore automatic diagnosis of COVID-19.

**EmbodiedTech** demonstrated that the human brain can repurpose neurons to represent and control artificial limbs with the ultimate goal of finding the necessary conditions for the **brain to recognise artificial limbs** following an amputation.

**CALC** establishes a computer-assisted framework for linguistics analysis, focusing on how **languages convey emotion and its meaning across cultures**.