



Overview on ICT-related access opportunities in EU and US

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ICT Policy, Research and Innovation
for a Smart Society

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www.picasso-project.eu



About the PICASSO Project

The PICASSO project “ICT Policy, Research and Innovation for a Smart Society: towards new avenues in EU-US ICT collaboration” (January 2016 – June 2018), funded under the European Union Horizon 2020 programme, brings together EU and US prominent specialists with the aim of reinforcing EU-US ICT collaboration in pre-competitive research in key enabling technologies related to societal challenges of common interest – 5G Networks, Big Data, Internet of Things and Cyber Physical Systems - and to support the EU-US ICT policy dialogue.

The PICASSO project provides an exchange platform for EU and US experts through three EU-US thematic ICT Expert Groups (5G Networks, Big Data, and IoT/CPS) and one EU-US ICT Policy Expert Group. The synergy between experts in ICT policies and in ICT technologies is a unique feature of PICASSO with benefit to both, the policy and the technology communities in the EU and the US. Further, interested EU and US specialists are invited to comment on/contribute to the project analytical materials and to participate in project workshops, info sessions and webinars.

Based on a panorama report on the ICT landscape in EU and US as well as in-depth analysis of industrial drivers and societal needs in the three strategic technology domains 5G Networks, Big Data, and Internet of Things/Cyber Physical Systems, the Expert Groups will develop Opportunity Reports, recommend priorities for EU-US ICT collaboration, and propose measures to stimulate the policy dialogue in these areas. Policy experts will identify policy gaps and prepare Policy Briefs on data protection and privacy, security, standards, spectrum..., as well as an ICT White Paper.

A tool named “CROSSROADS - Your EU-US ICT info-hub” will be made available as a mobile application, but also as a section of the project website, providing extensive support and information on EU-US collaboration opportunities (Horizon 2020 and US ICT programmes) and other relevant information.

The PICASSO consortium is combining academic, industrial and policy support experience and includes the EU-based partners Technische Universität Dortmund and Technische Universität Dresden, Germany, THHINK Wireless Technologies, UK, Athens Technology Center, Greece, Agenzia per la Promozione delle Ricerche Europea, Italy, GNKS Consult, The Netherlands, and the US-based partners Honeywell International, The Miami-Florida Jean Monnet Center of Excellence (MFJMCE) at Florida International University, and the Technological Leadership Institute, University of Minnesota, USA. The project is supported by NIST – the National Institute of Standard and Technology, USA. The project is supported by NIST – the National Institute of Standard and Technology, USA. The PICASSO partnership is led by inno TSD, France.

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PICASSO – EU/US ICT research, innovation and policy collaboration

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This document represents the current state of play of the EU-US collaboration opportunities in ICT. Updated information on opportunities will be displayed on the PICASSO website. The PICASSO team welcomes any contribution on relevant aspects. Please contact bezzi@apre.it for any suggestion.

Introduction and Purpose

The EU-US Research Collaboration Framework

The United States of America (US) are a long standing partner of the European Union (EU). For research and innovation, the cooperation between the EU and the US is governed by the "Agreement for Scientific and Technological Cooperation" that was originally signed in 1998, renewed four times for 5 years each time, and is now valid until October 2018. In June 2013, an independent review of the current [agreement](#)¹ has been published by the Commission.

On the basis of the agreement, a [Roadmap for cooperation](#) between the US and the EU² on research and innovation was developed in 2014 identifying the next future priorities by the Joint Consultative Group (JCG): Marine and Arctic Research; Health research; Transportation Research; Materials research / Critical Raw Materials / Nano safety and regulatory research / Health and Safety research (nano-EHS); Energy research (including the nuclear fission); Future and Emerging Technologies in the areas of brain research, interoperability of global data infrastructures and digital science policy framework; e-Infrastructures related to Open Access, Open Research Data and Digital Science.

As for cooperation in the ICT field, following the EU-US Summit in March 2014, EU and US leaders³ underlined the commitment "to expand cooperation in research, innovation and new emerging technologies, and protection of intellectual property rights as strong drivers for increased trade and future economic growth". In this occasion, they stressed in particular the need to further enhance cooperation on a number of cybersecurity foreign policy issues through the launch of a comprehensive EU-US cyber and Digital economy dialogue. Moreover, as for now, US is one of the few countries where research on new network infrastructures (which includes 5G) for Future Internet is encouraged and sought.

Over the last years, several EU-funded projects have supported cooperation and policy dialogue between the US and the EU, such as Bilat USA 2.0, as well EURAXESS-Links US and Link2US. Currently, on the general framework, the policy dialogue is supported by the project Bilat USA 4.0, while two topic-focused support the specific dialogue on Information and Communication Technologies: DISCOVERY and PICASSO.

In particular, PICASSO will focus on three key enabling technology areas that are at the center of the innovation in ICT during the next years and closely linked to addressing the societal challenges on the

¹ Evaluation of the EU-US Agreement on S&T, March 2013, <http://ec.europa.eu/research/iscp/pdf/policy/evaluation-eu-us-agreement-st.pdf#view=fit&pagemode=none>

² http://ec.europa.eu/research/iscp/pdf/policy/annex_roadmaps_sep-2014.pdf#page=61

³ The EU was represented by Herman Van Rompuy, President of the European Council, and by José Manuel Barroso, President of the European Commission. Catherine Ashton, High Representative of the Union for Foreign Affairs and Security Policy/Vice-President of the Commission, European Commissioner for Trade Karel De Gucht and the Head of the EU Delegation to the United States, João Vale de Almeida, also took part. The United States were represented by President Barack Obama, who was accompanied by US Trade Representative Michael Froman and the US Ambassador to the European Union, Anthony Luzzatto Gardner.

way to a “smart society”: 5G, Big Data and IoT/CPS. Together with other cross-cutting and application areas, such as Internet governance, cyber security, standards and interoperability, data privacy, and ethics, PICASSO priority areas reflect the main challenges and opportunities in next decades for both United States of America and European Union in the field of ICT research, challenges and applications.

Projects supporting cooperation and policy dialogue between US and EU

Bilat USA 2.0

Website: <http://www.euussciencetechnology.eu/>

The new BILAT USA 4.0 project continues activities started by the predecessor project BILAT USA 2.0 with the overall aim to enhance, support and further develop the research and innovation cooperation between the European Union and the United States of America, from 2016 to 2019).



A particular focus of the project activities will be put among others on an intensification of interactions between EU and US researchers and innovators, the support for the improvement of research and innovation framework conditions, the provision of analyses delivering a sound base for decision making and an enhanced coordination and synergies between different EU MS/AC and US policies and programmes. BILAT USA 4.0's targeted transatlantic activities work towards:

- Strategic priority setting for EU-US cooperation through identifying emerging STI fields with a high benefit and added value from cooperation, thus providing evidence-based input for policy decision-making;
- Stronger interaction between EU and US researchers through thematic events promoting funding opportunities on both sides and thus strengthening the quality and quantity of partnerships between STI actors in EU MS/AC and the US;
- Establishing optimal framework conditions through proposing concrete solutions for eliminating cooperation obstacles deriving from researchers' and innovators' feedback, thus, creating an environment that favors joint solutions for global challenges;
- Enhanced coordination and synergies between different policies through analyzing EU, MS/AC and US programmes and detection of duplications, thus, contributing to a greater coherence, joint ownership and resource efficiency;
- Ensuring close synergies with calls launched in H2020 and their int. dimension through screening of US-targeted actions in H2020 and liaising with relevant (ERA) projects to guarantee a consistent information exchange.

BILAT USA 4.0 has 16 partners, six from the US and ten from Europe. They represent a well-balanced mix of competencies, expertise and access to relevant stakeholder networks across the EU and US. Partners are national funding organisations, research management agencies, multipliers, think tanks, research institutions and research and innovation consultancies.

DISCOVERY Project

Website: <http://discoveryproject.eu/>

DISCOVERY is an international cooperation project co-funded by Horizon 2020 EU Framework Programme for Research and Innovation. The project was launched on 1st January 2016 and over the next 2 years Discovery will support dialogues between Europe and North America, (US and Canada) to foster cooperation in ICT R&I, both under Horizon 2020 and under US and Canada funding programmes.



DISCOVERY has established the Transatlantic ICT Forum as a mechanism to promote policy debate and provide opinions and recommendations for cooperation between Europe and North America and to become a permanent platform for EU-North America cooperation in ICT. Its three Working Groups on funding mechanisms, ICT policy and regulations, and cybersecurity, gather relevant experts from North America and Europe.

DISCOVERY identifies ICT priorities of common interest for EU-North America cooperation and support innovation partnerships for collaboration in ICT R&I projects. To engage the industry and researchers from both sides of the Atlantic and identify challenges for ICT R&I cooperation, we will organize the ICT Discovery Lab, a cycle of interactive workshops supported by participatory and co-creative techniques, and Capacity-building Workshops promoting collaboration opportunities under H2020 and US and Canada Programmes.

Purpose of the guide

Target of this guide are European/US academic or industrial researchers or innovators that are interested in increasing their knowledge or in expanding their network respectively on the US or EU territory, with the perspective of increasing the chances of collaboration between the two sides of the Atlantic ocean.

Final aim of this document is to improve the capacity of European/US potential participants to better orientate in the US/EU landscape in matters of ICT political strategic priorities, and to identify possible opportunities for participation in US programmes in PICASSO's priority areas, either in presence of available funding or not.

Main questions we aim to answer are:

- Which are the programmes, initiatives, and funds available for R&I in PICASSO's focus areas?
- How does the EU manage its funds for R&I through its framework programme H2020?
- Which are, in the US, the Federal Departments or Funding Agencies that are responsible for the same priorities and for funds?
- Who is eligible to participate to these programmes and initiatives?
- How to apply for funding?

After providing a brief historical on the EU-US Research Collaboration Framework, the guide divides its contribution into two parts: Part I, dedicated to opportunities for US researchers and innovators in the EU, and Part II, dedicated to opportunities for EU researchers and innovators in US.

For each part, we describe the main characteristics of research and innovation system, and we provide an overview of how PICASSO priority areas are present and represented in the strategic priorities of the EU and the US. Other ICT priorities are also taken into consideration, beyond the scope of action of PICASSO priority areas.

At the EU level we have limited our research to EU funding. This mainly coincides with H2020 instruments and opportunities, but not only. The EU section describes the entire panorama of EU-level initiatives, such as public-private initiatives, that either at the strategic or funding level have a major role in drawing the future of research and innovation in PICASSO' priority areas.

In US we have taken into account opportunities at the federal level, describing strategic orientations and operational approaches of the main funding agencies active on our focus areas. This section ends with a selection of funding opportunities in different relevant ICT areas, showing how different provisions are set by different funding agencies concerning foreign participation eligibility requirements.

For both parts, links and references to main information, research and support tools are provided.

PART I - Opportunities for US researchers and innovators

This first part of the report focus on the European research and innovation framework programme, Horizon 2020, which can be considered the main gateway for European researchers and innovators to get direct funding on their research and innovation proposals. This section is based mostly on desk research on the official European web-portals, dedicated to Information and Communication Technologies European policies and priority areas.

In the framework of the Innovation Union, one of the seven flagship of Europe 2020 strategy for a smart, sustainable and inclusive growth, Horizon 2020 is the main instrument in order to foster the advancement on the European Research Area. The ERA aims to achieve a genuinely world class science base by reducing both brain drain, notably from weaker regions, as well as the wide regional variation in research and innovation performance, aiming at excellence across the European Union through smart specialisation.

To this purpose the main focus of this section is related to Information and Communication Technologies in Horizon 2020, providing a portrait of US-EU collaboration in the last Framework Programme (FP7) and introducing Horizon 2020, its main features and characteristics, the policy context and program architecture as well as elements of primary importance for American researchers and innovators such as the participation rules, funding rates and intellectual property rights.

PICASSO priorities - 5G Networks, Big Data, Internet of Things and Cyber Physical Systems as prior key enabling technologies of interest for international cooperation between EU and US are described in terms of the research and innovation stakeholders' ecosystem existing around the priority areas and the funding streamlines that will be object of Calls for Proposals in the next years. Besides opportunities related to PICASSO's priority areas, the document will describe also a number of other relevant H2020 funding opportunities in the ICT field.

Finally, the last section of the "Opportunities for US researchers and innovators" part provides contact information and support services available to US American researchers and innovators who wish to participate in Horizon 2020 projects.

Understanding the European Framework landscape for Research and Innovation

Within the European Union, EU-level funding for Research and Innovation is supported through a common funding instrument called "Framework Programme (FP) for Research and Innovation", that is financed through the contributions of all Member States (but non only⁴) and has a 7-year duration.

⁴ Association to Horizon 2020 takes place through the conclusion of an International Agreement. Legal entities from Associated Countries can participate under the same conditions as legal entities from the Member States. As of 29 April 2016, the following countries are Associated to Horizon 2020: Iceland, Norway, Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland (partial association), Faroe Islands, Ukraine, Tunisia, Georgia.

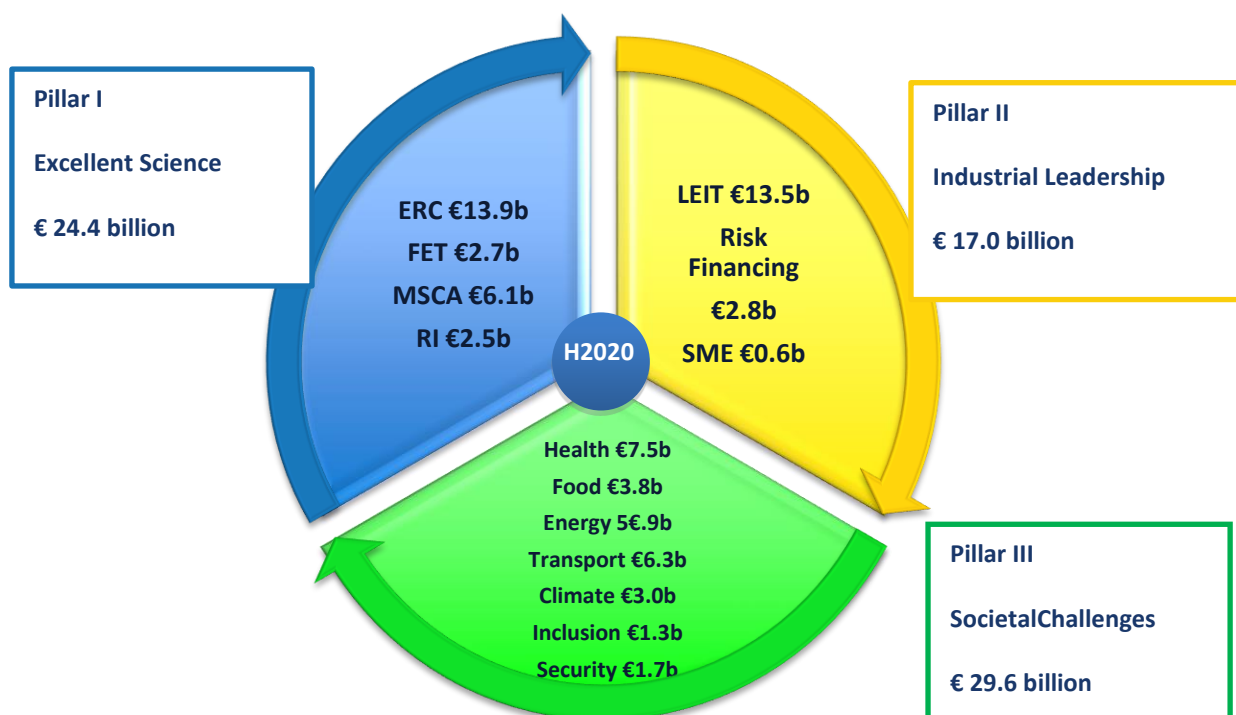
Horizon 2020 is the currently running EU Framework Programme for Research and Innovation. From 2014 to 2020, it will provide €80 billion for peer-reviewed research in all sectors and at all points in the value chain, promising more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. It is considered the eighth in a series of Framework Programmes first launched by the European Commission in 1984.

Horizon 2020, in particular, has been designed as a building block for the “Innovation Union,” a flagship initiative of the Europe 2020 Strategy adopted by the European Union to stimulate economic growth and well-being in every Member State. It aims specifically to bring researchers and innovators (involved in academic research or industrial development) together in order to foster scientific cooperation in wide set of themes and disciplines. Outstanding new features introduced by H2020 as compared to its predecessor programmes are:

- a strengthened focus on innovation and on new forms of innovation.
- measures to increase the participation of small and medium sized enterprises and industry.
- a more strategic focus on international cooperation partnerships.

Horizon 2020 will make European research more trans-national, multi-sectorial and international, increasingly focused on well-defined social, economic and global challenges. It will be an important vehicle for international research, offering US researchers and innovators a wide range of opportunities to work with well-funded colleagues, with similar goals, in a dynamic research environment.

H2020 Programme Architecture



Horizon 2020 is structured around three pillars, divided into thematic areas and reflecting EU policy priorities. For every thematic area within each pillar the European Commission publishes every two years specific Work Programmes, which are the main reference documents for specific calls and topics. Here a prospect of the thematic areas:

Excellent Science focuses on four specific activities:

- **The European Research Council (ERC)** grants provide flexible funding to enable exceptionally talented, top class individual researchers and their teams to pursue the most promising avenues at the frontier of science.
- **Future and Emerging Technologies (FET)** supports collaborative research across disciplines on radically new, high-risk ideas to accelerate the development of the most promising emerging areas of science and technology.
- **Marie Skłodowska-Curie Actions (MSCA)** provides innovative research training as well as opportunities for cross-border and cross-sectoral mobility of researchers and innovator at all stages in their careers.
- **Research Infrastructure** (including e-infrastructures) supports the development of all forms of EU research infrastructures for 2020 and beyond.

Industrial Leadership focuses on the development of emerging technologies and supports innovation in European SMEs:

- **Leadership in enabling and industrial technologies** provides dedicated support for research, development and demonstration projects related to five innovative technologies, emphasizing their interactions and convergence and their relationship to societal challenges:
 - Information and communications technology (ICT),
 - Nanotechnologies, advanced materials and production
 - Biotechnology
 - Advanced manufacturing and processing
 - Space
- **Access to risk finance** aims to overcome possible deficits in the availability of debt and equity finance for research and development and innovation-driven companies, including SMEs.
- **Innovation in SMEs** provides support to all forms of innovation related activities in European SMEs.

Societal Challenges focuses research and innovation from multiple sectors and disciplines on seven societal challenges for Europe and the world:

1. Health, demographic change and well-being
2. Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bio-economy
3. Secure, clean and efficient energy
4. Smart, green and integrated transport
5. Climate action, environment, resource efficiency and raw materials
6. Europe in a changing world - inclusive, innovative and reflective societies
7. Secure societies - protecting freedom and security of Europe and its citizens

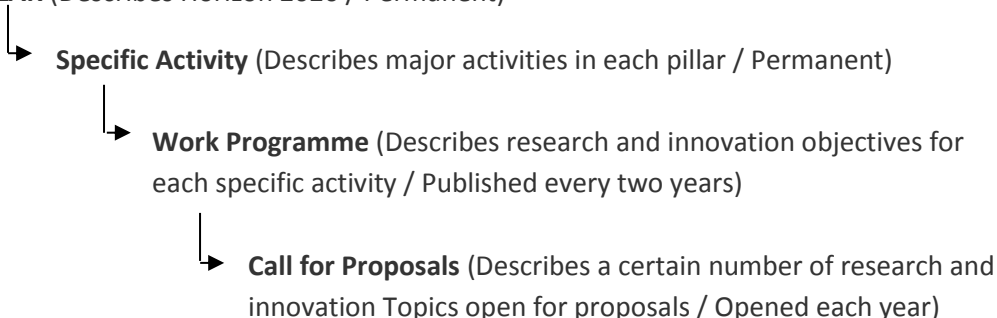
Cross Cutting Activities: For the years 2016-2017 the European Commission has identified a number of *focus areas* for research and innovation that are relevant to many of the subject areas outlined above, and has gathered them under a sole, dedicated Work Programme. For the upcoming years, there is no certainty that a similar Work Programme will be published, and, in case, which will be the priorities it contains. For 2016-2017, cross-cutting focus areas include: Pilots on advanced materials; Factories of the Future (FoF); Sustainable Process Industries (SPIRE); Circular Economy; Internet of Things; Smart and Sustainable Cities.

Targeted Opportunities: Occasionally, the European Commission will publish calls for proposal or topics identified as areas of importance for US-EU cooperation in which it will specifically request proposals with US partners (Please note: this does not mean that funding is available for US).

Work Programmes, Calls for Proposals and Topics

Work programmes are published every two years, and updated yearly. They contain a number of “Calls for Proposals”, divided into a number of more detailed Topics for which the Commission is seeking proposals. Each topic is described indicating its intended “Specific challenge”, “Scope”, “Expected impact”, and “Type of action” (funding instrument). Moreover, the work programme provides information on the amount of funding available and application deadlines.

PILLAR (Describes Horizon 2020 / Permanent)



Any up-to-date information on “open”, “closed” and “forthcoming” call for proposals for all H2020 Work Programmes is available on the Research and Innovation Participant Portal⁵.

Funding Instruments

The Commission uses different funding instruments to support different types of projects or activities. **Funding Instruments** comprise a number of different grant types, and of other supporting measures, such as prizes and public procurement.

In the first pillar, Excellent Science, grants take the form of support to individual researchers for what concerns the ERC and MSCA programmes. All other thematic areas under Pillar I, and those falling under Pillars two and three, more commonly use Research and Innovation Actions (RIA) or Innovation Actions (IA) to support small, medium or large-scale collaborative research and innovation projects; and Coordination and Support Actions (CSA) to support EU policy initiatives or pilot projects. The pillar two and three include also measures to support access to risk finance, Small and Medium Enterprises (SME Instrument) and pre-commercial activities (Fast Track to Innovation). Here below a more detailed description of each instrument’s characteristics.

Research and Innovation Actions (RIA)

Research and Innovation Actions (RIA) support small, medium or large-scale collaborative research and innovation projects aiming to establish new knowledge and/or to explore the feasibility of a new or improved technology, product, process, service or solution. They can finance basic and applied research, technology development and integration, testing and validation on a small-scale prototype in a laboratory or simulated environment. Projects may contain closely connected but limited

⁵ <https://ec.europa.eu/research/participants/portal>

demonstration or pilot activities aiming to show technical feasibility in a near to operational environment.

RIA projects require consortia of three or more organisations located in at least three European Member States or Associated Countries. Beyond this strict minimum, any number of organisations, located anywhere in the world, may participate. The size of a consortium, the size of grant requested and the duration of a proposed project are determined by the consortium members. However, the Commission expects RIA proposals to request on average €2.0-5.0 million for projects that last from 36-48 months. Typically, consortia include five to twenty-five different organisations.

Eligible expenses:

- **Direct Costs** (personnel costs (including benefits) and other direct costs (for travel and events, equipment and consumables). Funding Rate: 100 per cent.
- **Indirect Costs** or overhead costs. Funding Rate: The Commission will contribute 25 per cent of all direct costs (personnel and other) to indirect costs.

Innovation Actions (IA)

Innovation Actions (IA) support activities directly aiming at producing plans and arrangements or designs for new, altered or improved products, processes or services. They may include prototyping, testing, demonstrating, piloting, large-scale product validation and market replication. Projects may include limited research and development activities.

IA projects require consortia of three or more organisations in any sector located in at least three European Member States or Associated Countries. Beyond this strict minimum, any number of organisations, located anywhere in the world, may participate. The size of a consortium, the size of grant requested and the duration of a proposed project are determined by the consortium members. However, the Commission expects IA proposals to request on average €2.0-5.0 million for projects that last from 30-36 months. Typically, consortia include five to twenty-five different organisations.

Eligible expenses:

- **Direct Costs** (personnel costs (including benefits) and other direct costs (for travel and events, equipment and consumables). Funding Rate: 70 per cent for companies, 100 per cent for other legal entities.
- **Indirect Costs** or overhead costs. Funding Rate: The Commission will contribute 25 per cent of all direct costs (personnel and other) to indirect costs.

Coordination and Support Actions (CSA)

Coordination and Support Actions (CSA) are smaller-scale projects designed to facilitate coordination and support for research and innovation activities and / or policies (e.g. networking, information sharing, agenda setting, policy development and communication).

CSA projects require consortia of three or more organisations in any sector located in at least three European Member States or Associated Countries. Beyond this strict minimum, any number of organisations, located anywhere in the world, may participate. The size of a consortium, the size of grant requested and the duration of a proposed project are determined by the consortium members. However, the Commission expects CSA proposals to request on average €0.5-2.0 million for projects that last typically from 12-36 months. Typically, consortia include five to fifteen different organisations.

Eligible expenses:

- **Direct Costs** (personnel costs (including benefits) and other direct costs (for travel and events, equipment and consumables). Funding Rate: 100 per cent.
- **Indirect Costs** or overhead costs. Funding Rate: The Commission will contribute 25 per cent of all direct costs (personnel and other) to indirect costs.

Value Added Taxes are eligible expenses and may be included in these costs.

Participation features

Participation eligibility

Organisations and researchers from around the world, in all sectors, can participate in Horizon 2020 projects. However, eligibility for funding from the European Commission differs by country:

- **Member States:** Organisations and researchers from European Union Member States (MS) and their overseas countries and territories are fully eligible for financial support.
- **Associated Countries:** Associated Countries (AC) are not members of the European Union but make a financial contribution to the Framework Programme equivalent to that of a Member State. Organisations and researchers from Associated Countries are fully eligible for financial support.
- **Third Countries:** Third Countries (TC), like the US, are not members of the European Union and do not contribute financially to the Framework Programme. They are divided into two distinct groups in Horizon 2020.
 - **International Cooperation Partnership Countries:** These are 138 developing countries whose researchers are eligible for varying levels of EC support.
 - **Industrialized Countries:** These are developed countries, like the US, whose researchers are not eligible for EC support except in certain circumstances (see below in paragraph “US Participation Conditions”).

Participation Language

The European Commission has 24 official working languages and all EU citizens have the right to all EC documents in the official working language of their choice. However, to reduce costs, the EC is increasingly trying to operate in English, French or German. Most Framework Programme documents and web pages are produced exclusively in English.

Intellectual Property Rights

The General Grant Agreement for Horizon 2020 projects sets out minimum requirements governing the management of intellectual property. It asserts that each beneficiary owns any background they bring into a project and establishes, as a basic principal, that all beneficiaries should own a fair share of any foreground to which they contributed within a project. Beyond that, it insists only that the participants negotiate and sign a separate Consortium Agreement, between themselves (excluding the EC), to establish what background each brings into a project, the access rights of other participants and specific arrangements governing the ownership of any foreground developed within the project. All beneficiaries, including US covering their own costs, must negotiate and abide by the Consortium Agreement.

US Participation Conditions

US beneficiaries may fall into one of three categories:

1. In most cases, US beneficiaries, as industrialised countries, are not eligible to receive EC contribution and are required to cover the costs they will incur in during the project. In these cases, the European Commission has established standard (invariable) text provisions that may be included to facilitate arrangements. US participant can ask for these provisions to be included as options, through specific articles of the Grant Agreement:

- **Article 9:** Inclusion of the appropriate text will exempt entities not receiving an EC financial contribution from requirements to submit financial reports, certificates on financial statements and financial audits.
- **Article 57.2:** Inclusion of the appropriate text will exempt entities in Third Countries⁶ that do not receive EC financial contribution and cannot, for reasons of domestic law, be subject to foreign courts, from the jurisdiction of the General Court or the Court of Justice of the European Union. Most often, this applies only to Government of US entities. See Annex VI for legal text.

2. For what concerns research cooperation in the Health sector, a special agreement has been signed between NIH and the Health unit of the Directorate General for Research at the European Commission, allowing the funding of all US legal entities involved in projects under Societal Challenge 1 – Health⁷.

3. For all other topics in H2020, if a grant applicant can convincingly demonstrate that without the participation of a US partner the objectives or impact of the proposal cannot be achieved, the EC can allow the US partner to access funding. If you have a US partner who has a specific expertise, a patent, market access or anything that cannot be found within the EU, and that the overall project would be impossible without their participation, then there are the conditions for funding possibility. In these cases, US are subject to the same reporting requirements as all beneficiaries receiving funding from the Commission.

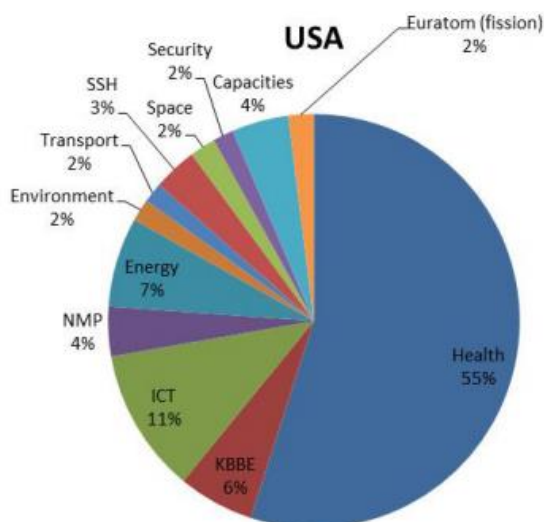
4. US may also participate as “Experts/Members of Advisory Boards” or “Associate Members.” In these cases, US are not beneficiaries and do not sign the Grant Agreement. Rather, other beneficiaries (usually the coordinator) will reimburse them for related travel and accommodation expenses.

⁶ Countries that are neither Member States or Associated Countries of the European Union.

⁷ From the Work Programme “Health”: “In recognition of the opening of the US National Institutes of Health’s programmes to European researchers, any legal entity established in the United States of America is eligible to receive Union funding to support its participation in all topics in calls under the Societal Challenge ‘Health, demographic change and well-being’.”

US Participation Trends

The diagram besides⁸ shows the distribution of US participation to the Seventh Framework Programme, which show 11% of organisations participating in Information and Communication related topics. The US has also been targeted as an important partner for cooperation in the first Horizon2020 work programme (2014-15), with topics encouraging cooperation with US researchers included in areas such as marine and arctic research (notably to implement the Galway declaration and the Transatlantic Ocean Research Alliance), health research, transport (incl. Aeronautics), materials research, raw materials, ICT, energy research and security research.



FP7 statistics (2007-2013)

US applications for 7th Framework Programme grants:

6269 US applicants, 5649 eligible proposals, total requested EU contribution approx. €368.89 million; Among the Third Countries, the US ranks 1st in terms of number of applicants and 2nd in terms of requested EC contribution.

US - United States - most active FP7 research priority areas by number of applications for the research projects						
FP7 priority area	Nr. of applicants	Requested EC contribution by applicants (M euro)	Nr. of mainlisted applicants	Success Rate (applicants)	Requested EC contribution by mainlisted applicants (M euro)	Success Rate (requested EC contribution)
Marie-Curie Actions	3,826	n/a	944	24.67 %	n/a	n/a
Information and Communication Technologies	546	64.42	121	22.16 %	13.76	21.36 %
Health	453	145.90	151	33.33 %	50.86	34.86 %
European Research Council	253	43.19	24	9.49 %	2.46	5.69 %
Food, Agriculture and Fisheries, and Biotechnology	232	28.76	62	26.72 %	5.19	18.05 %
Nanosciences, Nanotechnologies, Materials and new Production Technologies - NMP	166	4.98	50	30.12 %	0.55	11.02 %

⁸ Source: Roadmap for cooperation between the US and the EU. Diagram acronym explanation: NMP=Nanotechnologies, Advanced Materials and Production; SST=Social Sciences and Humanities; KBBE=Knowledge Based Bio-Economy

Signed Grant Agreements/ projects with US participation:

514 US participants in 410 signed grant agreements, with a total EU contribution of 81.96 million euros. Among the Third Countries in all FP7 signed grant agreements, the United States rank 2nd in number of participations and 1st in budget share.

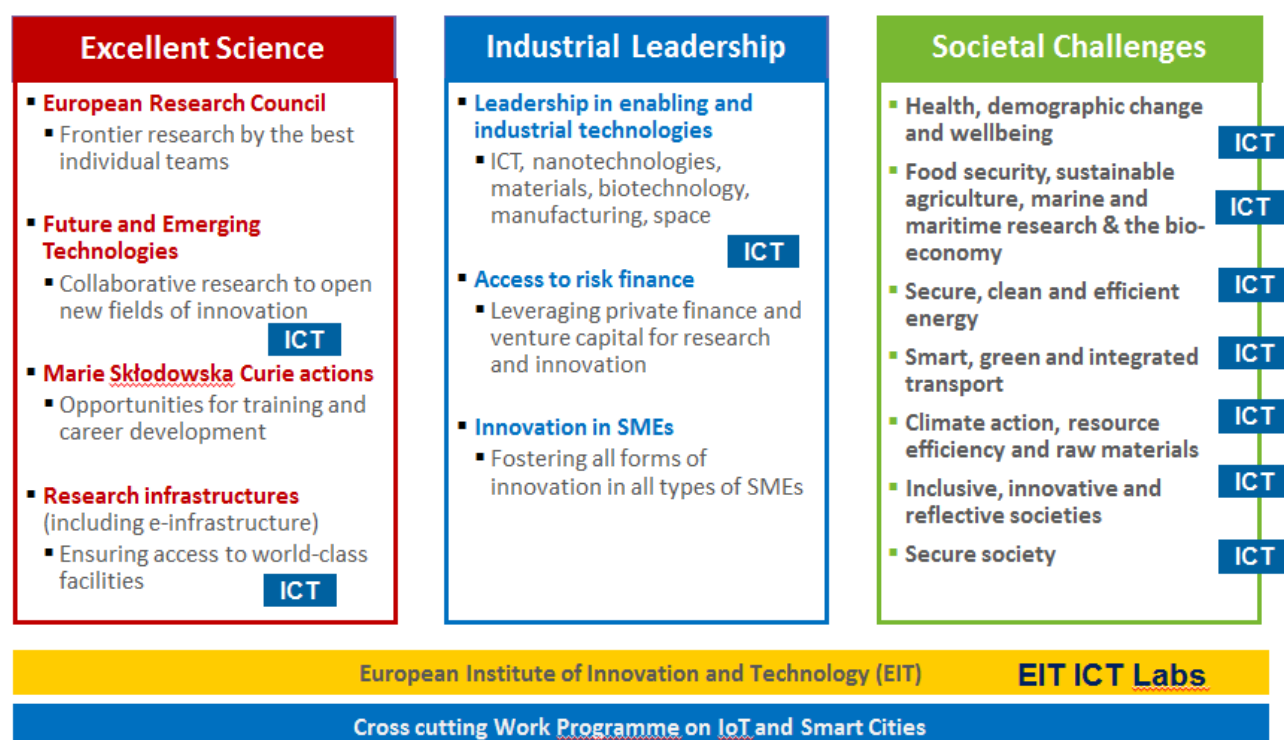
H2020 statistics (from 2014 to spring 2015)*US applications for H2020 grants:*

1. 977 applicants, 911 eligible proposals, with a total requested EU contribution of about 143.96 million euros. The US does not take up the role of coordinator in any EU-funded H2020 project.
2. Top 3 priority areas in terms of participations of United States' organisations :
 - Excellent Science - 765 applications; 103.39 million Euros of requested EU contribution.
 - Societal Challenges - 161 applications; 35.28 million Euros of requested EU contribution.
 - Industrial Leadership - 37 applications; 2.38 million Euros of requested EU contribution.Information and Communication Technologies: 17 applications; 0.85 million of requested EU contribution.
Space: 11 applications; 0.72 million of requested EU contribution.
3. Top 3 action types in terms of applications of United States are:
 - Marie Skłodowska-Curie Actions (MSCA) - 716 applications; 98.36 million Euros of requested EU contribution.
 - Research and Innovation action (RIA) - 206 applications; 39.95 million Euros of requested EU contribution.
 - Coordination and Support Action (CSA) - 24 applications; 2.04 million Euros of requested EU contribution.

Source: European Commission

EU ICT priorities and opportunities in H2020

Information and Communication Technology (ICT) is present in many areas of the EU's funding programme Horizon 2020. The following image shows Information and Communication Technologies components across the different parts of Horizon 2020:



Throughout all three pillars, each work programme comprises call for proposals or defined topics covering specific Information and Communication Technologies aspects. More in particular:

Pillar II, Industrial Leadership, includes a Work Programme specifically dedicated to Information and Communication Technologies. A number of activity lines will target ICT industrial and technological leadership challenges along the whole value chain and cover generic ICT research and innovation agendas, including notably:

- A new generation of components and systems
- Next generation computing
- Future Internet
- Content technologies and information management
- Advanced interfaces and robots
- Micro- and nano-electronics and photonics

Research in this WP also supports core ICT industries through a budget administered by a number of Public Private Partnerships (PPPs). This work contributes to maintaining and developing the technology leading edge in key areas such as electronics, photonics, embedded systems, computing, robotics, big data or network technologies and systems, in which the EU has and should keep major strengths. Public Private Partnerships (PPPs) will be described in the following pages.

Pillar I and III also include topics ad call with ICT components. This cross-cutting dimension of the ICT component throughout H2020, and in particular the application dimension of ICT applied to the seven Societal Challenges, is captured in a **guide** published yearly by the European Commission, which collects all **ICT-related topics in Horizon 2020**⁹.

Summarizing, all ICT related actions supported through those different work programmes cover the full innovation chain, from basic research to market uptake:

- Advanced research to uncover radically new technological possibilities and ICT contributions to upstream research and innovation are addressed in the ‘Excellent science’ part of the work programme, respectively under ‘Future and Emerging Technologies’ and ‘European research infrastructures’ (‘e-Infrastructures’);
- Research and innovation activities on generic ICT technologies either driven by industrial roadmaps or through a bottom up approach are addressed in the ‘Leadership in enabling and industrial technologies’ (LEIT) part of the work programme, within a dedicated ICT Work Programme;
- Multi-disciplinary application-driven research and innovation leveraging ICT to tackle societal challenges are addressed in the different ‘Societal challenges’.
- Activities aiming at supporting innovative SMEs of the ICT sector through the dedicated SME instrument are grouped together with similar activities addressing other scientific and technical fields in a single call of the ‘Innovation in SMEs’ part of the work programme.
- For the years 2016-2017 a specific work programme was created, called “Focus Areas”, collecting cross-cutting activities related to Internet of Things and Smart Cities and Communities.

⁹ For Work Programmes 2016-17 the guide is available at: <https://ec.europa.eu/digital-single-market/en/news/guide-ict-related-activities-horizon-2020>

EU ICT R&I priorities on 5G, Big Data, IoT, CPS and Smart Cities

Advances in technologies such as the Internet of Things (IoT), 5G, cloud computing, data analytics and robotics are transforming products, processes and business models in all sectors, creating new industrial patterns and value chains shifts at the global level. At the European level, but also globally wise, the development of common standards and interoperable solutions represent a crucial priority for the EU, as much as the need of ensuring an even level of digitization across Member States, regions, and different industry sectors, and of filling the gap between large companies and SMEs

With the goal to ensure that the EU is ready for next decades' challenges, the European Commission has launched on 19th April 2016 the first industry-related initiative of the [Digital Single Market](#), the [Digitising European Industry](#) package¹⁰. In order to provide strategic focus to standardisation and interoperability, the Digitising European Industry package identifies five priority areas for standardisation efforts: 5G, Cloud Computing, the Internet of Things (IoT), data technologies, and Cybersecurity. Streamlined cross-sectorial applications of these discovery areas will eventually help progressing in eHealth, smart energy systems, intelligent transport systems and connected vehicles, advanced manufacturing, smart homes and smart cities.

A sustained dialogue among all stakeholders, a reinforced cooperation in ensuring wide availability of technologies in an open and competitive global market and a strengthened international engagement is on the top of European strategic policies. The following chapter will then focus on 5G, Big Data, IoT, Cyber Physical System open opportunities in Horizon 2020, describing the research and innovation stakeholders' ecosystem existing around our priority areas, and the funding streamlines that will be object of Topic Calls during the next Work Programmes for 2018-2020.



The calls that are mentioned at the end of every paragraph can be found in the work programme "Information and communication technologies (ICT) 2016-17"¹¹, and "Cross-cutting activities (Focus Areas) 2016-17"¹².

¹⁰ <https://ec.europa.eu/digital-single-market/en/digitising-european-industry>

¹¹ http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-leit-ict_en.pdf

¹² http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-focus_en.pdf

5G - The "fifth generation" of telecommunications systems

Strategic framework

Within the strategic objective to reinforce the competitiveness of European industry in developing, mastering and shaping the next generation of Internet, [EU investment](#) in the next generation of communication systems, so as pursued under 5G approach, have aimed to achieve a truly converged network environment where wired and wireless communications will use the same infrastructure, driving the future networked society.



A wide range of applications and sectors including professional uses (e.g. assisted driving, eHealth, energy management, possibly safety applications, etc.) will be covered by Horizon 2020 Call for Proposals. Networks and Internet architectures in emerging areas such as [machine-to-machine communication \(M2M\)](#) and the [Internet of Things \(IoT\)](#) will be also of strategic relevance on 5G applications, in order to boost leadership and know-how in the field of ultrafast broadband.

In December 2013 the European ICT industry and the European Commission established the 5G-Infrastructure-Public Private Partnership (5G-PPP): a 1.4 Billion Euro joint initiative, aimed to rethink the infrastructure and to create the next generation of communication networks and services that will provide ubiquitous super-fast connectivity and seamless service delivery in all circumstances. The European Commission has earmarked a public funding of €700 million through the [Horizon 2020 Programme](#) to support this activity.

At the 2015 Mobile World Congress (MWC), the European Commission and Europe's tech industry presented the [EU's vision of 5G technologies and infrastructure](#), followed by different [strategic roadmaps](#) describing the target objectives on 5G of European Industries.

The European Commission has embarked on an ambitious international plan to accelerate global consensus building on 5G. Different bilateral agreements are in the making with more countries willing to contribute to the global "5G vision". Within *4G Americas* a [Memorandum of Understanding](#)¹³ has been signed in 2015, further collaboration with Intel Strategic Research Alliance (ISRA) and NYU Wireless Research Center were also exploited.

Funding opportunities

The 5G related calls for proposals will be organized in three different phases: first research (2014-2015), system optimisation (2016-2017) and large scale trials (2019-2020). They will aim to deploy 5G as from 2020, which will require before 2020 to develop a series of ground-breaking technologies, global standards and above all to agree on relevant spectrum bands.

¹³ <https://5g-ppp.eu/5g-ppp-mou-with-4g-americas/>

In 2014-15 nineteen projects were funded by the European Commission addressing a large diversity of key technological challenges ranging from new radio air interfaces and architectures to core network flexibility based on network virtualisation techniques.

In 2016-17 the challenge is to eliminate the current and anticipated limitations of network infrastructures, by making them capable of supporting a much wider array of requirement than is the current case and with capability of flexibly adapting to different "vertical" application requirements. A particular issue is to leverage work and results of phase 1 (WP 2014-15) and to accelerate on proof of concepts and demonstrators. This validation activity is also expected to be boldly leveraged in the context of the important standardisation (3G PP) and spectrum (WRC 19) milestones that will appear over the implementation period in 2016. It includes interaction with photonic systems as well as new cooperation networking and protocols, notably in the mobility context.

Development and exploitation of academic research through transfer and innovation towards industry with a particular focus on SMEs is an integral part of the challenge.

These are key issues for the competitiveness of the communication industry world-wide are globally researched in the context of future 5G integrated, ubiquitous and ultra-high capacity networks.

Strategic Objectives of "5G" of telecommunications systems: 5G- PPP

The development of new communication networks is dependent on the emergence of globally accepted standards in order to ensure interoperability, economies of scale with affordable cost for system deployment and end users. 5G - PPP aims to have European industry driving the development of 5G standards and to develop and exploit at least 20% of the 5G SEP (standards essential patents).

The following parameters are indicative new network characteristics to be achieved at an operational level:

- Providing 1000 times higher wireless area capacity and more varied service capabilities compared to 2010.
- Saving up to 90% of energy per service provided. The main focus will be in mobile
- Communication networks where the dominating energy consumption comes from the radio access network.
- Reducing the average service creation time cycle from 90 hours to 90 minutes.
- Creating a secure, reliable and dependable Internet with a "zero perceived" downtime for services provision.
- Facilitating very dense deployments of wireless communication links to connect over 7 trillion wireless devices serving over 7 billion people.
- Enabling advanced user controlled privacy.

This new high-performance network will be operated via a scalable management framework enabling fast deployment of novel applications, including sensor based applications, with reduction of the network management opex by at least 20% compared to today.

In addition, new lightweight but robust security and authentication metrics suitable for a new era of pervasive multi domain virtualised networks and services will have to be provided.

Call for Proposals:

- ICT-07-2017: 5G PPP Research and Validation of critical technologies and systems (Deadline: 08/11/16)
- ICT-08-2017: 5G PPP Convergent Technologies (Deadline: 08/11/16)
- ICT-09-2017: Networking research beyond 5G (Deadline: 08/11/16)

Big Data

Strategic framework

A recent study commissioned by demoseUROPA¹⁴ estimates that Big and Open Data will contribute to an additional EU-28 GDP of 206 billion € by the year 2020, with a profound societal impact in almost all sector of applications.



Advancements among key industrial ecosystems such as the data value chain are strategic objectives outlined in the [Communication](#) adopted in July 2014, drawing on the prospects offered by Big Data technologies, as well as the [Public Sector Information \(PSI\) directive](#). The overall aim is to provide professionals and citizens with new tools to create, access, exploit, preserve and re- use all forms of digital content in any language and to model, analyse and visualise vast amounts of data (big data), including linked data.

In order to sustain the Big Data growth, Europe needs to foster, strengthen and support the development and wide adoption of Big Data Value technologies, successful use cases and data-driven business models. At the same time, it is necessary to deal with many different aspects of an increasingly complex landscape, such as i. Skills development, ii. Business Models and Ecosystems, iii. Policy, Regulation and Standardization, iv. Social perceptions and societal implications.

To achieve these goals, the **European contractual Public Private Partnership on Big Data Value (BDV PPP)** was signed on 13 October 2014. The European Commission and Europe's data industry have committed to invest €2.5 billion in a public-private partnership (PPP) that aims to strengthen the data sector and put Europe at the forefront of the global data race. The EU has earmarked over €500 million of investment over 5 years (2016-2020) from Horizon 2020 which private partners are expected to match at least four times over (€2 billion).

The BDV PPP has outlined [the Big Data Value Strategic Research and Innovation Agenda \(BDV SRIA\)](#), which defines the overall goals, main technical and non-technical priorities, and a research and innovation roadmap by 2020.

Funding opportunities

The strategy on Big Data outlined above will rely on a coordinated action plan involving Member States and the EU so as to guarantee the necessary scope and scale of the activities. The envisaged actions will result in:

- support "lighthouse" data initiatives capable of improving competitiveness, quality of public services and citizen's life;

¹⁴"Big and open data in Europe A growth engine or a missed opportunity?" Warsaw Institute for Economic Studies (WISE Institute), 2014

- develop enabling technologies, underlying infrastructures and skills, particularly to the benefit of SMEs;
- extensively share, use and develop its public data resources and research data infrastructures;
- focus public R&I on technological, legal and other bottlenecks;
- make sure that the relevant legal framework and the policies are data-friendly;
- accelerate the digitisation of public administration and services to increase their efficiency, and use public procurement to bring the results of data technologies to the market.

These results will be achieved by a comprehensive strategy to overcome technical challenges related to:

- *Data Management*, engineering the management of data;
- *Data Processing Architectures*, optimized architectures for analytics both data at rest and in motion with low latency delivering real-time analytics;
- *Deep Analytics*, deep analytics to improve data understanding, deep learning, meaningfulness of data;
- *Data Protection and Preservation Mechanism*, to make data owners comfortable about sharing data in an experimental setting; *Data Visualization and User Experience*, to enable intelligent visualization of complex information relying on enhanced user experience and usability.

Call for Proposals:

- ICT-14-2016-2017: Big Data PPP: cross-sectorial and cross-lingual data integration and experimentation (Deadline: 25/04/2017)
- ICT-15-2016-2017: Big Data PPP: Large Scale Pilot actions in sectors best benefitting from data-driven innovation (Deadline: 25/04/2017)
- ICT-16-2017: Big data PPP: research addressing main technology challenges of the data economy (Deadline: 25/04/2017)
- ICT-17-2016-2017: Big data PPP: Support, industrial skills, benchmarking and evaluation (Deadline: 25/04/2017)

Internet of Things (IoT)

Strategic framework

According to a [recent European Commission study](#), the generating market value of the IoT in the EU is expected to exceed one trillion euros in 2020. The [Digital Single Market](#) (DSM), adopted in May 2015, leads Europe a step further in accelerating developments on IoT. The DSM consolidates initiatives on security and [data protection](#), which are essential for the adoption of this technology. Most importantly, it announces an initiative on the Data economy (free flow of data, allocation of liability, ownership, interoperability, usability and access) and promises to tackle interoperability and standardisation.



Technical requirements will be fostered and enhanced, such as: i. a smaller, lighter, more power-efficient and cheaper hardware; ii. More intelligent sensors and actuators; iii. New platforms; vi. Ubiquitous wireless connectivity; v. available data analytics tools. The requirements of IoT will also be fed into the research on empowering [network technologies](#), like [5G Mobiles](#). [FIWARE](#) will be one of the platforms to support building blocks useful for IoT applications, while [Cloud Computing](#) will provide objects with service and storage resources. On the application side, initiatives like Sensing Enterprise and [Factory of the Future](#) help companies use the technology to innovate, while experimental facilities like [FIRE](#) are available for large-scale testing.

In 2014 it was established the [IERC-Internet of Things European Research Cluster](#), which groups together the [IoT projects](#) funded by the European research framework programs, as well as national

IoT initiatives.

In March 2015 the European Commission initiated the creation of the [Alliance for Internet of Things Innovation \(AIOTI\)](#), in order to develop and support the dialogue and interaction among [the Internet of Things \(IoT\)](#) various players in Europe. The overall goal of the AIOTI is the creation of a dynamic European IoT ecosystem to unleash the potentials of the IoT. This ecosystem is going to build on the work of the [IoT Research Cluster \(IERC\)](#) and spill over innovation across industries and business sectors of IoT transforming ideas into solutions and business models. The Alliance will also assist the European Commission in the preparation of future IoT research as well as innovation and standardisation policies. On last 19th April 2016 a [staff working document on the Internet of Things](#) was also published by the European Commission, accompanying the Communication “Digitising European Industry - Reaping the full benefits of a Digital Single Market”, with specific provision of further measures to advancing the Internet of Things in Europe.

The IERC Cluster provides its own Strategic Research and Innovation Agenda (SRIA), in order to highlight the main research topics that are associated with the development of IoT enabling technologies, infrastructures and applications with an outlook towards 2020. In 2015 an updated SRIA “[Internet of Things beyond the Hype: Research, Innovation and Deployment](#)” was developed. A new version will be provided each year with the support of the European-led community of interrelated projects and their stakeholders.

Funding Opportunities

The important investments on Internet of Things technologies which have already been taken at EU and Member States levels, reveals the next big step towards implementation of large scale pilots.

In 2016, the European Commission launched a [series of IoT large scale pilots](#), with a budget between 15 M euros to 30 M euros each and supported by [Horizon 2020](#), in the following domains: Smart living environments for ageing well; Smart Farming and Food Security; Wearables for smart ecosystems; Reference zones in EU cities; Autonomous vehicles in a connected environment

The five pilots will deliver IoT practical solutions in terms of applicable technology and standards, privacy and security, business models as well as usability. The pilots should also serve to deduce methodologies to assess privacy and security impacts of IoT. The five Large Scale Pilots, to be implemented during 2016 and 2020, will involve all value-chain actors, address business model validation and standardization, address user validation and acceptability and will serve as up-scaling of open platforms like FI-Ware¹⁵, CRYSTAL¹⁶, UniversAAL¹⁷.

Call for Proposals

- IoT-03-2017: R&I on IoT integration and platforms (Deadline: 25/04/2017)

Cyber Physical Systems (CPS)

Strategic Framework

With a 410 billion market and 4 million jobs worldwide of which one quarter in Europe, cyber-physical systems heavily depend on the availability of technologies, which allow to interact with the physical world as well as process on a local and global scale. With the emergence of [high speed broadband](#) and the [Internet of Things \(IoT\)](#), the embedded systems bring intelligence to objects, devices and other artefacts. In the future



¹⁵ www.fiware.org

¹⁶ www.crystal-artemis.eu

¹⁷ <http://universaal.sintef9013.com/entry>

world of cyber physical systems, a huge number of devices connected to the physical world will be able to exchange data with each another, access web services, and interact with people.

It is therefore the rapid improvements in fields related to these technologies in the recent decades – embedded computing, communication, sensors and actuators, and informatics and control – that will made the development of cyber-physical systems pivotal for wide solutions in different domains, such as smart transportation, smart energy, smart health, smart production, smart cities. The European Commission supports the digitisation of European industry through policy actions and through research and innovation mainly in industrial manufacturing, automotive, aerospace, safety critical applications, including also the traditional “low-tech” industries like agriculture or construction.

To achieve these goals, different stakeholders representative mechanisms have been created with the aim of advising the European Commission on the main paths and most crucial research and innovation priorities to be explored. One of the most relevant and active in the field of Embedded Intelligent Systems, established in 2004, is the [Artemis Industry Association](#)¹⁸, supporting industry and academia collaboration. Artemis IA, in 2015 and 2016 has undertaken a major joint exercise with other industrial representative bodies such as AENEAS¹⁹ and EPoSS²⁰ to draw up the ECSEL (Electronic Components and Systems Joint Undertaking)²¹ Multi-Annual Strategic Research and Innovation Agenda ([MASRIA 2016](#)²²), representing the major research and innovation priorities in the fields of micro/nano-electronics, smart integrated systems and embedded/cyber-physical systems. Artemis has also developed its own [Strategic Research Agenda 2016](#) highlighting cyber-physical systems technology developments, as a basis for embedded intelligence and major enabler of the Digital transformation and for the ‘Digitisation of Industry’.

Roadmap and orientation initiatives in this field are supported also by EU-funded projects. The [CyPhERS](#) project ([Cyber-Physical European Roadmap and Strategy](#)), launched in mid-2015, aims to develop a European strategic research and innovation agenda for cyber-physical systems (CPS) to ensure Europe's competitiveness in this emerging field; while [Road2CPS](#) project is aimed to carry out strategic action for future CPS through roadmaps, impact multiplications and constituency building. Finally, the [CPS Summit](#) project, launched in 2015 and ending in July 2016, aims, mainly through the organisation of a big event, at facilitating an enduring and sustainable collaboration on CPS research and development between Europe and the US.

Funding Opportunities

In this context, research and innovation projects in the “Computing” and “CPS” areas are meant to contribute to two main pillars of the “Leadership in Digital Industry” strategy, which are (1) digital platforms for industry and (2) innovation hubs for the widespread adoption of digital technologies. As an answer to these two challenges, the European Commission proposes the creation of a ‘[Smart Anything Everywhere](#)’ Initiative (SAE). The SAE will build an ecosystems based on collaboration between researchers, large industries and SMEs across the complete value chain in a large number of small experiments facilitated by Europe's leading competence centres.

A first group of four projects (funded through [Horizon 2020](#) Innovation Actions) will make available EUR 25 mln to support around 100 experiments with the aim of involving more than 200 SMEs and

¹⁸ ARTEMIS IA, <https://artemis-ia.eu>. Active in the field of embedded/cyber-physical systems.

¹⁹ AENEAS, www.aeneas-office.eu. Active in the field of micro and nanoelectronics enabled components and systems.

²⁰ EPoSS, www.smart-systems-integration.org. Active in the field of systems integration.

²¹ ECSEL JU, www.ecsel-ju.eu. Public-private initiative active in the field of Electronic Components and Systems.

²² ECSEL JU MASRIA 2016, <https://artemis-ia.eu/publication/download/masria-2016.pdf>

midcaps in the field of Cyber-Physical Systems (CPS), Internet of Things (IoT) and Smart Systems Integration (SSI).

Call for Proposals

- ICT-04-2017: Smart Anything Everywhere Initiative (Deadline: 08/11/2016)

Besides H2020 programmes and opportunities, a number of additional funding opportunities are available through the public-private initiatives mentioned in the paragraph above. [ECSEL JU](#) – unlike H2020 which is more focused on CPS research – finances mostly large scale federating projects and integrated demonstrations and pilots. The EUREKA Cluster programme and its related initiative [ITEA](#), provide additional opportunities in the area of innovative, industry-driven, pre-competitive R&D projects in the area of Software-intensive Systems & Services (SiSS). For these programmes US participants are excluded from funding but not from participation.

Smart Cities

Strategic Framework

With Europe 2020, a comprehensive strategy has been put forward to foster smart, inclusive and sustainable growth in Europe and to provide a framework for the European Union to emerge strengthened from the current financial and economic crisis. Through the Smart Cities and Communities - European Innovation Partnership [COM\(2012\)4701 of 10 July 2012](#),



the European Commission has initiated the European Innovation Partnership (EIP SCC) that will bring together European cities, industry leaders, and representatives of civil society to smarten up Europe's urban areas. The [Smart Cities and Communities European Innovation Partnership \(EIP SCC\)](#) is a partnership across the areas of energy, transport and information and communication with the objective to catalyse progress in areas where energy production, distribution and use; mobility and transport; and information and communication technologies (ICT) will offer new interdisciplinary opportunities for better public services for citizens, better use of resources and less impact on the environment.

So far, the European Innovation Partnership (EIP) on Smart Cities and Communities has received several commitments, which involve more than 4.700 partners across 31 countries Europe, to fund and develop smart solutions in the areas of energy, ICT and transport. The EIP SCC is organized in six Action Clusters focus on specific issues related to smart cities: 1. Sustainable Districts and Built Environment; 2. Sustainable Urban Mobility; 3. Integrated Infrastructures & Processes; 4. Business Models, Finance and Procurement; 5. Citizen Focus; 6. Integrated Planning, Policy & Regulations.

Every year the EIP-SCC defined the key priorities in terms of collaboration among cities, industry and other key partners. In 2016 the [EIP-SCC Roadmap 2016](#) "Supporting smarter European cities: better quality of life, growth, jobs and decarbonisation" identifies defined targets and actions to be performed during the course of the year.

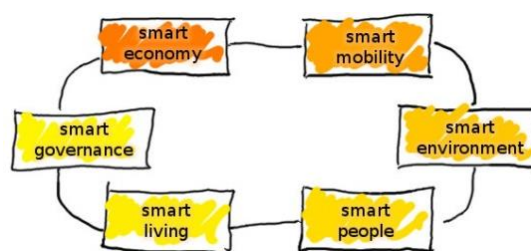
There are also other key initiatives and networks at European level which complement the broader approach to urban development supported by EU regional policy. These include, but are not limited to: [Smart Cities Information System](#); [CIVITAS](#); [Covenant of Mayors](#); [EUROCITIES](#), the network of major European cities; European Institute of Innovation & Technology – Knowledge and Innovation Communities ([Climate-KIC](#) and [KIC InnoEnergy](#)); [ERRIN](#) European Regions Research and Innovation Network; [POLIS](#) Network; [Energy Cities](#).

Funding Opportunities

The initiative will benefit from the European Commission's Horizon 2020 pilot lines to rebalance its financing support towards product demonstration activities, prototyping and products validation.

Lighthouse projects will tackle issues at the intersection of the transport, energy and ICT sectors.

The projects should trigger strategic partnerships of innovation-driven companies in order to foster the development of smarter urban transport networks, upgraded water supply and waste disposal facilities, and more efficient ways to light and heat buildings. The lighthouse projects will also encompasses a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population.



Call for Proposals

- SCC-1-2016-2017: Smart Cities and Communities lighthouse projects (Deadline: 14/02/17)
- SCC-02-2016-2017: Demonstrating innovative nature-based solutions in cities (Deadline: 07/03/17; 05/09/17)

Besides H2020 opportunities and in topic of Smart services, it is worth mentioning the funding opportunities falling under the AAL²³ (Ambien Assisted Living) initiative, a Member States' led association that addresses the challenge of ageing population through funding projects aiming at creating better conditions of life for the older adults through the use of information and communication technology (ICT). In particular, in 2016, AAL has launched a Challenge Prize of 50.000 on Internet of Things (IoT) applications to empower older adults to achieve the quality of life they aspire to.

Normally AAL funds projects through one call per year, launched in the period of time between February and March. Eligible for funding are only organisations that are explicitly included in the national eligibility criteria, available in the Annex of the Guide for Applicants for each call. In addition, the project may eventually include organisations that are not requesting funding, organisations that are not eligible for funding according to national eligibility rules, or organisations not residing in any AAL Partner State.

²³ www.aal-europe.eu

Other ICT opportunities

Photonics

Photonics research and innovation activities are defined according to the photonics public private partnership (PPP). The European Technology Platform [Photonics 21](#), founded in 2005, represents more than 2500 members in industry as well as research organisations acting in the field of photonics in Europe.



In November 2013 Photonics21 was invited to form such a Photonics Public Private Partnership. The European Commission has earmarked around €700 million for the photonics PPP in Horizon 2020. The photonics industry will invest at least €2,800 million in activities related to PPP objectives. As one of six Key Enabling Technologies (KET's), Photonics plays a major role for driving growth and employment in Europe and contributes to solve the major societal challenges such as aging society, energy efficiency, inclusion and smart living.

A seven years [Multiannual Strategic Roadmap 'Towards 2020 – Photonics Driving Economic Growth in Europe'](#) underpins the proposed activities of this Key Enabling Technology of growing photonics manufacturing and employment and act as a basis of the Public Private Partnership.

Setting photonics research and innovation priorities for the Horizon 2020 lies in the heart of the Photonics Public Private Partnership tasks. The Photonics21 Work Groups started the process to discuss about and define the photonics research and innovation [priorities for Horizon 2020 Work Programme 2018 - 2020](#).

Specific activities will be launched in order to enhance the further potential for innovation and value creation and for job creation in many industrial sectors and in solutions addressing major societal challenges such as health and well-being, energy efficiency or safety. Identified actions will be activated to better exploit the innovation capacity of the photonics SMEs and the innovation leverage potential of the innovation clusters and national platforms.

Call for Proposals

- ICT-30-2017: Photonics KET 2017 (Deadline: 25/04/2017)
- ICT-31-2017: Micro- and nanoelectronics technologies(Deadline: 25/04/2017)

Robotics

The partnership for robotics in Europe, [SPARC](#) aims to make available European robots in factories, in the air, on land, under water, for agriculture, health, rescue services, and in many other applications in Europe which have an economic and societal impact. It was launched in 2014 by the joint public-private partnership (PPP) between the European Commission and the robotics industry and academia, associate members within euRobotics. Investments under this joint initiative are expected to reach 2.8 billion euro with 700 million euro in financial investments coming from the European Commission under Horizon 2020 over 7 years.



The outcomes of the consultations between the different parties within the PPP SPARC resulted in a [Strategic Research Agenda for Robotics in Europe](#) (SRA), integrated into the Horizon 2020 work

programmes. The SRA provides a high level strategic overview of the European robotics community, and it is complemented by the [multi-annual roadmap](#) (MAR). The roadmap is a more detailed technical guide identifying expected progress. It provides an analysis of the medium term research and innovation goals for the robotics community, including also the legal aspects.

The members of euRobotics work in topic groups spanning across different domains, and in particular agriculture, healthcare, manufacturing, consumer, civil, commercial logistic & transport.

The multi annual roadmap has defined specific targets from 2016 to 2020 related to the different domains explained above as well as for system ability - adaptability, cognitive ability, configurability, decisional autonomy, dependability, interaction ability, manipulation ability, motion ability and perception ability – and technologies, which are divided into clusters each characterized by a purpose: i. Systems Development - better systems and tools; ii. Human Robot Interaction -better interaction; iii. Mechatronics -making better machines; iv. Perception, Navigation and Cognition- Better action and awareness.

Call for Proposals

- ICT-25-2016-2017: Advanced robot capabilities research and take-up (Deadline: 25/04/2017)
- ICT-27-2017: System abilities, SME & benchmarking actions, safety certification (Deadline: 25/04/2017)
- ICT-28-2017: Robotics Competition, coordination and support (Deadline: 25/04/2017)

Cloud Computing

Cloud Computing was at the forefront of European Commission strategies during the last years. Through several EC communications from 2012 to 2014, the European Commission as continuously shown commitment to research and innovation under Horizon 2020 on long term challenges specific to cloud computing, such as the [Unleashing the potential of cloud computing in Europe](#) COM(2012)529 of 27 September 2012 and the [Towards a thriving data-driven economy](#) COM(2014)442 of 2 July 2014.

In the last 4 years and a total value of over 100m€, more than 70 projects were supported through the previous Seventh Framework Programme and the current Horizon 2020 programme. The critical mass around these projects collaborates collectively on common themes through the organisation into clusters, with the aim to develop their strategies to get digital products onto the market. [Four clusters](#) were identified in: i. Software Engineering for Services and Applications; ii. Inter-cloud Challenges, Expectations and Issues; iii. New Approaches for Infrastructure Services; iv. Data Protection, Security and Privacy in the Cloud. Future R&I actions under H2020 will address the optimal use and configuration of cloud computing solutions for data analytics and advanced infrastructures and services. The new strategies and opportunities will be defined according to the [Cloud Select Industry Group](#) (CSIG), composed of representatives from European and multinational industry, public administrations and other.

In 2016 the European Commission launched the "[European Cloud Initiative – Building a competitive data and knowledge economy in Europe](#)", as part of the package of measures for [Digitising European industry](#), with the aim to strengthen Europe's position in data-driven innovation, improve its competitiveness and cohesion, and help create a [Digital Single Market](#) in Europe. A [European Open Science Cloud](#) (EOSC) will offer Europe's 1.7 million researchers and 70 million science and technology

professionals a virtual environment to store, share and re-use the large volumes of information generated by the big data revolution. This will be underpinned by the [European Data Infrastructure](#) (EDI), deploying the high-bandwidth networks and the supercomputing capacity necessary to effectively access and process large datasets stored in the Cloud. Focusing initially on the scientific community, the user base will over time be enlarged to the public sector and to industry.

Calls for Proposals

- ICT-05-2017: Customised and low energy computing (Deadline: 25/04/2017)

Content Technologies

Developments related to content creation, distribution, access, retrieval and interaction offer a number of opportunities and challenges for the media and creative industries. This was underlined by the European Commission through the [Promoting cultural and creative sectors for growth and jobs in the EU](#) COM(2012)537 of 26 September 2012, where content technologies were described as untapped resource for the EU 2020 strategy. Horizon 2020 supports R & I activities in the field, in order to develop new tools to model, analyse, and visualise vast amounts of data from which to extract more value; to make an intelligent use of data coming from different sources and to create, access, exploit; and to re-use all forms of digital content in any language on any device.

Several fields can be described as opportunities and challenges for the next research and innovation activities, such as personalisation, accessibility and inclusion and with specific relevance to: *Big Data* - multilingual data products and services and scalability and responsiveness of analytics capabilities; *Content convergence* user generated content rights, real time rights management, orphan work rights, conditional access throughout different networks; *Machine translation* in order to overcome barriers to multilingual online communication; *Media convergence and social media*, support dedicated to the adoption and deployment of innovative ICT solutions by and for the creative industries SMEs, from the content side (e.g. 3D, augmented reality technologies, real time media), and from the user context (relevant community feedback, context-centric); *Technologies for better human learning and teaching* including formal and informal learning and advanced gaming/gamification in professional, educational and other non-leisure context; *Multimodal and natural human-computer interaction* to make smarter interfaces for a multimodal, inter-cultural, verbal and non-verbal communication.

Call for Proposals

- ICT-19-2017: Media and content convergence (Deadline: 25/04/2017)
- ICT-20-2017: Tools for smart digital content in the creative industries (Deadline: 25/04/2017)
- ICT-23-2017: Interfaces for accessibility (Deadline: 25/04/2017)

Micro-nano-electronics

Since 2007, the EU has invested EUR 450 million in more than [110 projects](#) related to micro- and nanoelectronics, smart embedded components and systems, contributing to the progress of miniaturisation (More Moore) and improved functionality (More than Moore) at an affordable cost. [More efficient electrical cars](#), [smart textiles](#), [revolutionary health devices](#) and many more are just

some examples of results achieved with micro and nano-electronics technologies. In order for Europe to stay at the forefront in the design and manufacturing of these technologies and to provide benefits across the economy, the European Commission adopted on May 23rd 2013 a '[European strategy for micro- and nano-electronics components and systems](#)', identifying as part of the [Key Enabling Technologies](#) (KETs) – the drivers of the development of digital goods – can open important new possibilities for Europe's growth and industrial competitiveness, create new jobs and usher in new products and services.

On 30 June 2014, the [Electronic Leaders Group](#) (ELG) submitted to Vice President Kroes the Implementation Plan of the [European Industrial Strategic Roadmap](#), which defined the key priorities and initiatives to be promoted.

The policy on micro- and nano-electronics is implemented in close cooperation with the [ECSEL Joint Undertaking](#), Joint Technology Initiative to support R&D&I actions in micro and nano-electronics, advancement in the state-of-the-art of the technologies and their manufacturing towards market-readiness ECSEL JU is supported through Horizon 2020 budget but it can be considered a different programme from Horizon 2020. Beside the [Electronic Leaders Group](#) (ELG) inputs on key priorities came from [ENEAS](#), the Association, established in 2006, in the field of micro and nano-electronics enabled components and systems and part of ECSEL JU.

Call for Proposals

- In 2016 the European Commission launched within Horizon 2020 the [Call for Proposal ICT-31-2017: Micro- and nanoelectronics technologies](#), with deadline 25th April 2017 with the purpose to prepare for the future of the electronics industry the next wave of industry-relevant technologies to extend the limits (technological and/or economic) mainstream technologies will be facing in the medium term. This specific Call for Proposal will foster the development of new approaches to scale functional performance of information processing and storage and the 3D sequential integration (at transistor scale) possibly mixed with 3D parallel integration (at circuit level) for system solutions to increase functionalities and capabilities. International cooperation with clear EU industrial benefits may be considered preferably with nations such as **US**, Japan, South Korea and Taiwan.

System integration

In the area of systemic integration, different R&I projects were funded through the Seventh Framework Programme and the current Horizon 2020, with specific targets related to [Embedded Systems](#) (ES), [Systems-of-Systems](#) (SoS) and [Monitoring and Control](#) (M&C).



EPoSS

European Technology Platform
on Smart Systems Integration

The European critical mass related to system integration is represented by [EPoSS](#), the European Technology Platform on Smart Systems Integration, who define R&D and innovation needs as well as policy requirements related to Smart Systems Integration and integrated Micro- and Nanosystems, through the definition of the [Strategic Research Agenda](#), which correspond to the main consultation mechanism for the European Commission in the theme.

EPoSS represents the Smart Systems community in the ECSEL JU and collaborate within [Artemis Industry Association](#) in Embedded Intelligent Systems, for the definition of the strategic priorities for the next years.

In the field of Cyber-Physical Systems (CPS), Internet of Things (IoT) and Smart Systems Integration (SSI), the European Commission launched in 2015 the [Smart Anything Everywhere initiative \(SAE\)](#), supporting product and service innovation through digital technologies. Clustered in four projects with a total budget of 25M€, 23 of Europe's leading competence centres in the components and systems value chain across 11 Member States started from January 2015 to support 100 user-supplier experiments with 200 SMEs and mid-caps.

Call for Proposals

- ICT-04-2017: Smart Anything Everywhere Initiative (Deadline: 08/11/2016)

Future Internet

Research projects funded by the European Commission are spearheading future networks which are fast, flexible and ever-responsive to demands from both humans and machines. European ecosystem around future internet evolved as the main critical mass



that it is represented. As primary actor in Future Internet, [NETWORLD2020](#), the European Technology Platform for communications networks and services, develops position papers on technological, research-oriented and societal issues, in order to strengthen Europe's leadership in networking technology and services. During Seventh Framework Programme the [Future Internet Public Private Partnership \(FI PPP\)](#), born in 2010, launched three different phases of implementation: Phase 1, from 2011-12, with a budget of 90 million euros, focused on laying the technology foundation, defining "use case scenarios" in different industry sectors and making an inventory of available (public) infrastructures via capacity building; Phase 2, from 2013-14, with a budget of 80 million euros, focused on developing use case pilots and platforms and setting up infrastructures; Phase 3, from 2014-16, with a budget of 130 million euros, focused on the expansion of the previous use cases by developing applications and services and extending the technology foundation by the involvement of SMEs and web entrepreneurs in order to foster the take-up of innovative Internet services and applications.

To this purpose a new initiative was launched in 2014, [FIWARE Accelerator Programme](#) which promotes the take up of FIWARE technologies among solution integrators and application developers, with special focus on SMEs and start-ups in the following domains: smart cities, eHealth, Transport, Energy and Environment, Agrifood, Media and Content, Manufacturing and Logistics, Social and Learning. FIWARE embraced also worldwide links through the specific [FIWARE Mundus](#) with the overall objective to define a long-term vision of FIWARE technologies and business models taking into account similar research and innovation schemes coming from other countries such the United States of America.

In order to testing the ground for new ideas the European Commission launched in 2010 the [FIRE – Future Internet Research and Experimentation \(FIRE\) testbeds](#), which offers cutting edge test facilities in different vertical segments, including 5G, Smart Cities, Manufacturing, eHealth, etc., to experiment with networks, infrastructures and tools in a multidisciplinary test environment.

Social innovation is also part of European Commission key strategies, who define a line of different funding schemes to harness the collaborative power of ICT networks in order to create collective

awareness of sustainability threats and enable collective solutions through the [Collective Awareness Platforms for Sustainability and Social Innovation \(CAPS\)](#).

Collective awareness platforms include several areas, such as collaborative consumption, getting facts/evidence from citizens for better decision making, driving sustainable behaviours and lifestyles, or developing alternative collaborative approaches to problem solving.

On 27 June the Electronic Components and Systems for European Leadership (ECSEL JU) public private partnership came into existence – in less than a year from the Commission Proposal. All preparatory steps to launch a Call for Proposals have been taken. The [Multi-Annual Strategic Plan](#) has been approved on 30 June.

Call for Proposals

- ICT-11-2017: Collective Awareness Platforms for Sustainability and Social Innovation (Deadline: 25/04/2017)

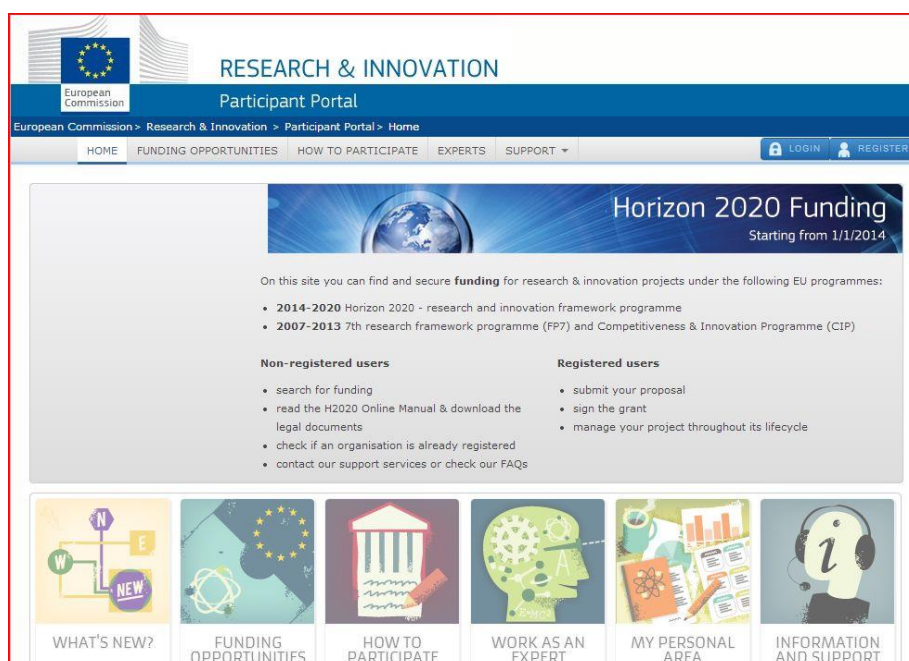
Key information and gateways to the EU-US Cooperation

The European Commission and USA partner organisations in the academic, private and public sectors have launched joint initiatives to advise and assist US researchers and organisations seeking opportunities for international partnerships in Horizon 2020 related to the specific theme of Information and Communication Technologies. Each initiative offers a range of services for different types of organisations.

Research and Innovation Participant Portal

<http://ec.europa.eu/research/participants/portal/desktop/en/home.html>

The Research and Innovation Participant Portal is the main gateway to Horizon 2020 programme. It is a user-friendly platform that will help proposers on finding support services, necessary documents and more funding opportunities for their project ideas. It has both public and secure sections. In the public section you will find:



- **Funding Opportunities:** Find all Horizon 2020 calls for proposal described in detail, including a description of each specific research topic for which proposals are sought and downloadable “call documents” including the relevant Work Programme and other information for applicants. Topics/open calls are searchable by status (open or closed or forthcoming), title (keyword), research area, publication date and deadline date as well as by the cross cutting priorities addressed.
- **How to Participate:** Download all or sections of the **Model Grant Agreement** in section *Reference Documents*, as well as all official documents establishing and governing the Framework Programme or Access the comprehensive guidelines for Beneficiary Register your organisation, provide a Financial Viability Self-Check or be informed about the opportunities and specific guidelines for SME participation
- **Expert Database:** Register as an expert evaluator for Horizon 2020
- **Support:** Access the comprehensive **H2020 Online Manual** that describes how to find a call, find a partner, create an account, register an organisation, prepare and submit a proposal. Find links to the Horizon 2020 Helpdesk, the IT Helpdesk, a Glossary of terms and FAQs as well as links to support organisations such as Horizon 2020 National Contact Points (NCPs) and the Enterprise Europe Network (EEN). For more information on NCP and EEN see below.

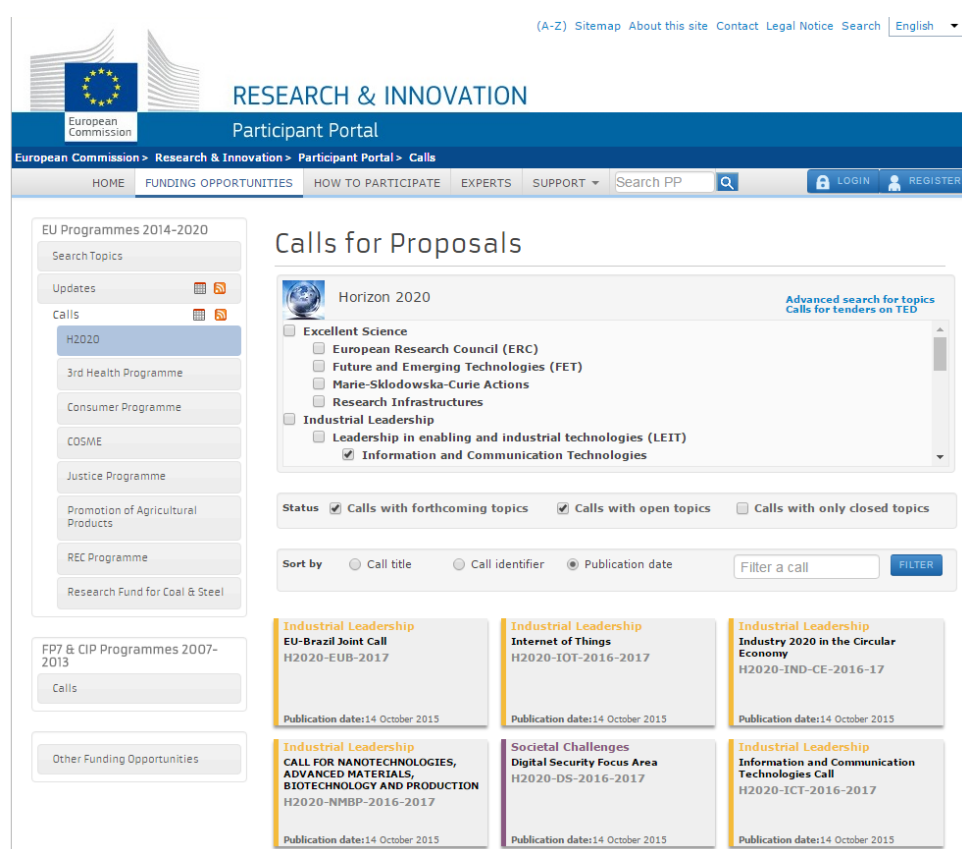
The secure area of the Participant Portal is where organisations establish their accounts with the European Commission, where they register, where they can submit proposals and where projects are managed (from submission forms to scientific and financial reports, everything is submitted electronically). The first step towards participating in a Horizon 2020 project is to open an account and ensure that your organisation is registered.

Using the Research and Innovation Participant Portal

Finding a Call for Proposals / Research Topic

The Research and Innovation Participant Portal, provides two ways for researchers and innovators to find Calls for Proposals and Topics of interest.

Search Calls for Proposals



The screenshot shows the 'Research & Innovation Participant Portal' interface. The top navigation bar includes links for (A-Z), Sitemap, About this site, Contact, Legal Notice, Search, and a language dropdown set to English. The main header features the European Commission logo and the text 'RESEARCH & INNOVATION Participant Portal'. Below this is a breadcrumb trail: 'European Commission > Research & Innovation > Participant Portal > Calls'. The main navigation bar includes links for HOME, FUNDING OPPORTUNITIES, HOW TO PARTICIPATE, EXPERTS, SUPPORT, a search bar, and LOGIN/REGISTER buttons.

The left sidebar contains a 'EU Programmes 2014-2020' section with a 'Search Topics' input, 'Updates' and 'Calls' icons, and a list of programmes including H2020 (highlighted in blue), 3rd Health Programme, Consumer Programme, COSME, Justice Programme, Promotion of Agricultural Products, REC Programme, and Research Fund for Coal & Steel. Below this is a 'FP7 & CIP Programmes 2007-2013' section with a 'Calls' input, and an 'Other Funding Opportunities' section.

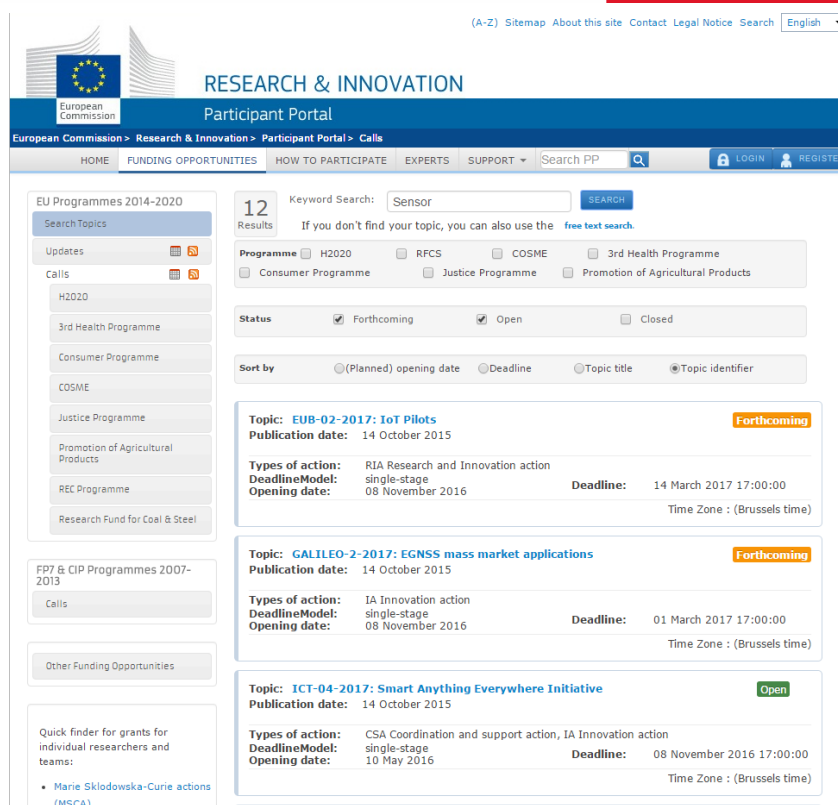
The main content area is titled 'Calls for Proposals'. It features a 'Horizon 2020' section with a list of topics: Excellent Science (European Research Council (ERC), Future and Emerging Technologies (FET), Marie-Sklodowska-Curie Actions, Research Infrastructures), Industrial Leadership (Leadership in enabling and industrial technologies (LEIT), Information and Communication Technologies). The 'Status' section has checkboxes for 'Calls with forthcoming topics' (checked), 'Calls with open topics' (checked), and 'Calls with only closed topics'. The 'Sort by' section has radio buttons for 'Call title', 'Call identifier', and 'Publication date' (selected), along with a 'Filter a call' input and a 'FILTER' button.

The bottom section displays a grid of call cards, each with a title, ID, and publication date (14 October 2015):

- Industrial Leadership EU-Brazil Joint Call** (H2020-EUB-2017)
- Industrial Leadership Internet of Things** (H2020-IOT-2016-2017)
- Industrial Leadership Industry 2020 in the Circular Economy** (H2020-IND-CE-2016-17)
- Industrial Leadership CALL FOR NANOTECHNOLOGIES, ADVANCED MATERIALS, BIOTECHNOLOGY AND PRODUCTION** (H2020-NMBP-2016-2017)
- Societal Challenges Digital Security Focus Area** (H2020-DS-2016-2017)
- Industrial Leadership Information and Communication Technologies Call** (H2020-ICT-2016-2017)

In the tab, “Funding Opportunities,” researchers and innovators can select “Calls” (highlighted in blue on the left in the screen shot above). In the example above, a researcher has asked for “open” calls in the specific activity for “Information and Communication Technologies.” Seven Calls for Proposals are identified at the bottom of the screen shot. By clicking on the Call for Proposals, the researcher is taken to a page that lists all of the Topics in that Call for Proposals.

Search Topics



The screenshot shows the European Commission Research & Innovation Participant Portal. The top navigation bar includes links for (A-Z), Sitemap, About this site, Contact, Legal Notice, Search, and a language dropdown set to English. The main header features the European Commission logo and the text 'RESEARCH & INNOVATION Participant Portal'. Below this, a breadcrumb trail reads 'European Commission > Research & Innovation > Participant Portal > Calls'. The main navigation bar includes links for HOME, FUNDING OPPORTUNITIES, HOW TO PARTICIPATE, EXPERTS, SUPPORT, a search bar, and LOGIN/REGISTER buttons. The left sidebar contains a 'Search Topics' section with a list of EU programmes and calls, including H2020, 3rd Health Programme, Consumer Programme, COSME, Justice Programme, Promotion of Agricultural Products, REC Programme, and Research Fund for Coal & Steel. The main content area displays search results for the keyword 'Sensor'. It shows 12 results and provides a 'free text search' option. The results are filtered by Programme (H2020, RFCS, COSME, 3rd Health Programme, Consumer Programme, Justice Programme, Promotion of Agricultural Products) and Status (Forthcoming, Open, Closed). The results are sorted by (Planned) opening date, Deadline, Topic title, and Topic identifier. Three topics are highlighted: 'EUB-02-2017: IoT Pilots' (Forthcoming), 'GALILEO-2-2017: EGNSS mass market applications' (Forthcoming), and 'ICT-04-2017: Smart Anything Everywhere Initiative' (Open). Each topic card shows the publication date, types of action, deadline model, opening date, and deadline.

In the tab, “Funding Opportunities,” researchers and innovators can also select “Search Topics” (highlighted in blue on the left in the screen shot above). In the example above, a researcher has entered the keyword “sensor” and found twelve relevant Topics. By clicking on the Topic, the participant is taken to a page that includes three tabs:

- Topic Description
 - Specific Challenge
 - Scope
 - Expected Impact
 - Type of Action (Funding Instrument)
- Topic Conditions and Documents
 - Eligibility
 - Evaluation
 - Timetable
 - Provisions, Proposal Templates and Evaluation Forms for the Types of Actions (Funding Instruments) used for this Topic.
- Submission Service
 - A direct link to the electronic application system for this Topic.
- By clicking on a Topic, the proposer will be able to identify any specific information related to that specific action. Different funding instruments may be available for the same Topic. To this purpose it is essential to check for the selected Type of Action (Funding Instrument):
 - Specific provisions (Rule for funding; Eligibility and admissibility conditions)
 - Specific Proposal Templates, which will be the eligible format for presenting your project idea
 - Specific Evaluation procedure, Evaluation Forms and related criteria

Information and Assistance on the Research and Innovation Participant Portal

The Participant Portal provides all sort of introductory information and support regarding all phases of the application procedure, in particular through the H2020 Online Manual, which offers an overview and brief description of all steps required for the electronic management of proposals and grants. It includes links and references to guidance notes, templates, other user manuals and “frequently asked questions”. The Online Manual is available at the following link:

http://ec.europa.eu/research/participants/docs/h2020-funding-guide/index_en.htm

The Manual specifies a number of cross cutting issues, such as international cooperation, open access & data management, ethics, gender, intellectual property. In particular, in the section dedicated to international cooperation, a number of State fact-sheets are available, which describe specific cooperation features and support resources. Regarding US, the link is:

http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020_localsupp_usa_en.pdf

Other important reference documents are accessible through the participant portal, such as legal documents and model grant agreements, and guides for specific actions and horizontal issues. In particular, the General Annexes to the Work Programmes, provide general information on list of countries eligible for funding, standard admissibility conditions and related requirements, standard eligibility conditions, types of action and specific provisions and funding rates, Technology Readiness Levels (TRL), and evaluation rules.

General Manuals are also available, such as the following:

- Guide on beneficiary registration, validation and financial viability check:
http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/lev/h2020-guide-lev_en.pdf
- Guide for proposal submission and evaluation:
http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/pse/h2020-guide-pse_en.pdf
- Horizon 2020 Annotated Model Grant Agreement:
http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf
- Horizon 2020 Experts Manual:
http://ec.europa.eu/research/participants/data/ref/h2020/experts_manual/h2020-experts-mono-contract_en.pdf

Horizon 2020 Helpdesks

Accessible through the Participant Portal Website:

https://ec.europa.eu/research/participants/portal/desktop/en/support/research_enquiry_service.html

The Horizon 2020 Helpdesk responds to questions regarding all aspects of the Framework Programme. Researchers must submit an electronic contact form when submitting an inquiry. Please submit all

questions regarding specific proposals at least two weeks before the deadline to ensure they are answered in time.

Also accessible through the Participant Portal are helpdesks responsible for responding to questions on the following subjects:

- Ethics Helpdesk
- European IPR Helpdesk
- European Committee for Standardisation (CEN-CENELEC)
- IGLO - Informal Group of RTD Liaison Offices
- National R&D and Innovation Information

The above mentioned Helpdesks are accessible through the following website:

https://ec.europa.eu/research/participants/portal/desktop/en/support/other_help_services.html

Horizon 2020 IT Helpdesk

Accessible through the Participant Portal, for all IT-related questions on the Participant Portal.

Website: <https://ec.europa.eu/research/participants/api//contact/index.html>

Horizon 2020 Website

The Horizon 2020 website describes the policies and programme architecture shaping Horizon 2020:

- **Programme Information:** Find information on EU policy priorities as well as the program architecture and objectives of each Pillar.
- **Find your area:** A unique feature of the website. See how each thematic research area is addressed in the Horizon 2020 programme architecture.
- **Events:** Find information on research conferences and networking opportunities.
- **News:** Find Programme updates and articles about Horizon 2020 research

Website: <http://ec.europa.eu/programmes/horizon2020/en>

CORDIS Website

http://cordis.europa.eu/home_en.html

The “Community research and development information system” (CORDIS) website provides access to news and information on all European Framework Programmes. Most importantly, it is a gateway to:

- **Projects and Results:** A unique feature of the website. Follow this tab to a searchable database of information on all Framework Programme projects since 1990. Search the database by the country of each participant, by theme, title and other variables. Find grant details, funding, participants, publications and summaries.
- **Research Partners:** A unique feature of the website. Follow this tab to a searchable database of thousands of European and international researchers seeking partners. US can submit their own profiles too. The database is searchable by area of expertise, country and call for proposal.
- **Events:** Find information on research conferences and networking opportunities.
- **News:** Find Programme updates and articles about Horizon 2020 research.

Digital Single Market Website

This portal is the main entrance of information related to the Digital Single Market strategy, an ambitious work programme to encourage trade between Member States by removing barriers and encouraging free movement of goods, services and people.

The Digital Single Market strategy is made up of three policy areas or 'pillars':

- Better online access to digital goods and services, Helping to make the EU's digital world a seamless and level marketplace to buy and sell.
- An environment where digital networks and services can prosper, Designing rules which match the pace of technology and support infrastructure development.
- Digital as a driver for growth, Ensuring that Europe's economy, industry and employment take full advantage of what digitalisation offers.

The web portal gives information related to the whole European Union policies in Information and Communication Technologies. It collects information related to the last developments of European funded projects, related events, publications, reports and consultations as well as studies made by the European Commission.

Finally, the European Commission often organizes “Info Days” to provide information following the release of each Work Programme, published in the Digital Single Market website. Prior to submission deadlines, with specific relevance for ICT related Calls for Proposals, the European Commission is used to organise the “ICT event” (organised in conjunction of the launch of the new Work Programmes, e.g. [ICT 2015](#)) or “ICT Proposers’ Days,” (e.g. in 26th -27th September 2016 [ICT Proposers’ Days](#)). Those events, like ICT Proposers’ Day, are combined with related “Brokerage Events” designed specifically to bring together researchers and innovators interested in particular calls.

Networks and support services

National Contact Points (NCPs)

Website:

http://ec.europa.eu/research/participants/portal/desktop/en/support/national_contact_points.html

The European Commission has established networks of National Contact Points (NCPs) in all Member States and Associated Countries and many Third Countries around the world to provide researchers in all sectors, and all subject areas, with guidance, practical information and assistance regarding Horizon 2020.



All NCPs have a deep knowledge of the research community in their field within their country. They understand the research, know the researchers and research institutions, and are familiar with national funding agencies and programs. They work in government agencies and research institutions. Often, more than one person fulfills this role in each country to ensure they provide the best possible services.

- Communications and Assistance: NCPs inform their national research communities of calls for proposals and assist researchers with the preparation of proposals and the management of projects by preparing guidelines, providing training sessions and offering coaching services.
- Partnerships: To ensure that their researchers are engaged in strong – and successful – projects, NCPs use their network across Europe to assist their researchers in developing partnerships with strong researchers in other countries.
- Policy: The European Commission facilitates the work of NCPs by providing them privileged access to program statistics and advance information on policy changes, upcoming events and calls for proposals. The EC also consults regularly with NCPs on policy and programme changes.

As a result, NCPs represent important gateways into European research communities for US. They welcome inquiries from US researchers and research institutions. Their contact information is available, in a *searchable online contact database*, at the website address above.

As of May 2016, there aren't specific NCPs related to Information and Communication Technologies supported by US organisations. To this purpose the network of National Contact Points (NCPs) related to Information and Communication Technologies, [Idealist](#), is the main structure to provide guidance, practical information and assistance on all aspects of participation in Horizon 2020. Idealist is an international ICT (Information and Communication Technologies) network, with more than 65 H2020 ICT National Contact Points from EU and Non-EU Countries, such as Associated States, Eastern European Partner Countries (EEPC), Mediterranean Partner Countries (MPC) as well as other industrialized countries.

Idealist with its long lasting experience since 1996, offers:

- unique information services - Newsletter, press releases, Work Programme information;
- networking services - a quality labelled Partner Search tool and Brokerage Events;
- educational services: trainings and webinars.

Website: www.ideal-ist.eu

Other thematic NCP networks across Europe also maintain searchable and quality controlled subject specific databases, with dedicated information and support services, in the following fields:

- Nanotechnologies: www.nmpteam.eu
- Space: <http://ncp-space.net>
- Health: www.healthncp.net; www.fitforhealth.eu
- Food and Agriculture: www.ncp-biohorizon.net
- Energy: www.c-energy2020.eu
- Transport: www.transport-ncps.net
- Environment: www.ncps-care.eu
- Socio-Economic Sciences and Humanities: www.net4society.eu
- Security: www.seren-project.eu

Enterprise Europe Network – US

The Enterprise Europe Network (EEN) brings together 570 business support organisations, with over 3,000 advisors, from 58 countries around the world to help businesses find international partners, source new technologies, secure funding and expand globally. There are currently more than 2.5 million small and medium sized enterprises using EEN worldwide.

EEN offers two core services:

- It serves as a quality-controlled clearinghouse for businesses seeking or offering opportunities as suppliers, distributors or developers of new technologies.
- It also serves as a key source of market intelligence and international business support.



In science, technology and innovation, EEN partners serve as advisors to businesses worldwide seeking opportunities to work with partners in Europe and around the world on projects supported by Horizon 2020.

EEN maintains searchable and quality controlled profiles of international companies and research organisations available for business, innovation and technology cooperation²⁴.

Different organisations support US researchers and innovators as EEN members: NineSigma (Cleveland); the Research Triangle Institute (Durham); the European US Business Organisation Inc. (New York); the European US Enterprise Council (San Diego)²⁵.

²⁴ <http://een.ec.europa.eu/tools/services/SearchCenter/Search/ProfileSimpleSearch?shid=32db25cb-726f-43b0-8b5f-7742d0935799>

²⁵ For more information see EEN-US at: <http://een.ec.europa.eu/about/branches/USA>

PART II - Opportunities for EU researchers and innovators

This part of the report is based mostly on desk research, completed and validated through direct contribution of experts on different programmes, in particular NIST, namely regarding the description of the general US strategic and funding framework on matter of ICT. It also builds on the work of and experience gained during the project BILAT 2.0²⁶ project, although focusing on very different priority areas. PICASSO's objective is indeed to highlight pathways and opportunities in pre-competitive research and innovation in the ICT field, in particular in key enabling technologies areas (5G networks, Internet of Things, Cyber Physical Systems, Big Data) that have a direct applicability to sectors that are strategic for smart and sustainable innovation, i.e. the transport, energy, and more widely, the smart city sectors.

Although cutting-edge and dynamic research support is present also at the State level, this type of support is highly different across the 50 US States, often present a more local-priority-focused orientation, and – most importantly – are normally not open to foreign participation. For this reason this report focuses only on the Federal level, drawing a clear picture of all the Federal institutions having a key role in one of PICASSO's priority areas, either at the strategic or at the operative level, taking care of highlighting relationships and coordinated activities among them.

Given the fragmented distribution of research and innovation priorities over a wide number of different agencies, and in view of the changing nature of the information provided, guaranteeing full information is not envisaged in this context. However, for every funding agency we include a number of calls that are currently open with the objective of representing a significant sample of available opportunities, their mechanisms and characteristics.

²⁶Project BILAT 2.0 aimed at enhance and develop S&T partnership between the EU and US, focussing on four key research areas: Marine and Arctic research, NMP, Health, Transport. Its objectives are now continued by the running BILAT project, BILAT USA 4.0. <http://www.euussciencetechnology.eu/>.

Characteristics of the US funding landscape for Research and Innovation

In US, Research and Innovation is mostly financed by Federal research programmes, which reflect directly the President's priorities and interests. Research funding is also available at the State level, but these kind of funding normally reflects local-specific needs, and are normally open only to local applicants – meaning that neither entities from other US States nor foreign entities have access to these resources.

Federal research and development (R&D) priorities are decided based on three main sources of input: the yearly Memorandum drafted by the Office of Science and Technology Policy (OSTP) of the White House – which provides policy advice and coordinate STI policies; the Congress input; the State's Departments and relative funding agencies. Priorities and their corresponding allocated budget are then yearly detailed by the Office of Science and Technology Policy of the President in the Multi-Agency Science and Technology Priorities for the Fiscal Year Budget²⁷.

Apart for specific areas, such as Security or Defense, which require a more confidential approach, at the level of individual funding agencies' policy, foreign participation and international partnerships are often allowed and valued, as perceived as a benefit and a positive asset to strengthen credibility to research projects. However, funding is not always foreseen, and foreign participants and organisations are expected to cover their part of effort.

According to the research conducted by the project BILAT 2.0. "nearly one-quarter of individual organisations' policy measures provide funds to other countries as long as the leading organisation is a U.S.-based university or other research institution. About 40% of the measures do not provide funding to non-U.S. institutions. The remaining 40% have specific pre-requisites for allowing receipt of U.S. funds by third countries"²⁸.

To our knowledge, no specific calls are published for foreigners' participation, and normally international partnerships result more from existing and previous personal research collaborations than from a manifest encouragement in the call announcements.

Federal Funding instruments

Federal agencies use several types of financial assistance instruments to transfer funds to people and organisations that can contribute to the achievement of the agency's authorized mission. The principal types of instruments used are procurement contracts, grants, and cooperative agreements, and are legally defined as follows²⁹:

Procurement contracts: the principal purpose of the instrument is to acquire (by purchase, lease, or barter) property or services for the direct benefit or use of the United States Government.

²⁷www.whitehouse.gov/sites/default/files/omb/memoranda/2015/m-15-16.pdf

²⁸ Deliverable D3.1, *Report on the EU and US innovation policy framework and relevant initiatives*, in <http://www.euussciencetechnology.eu/documents-and-publications>

²⁹According to the Federal Grant and Cooperative Agreement Act of 1977 (P.L. 95-224, 31 USC 6301 et seq.)

Cooperative Agreement: the principal purpose of the relationship is to transfer a thing of value to the State, local government, or other recipient, to carry out a public purpose of support or stimulation authorized by a law of the United States instead of acquiring (by purchase, lease, or barter) property or services for the direct benefit or use of the United States Government. It is distinguished from a grant in that it provides for substantial involvement between the Federal awarding agency or pass-through entity and the non-Federal entity in carrying out the activity contemplated by the Federal award.

Grant Agreement: the principal purpose of the relationship is to transfer a thing of value to the State or local government or other recipient to carry out a public purpose of support or stimulation authorized by a law of the United States instead of acquiring (by purchase, lease, or barter) property or services for the direct benefit or use of the United States Government. It is distinguished from a cooperative agreement in that it does not provide for substantial involvement between the Federal awarding agency or pass-through entity and the non-Federal entity in carrying out the activity contemplated by the Federal award.

Award: Financial assistance that provides support or stimulation to accomplish a public purpose. Awards include grants and other agreements in the form of money or property in lieu of money, by the federal government to an eligible recipient. The term does not include: technical assistance, which provides services instead of money; other assistance in the form of loans, loan guarantees, interest subsidies, or insurance; direct payments of any kind to individuals; and contracts which are required to be entered into and administered under federal procurement laws and regulations.

Federal Portals and Tools on research funding

Grants.gov

Website: www.grants.gov

Although no single management organisation exists for the research and innovation federal funding, as of 2002 the Grants.gov program management office was established, to “deliver a system that provides a centralized location for grant seekers to find and apply for federal funding opportunities”.

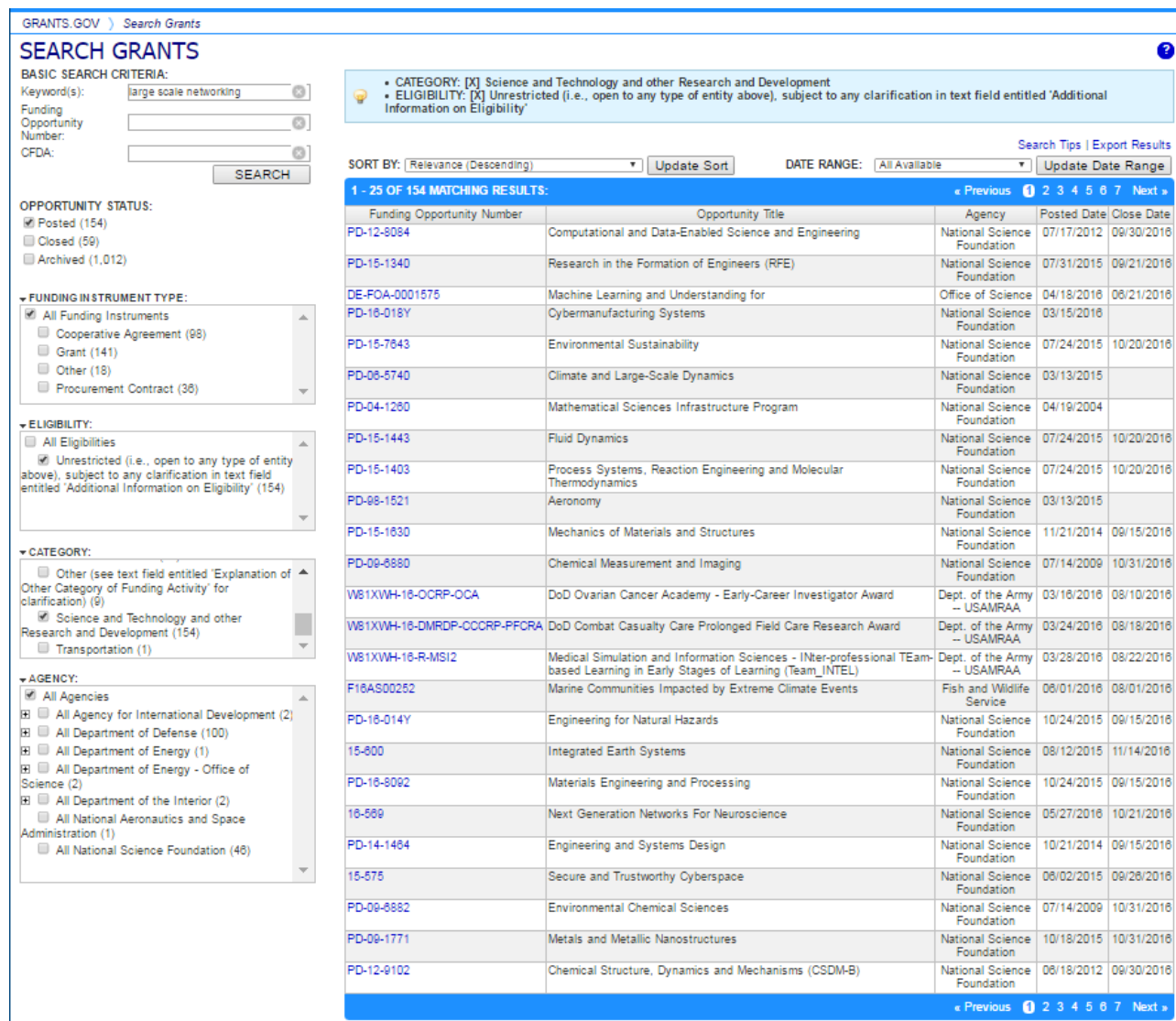
Grants.gov is managed by the Department of Health and Human Services (HHS). Today, the Grants.gov system houses information on over 1,000 grant programs, centralizing all opportunities coming from federal grant-making agencies. Here under it summarizes the general policy appearing of in its “Grant eligibility” section of the portal regarding foreign applicants:

The authorizing legislation and agency policies will determine whether a foreign individual or organisation may apply for the grant. Foreign applicants need to complete the same registration process as domestic applicants, but there are additional steps to this registration process.

Depending on the intended usage of the grant you are applying for, you may need to file a U.S. tax return which requires a Taxpayer Identification Number (TIN), also referred to as an employer Identification Number (EIN). If a non-resident alien is awarded funding to perform activities outside the United States, then this likely does not constitute U.S. source income and a TIN/EIN is not necessary. Examples of such funding include scholarships, fellowship grants, targeted grants, and achievement awards.

Before applying, foreign applicants should thoroughly review the IRS website and search for their most recent guidance for Aliens and International Taxpayers.

The portal allows for multi-criteria search through multiple checkbox choice for each criterion. Besides basic search criteria such as free keywords, and funding opportunity numbers, opportunities are searchable by “opportunity status”, “funding instrument type”, “eligibility”, “category” (sector), and “agency”, as shown by the picture below.



The screenshot shows the GRANTS.GOV Search Grants interface. The left sidebar contains search filters for BASIC SEARCH CRITERIA, OPPORTUNITY STATUS, FUNDING INSTRUMENT TYPE, ELIGIBILITY, CATEGORY, and AGENCY. The main area displays a table of 154 matching results, including columns for Funding Opportunity Number, Opportunity Title, Agency, Posted Date, and Close Date. The table lists various research and development opportunities from the National Science Foundation and other agencies.

Clicking on each of the opportunities, we access a page with basic call information, including eligibility criteria, and possibly a link to the pdf version of the FOA (Funding opportunity announcement), that includes instructions – a Grant Application Guide, and forms – a Grant Application Package; in lack of this document, the system normally redirects the user to the page of the funding agency responsible for the call.

Federal Business Opportunities (FedBizOpps)

Website: www.fbo.gov

FedBizOpps is the federal portal for bids and procurement. Federal agencies use this site to communicate their buying requirements to potential suppliers. All federal contract solicitations with a

value of at least \$25,000 are published on FedBizOpps. Government agencies publish the solicitations on FedBizOpps, and provide detailed information on how and when vendors should respond.

An Help Desk is available by clicking on the help desk link on the bottom left of every page or by visiting the Federal Service Desk (<https://www.fsd.gov>).

Eligibility is different from call to call. No basic and general set of requirements is specified for foreigners' participation, and they are specific to the single call. However, in some calls foreign participants are allowed to compete, provided they comply with a minimum set of requirements.

US ICT Priorities

As concerns the opportunities for PICASSO ICT focus areas – 5G, Big Data, IoT/CPS, Smart Cities – they fall under the *Networking and Information Technology Research and Development (NITRD) Program*, which is defined as “the primary source of federal funds for all what concerns advanced information technologies (IT) in computing, networking, and software.

The NITRD Program is one of the oldest and largest of the formal Federal programs that engage multiple agencies in coordination activities, providing a framework and mechanisms for coordination among the Federal agencies that – in alignment with their individual missions – concretely support advanced IT R&D, including managing the funding and reporting back to NITRD”. NITRD focuses its work both on R&D foundations and on deployment and applications connected to issues such as defense and national security, productivity and economic productiveness, environment protection, improved health and education systems.

The NITRD programme is divided into a number of *Program Component Areas (PCAs)*, reflecting the nation’s priorities.

Agencies working on the same PCA meet through Interagency Working Group (IWG), aimed at coordinating and maximizing the allocation of R&D resources in the same priority area (e.g. using the same testbed environments) in order to avoid expenses of duplicate facilities.

Here is the list of NITRD Program Component Areas and of the different agencies involved on each of them:

NITRD Program Component Area	Involved Agencies and Departments
Cyber Security Information Assurance (CSIA)	<p>NITRD Agencies: DARPA, DHS, DoD (CERDEC), DoD Service Research Organisations (AFOSR, AFRL, ARL, ARO, ONR) DOE/OE, NIH, NIJ, NIST, NSA, NSF, and OSD</p> <p>Other Participants: DOT, IARPA, NRC, ODNI, and Treasury</p>
Enabling-R&D for High-Capability Computing Systems (EHCS)	<p>NITRD Agencies: DARPA, DoD (HPCMP), DoD Service Research Organisations, DOE/NNSA, DOE/SC, EPA, NASA, NIH, NIST, NOAA, NSA, and NSF</p> <p>Other Participants: IARPA</p>
High-Capability Computing Systems Infrastructure and Applications (HCSIA)	<p>NITRD Agencies: DoD (HPCMP), DoD Service Research Organisations, DOE/SC, NASA, NIH, NIST, NOAA, NSF, and OSD</p>
High Confidence Software and Systems (HCSS)	<p>NITRD Agencies: DARPA, DHS, DoD Service Research Organisations, DOE, NASA, NIH, NIST, NOAA, NSA, NSF, and OSD</p> <p>Other Participants: DOT, FAA, FDA, FHWA, NRC, and USDA/NIFA</p>
Human Computer Interaction and Information Management (HCI&IM)	<p>NITRD Agencies: AHRQ, DHS, DoD Service Research Organisations, EPA, NARA, NIH, NIST, NASA, NOAA, and NSF</p>

Large-Scale Data Management and Analysis (LSDMA)	NITRD Agencies: DARPA, DHS, DOE/NNSA, DOE/SC, EPA, NARA, NASA, NIH, NIST, NOAA, NSA, NSF, and OSD Other Participants: USAID and USGS
Large Scale Networking (LSN)	NITRD Agencies: DARPA, DoD (CERDEC, DREN), DoD Service Research Organisations (AFRL, AFOSR, ONR), DOE/SC, NASA, NIH, NIJ, NIST, NOAA, NSA, NSF, and OSD Other Participants: FAA, FCC, USDA/ARS, and USGS
Robotics and Intelligent Systems (RIS)	NITRD Agencies: DoD Service Research Organisations, NASA, NIH, NIJ, NIST, NSF, and OSD Other Participants: DOE/EM and USDA/NIFA
Software Design and Productivity (SDP)	NITRD Agencies: DHS, DoD Service Research Organisations (AFRL, ARL, NRL, ONR), DOE/NNSA, DOE/SC, NASA, NIH, NIST, NSF, and OSD Other Participants: BLS, ED, IARPA, and USDA
Social, Economic, and Workforce Implications of IT and IT Workforce Development (SEW)	NITRD Agencies: DHS, DoD Service Research Organisations (AFRL, ONR), DOE/SC, NASA, NIH, NIST, NOAA, NSA, NSF, and OSD Other Participants: BLS, FDA, and NRC

It is worth comparing NITRD PCAs with European Commission's priorities in the field of ICT research and innovation to grasp the extent of similar focus priorities and objectives. The following scheme lists NITRD Program Focus Areas mapping them against the corresponding EU priorities and definitions as outlined in the H2020 Specific Programme. It is not its objective to be exhaustive regarding ICT EU priorities in Horizon 2020, which are defined in detail in Chapter 2. The table also provide the estimated budget expenditure for 2016-2017, according to NITRD Supplement to the President's Budget for Fiscal Year 2017³⁰.

NITRD Program Component Area	US Budget estimate 2016-2017 (\$ML)	European Commission's Priorities and definitions in H2020
Cyber Security Information Assurance (CSIA) CSIA focuses on research and development to detect, prevent, resist, respond to, and recover from actions that compromise or threaten to compromise the availability, integrity, or confidentiality of computer- and network-based systems. These systems provide the IT foundation in every sector of the economy, including critical infrastructures such as power grids, financial systems, and air-traffic-control networks. These systems also support national defense, homeland security, and other Federal missions. Broad areas of emphasis include Internet and network	2016: 718.0 \$ML 2017: 727.7 \$ML	Specific digital security and privacy issues are included in selected topics in LEIT ICT Work Programme, focusing on embedding security and privacy within environments with particular functional requirements such as low computing power, size, energy efficiency, interconnectivity, or the volume of data. Security and privacy issues will be notably covered in IoT, Big Data, Software Engineering and Cloud Computing . Dedicated actions provides fundamental security and privacy industry-driven building blocks (technologies or processes) which constitute a common requirement in several LEIT-ICT objectives. One

³⁰<https://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/fy2017nitrdsupplement-final.pdf>

security; security of information and computer-based systems; approaches to achieving hardware and software security; testing and assessment of computer-based systems security; reconstitution of computer-based systems and data; and resilience against cyber-attacks on computer-based systems that monitor, protect, and control critical infrastructure.		dedicated action addresses metrics, assurance and certification of security and/or privacy requirements. Proper coordination is made with the activities included in the Societal Challenge “Secure societies – Protecting freedom and security of Europe and its citizens” , where validation and piloting is done across several environments or use-cases.
Enabling-R&D for High-Capability Computing Systems (EHCS) Research and development to enable advancements in high-capability computing systems, spanning the hardware, software, architecture, system performance, computational algorithms, data analytics, development tools, and software methods for extreme data- and compute-intensive workloads; and developing fundamentally new approaches to high-capability computing systems.	2016: 680.7 \$ML 2017: 647.5 \$ML	Within European High Performance Computing Strategy, the Future and Emerging Technologies (FET) programme supports the development of the next generation of HPC technologies, applications and systems towards exascale. The scope is R&D of HPC technology covering the whole spectrum from processors and system architectures to high-level software and tools to delivering prototype exascale systems and associated applications according to specifications.
High-Capability Computing Systems Infrastructure and Applications (HCSIA) High-capability computing systems (HCS) and associated application software, communications, storage, data management, and HCS infrastructure to meet agency mission needs.	2016: 930.8 \$ML 2017: 958.3 \$ML	Within European High Performance Computing Strategy, the Research Infrastructure programme supports the access to the best supercomputing facilities and services for both industry including SMEs and academia (this includes support to PRACE infrastructure), as well as the achievement of excellence in HPC application delivery and use by the establishment of Centres of Excellence (CoEs) to focus and coordinate support to the application of HPC in scientific or industrial domains that are most important for Europe.
High Confidence Software and Systems (HCSS) HCSS R&D supports development of scientific foundations and innovative and enabling software and hardware technologies for the engineering, verification and validation, assurance, standardization, and certification of complex, networked, distributed computing systems and cyber-physical (IT-enabled) systems (CPS). The goal is to enable seamless, fully synergistic integration of computational intelligence, communication, control, sensing, actuation, and adaptation with physical devices and information processes to routinely realize high-confidence, optimally performing systems that are essential for effectively operating life-, safety-, security-, and mission-critical applications. These systems must be capable of interacting correctly, safely, and securely with humans and the physical world in changing environments and unforeseen conditions. In many cases, they must be certifiably dependable. The vision is to realize dependable systems that are precise and highly efficient; respond quickly; work in dangerous or inaccessible environments; provide large-scale, distributed coordination; augment human capabilities; and enhance societal quality of life. New science and technology are needed to build these systems with computing, communication, information, and control pervasively embedded at all levels, thus enabling entirely new generations of	2016: 155.0 \$ML 2017: 167.5 \$ML	The establishment of a Focus Area related to Internet of Things allows complementing technology developments with large-scale pilots, thus demonstrating actual IoT solutions in real-life settings and making it possible for providers to test user needs, user acceptance, business models and integration modalities through direct experimentation and for users to innovate their services, applications and solutions. Electronics (including Organic and Printed Electronics), microsystems and cyber-physical systems are defined into LEIT ICT Work Programme. This ICT challenge is driven by the "Smart Anything Everywhere" vision: from vertical value chains to horizontal ones. Developments on "co-design" approaches across vertical value chains from nano-electronics and smart integrated systems up to embedded software and cyber-physical systems are fostered. This ICT challenge within LEIT ICT Work Programme focuses on two high level objectives: - Building the basis for the next generation of components and systems supporting the "Smart Anything Everywhere" vision through advanced research in emerging fields and in areas along the full computing continuum not yet mature enough to be picked up by the ECSEL Joint Undertaking (please find more information on Chapter 2). Activities may include advanced cyber-physical systems, wearables,

engineering designs that can enhance U.S. competitiveness across economic and industrial sectors.		thin, organic and printable electronics as well as micro-nano-bio-systems including micro-robotics smart systems integration and high performance computing. - Supporting the organic growth of the "Smart Anything Everywhere" ecosystem building on a tighter integration of competences across the full electronics components and systems value chain. This may include the establishment of "reference zones" for large scale testing of components and systems technologies in "Smart Anything Everywhere" applications.
Human Computer Interaction and Information Management (HCI&IM) Human computer interaction, collaboration, and communication technologies and information management to expand human capabilities, enabled through research on visualization, collaborative systems, multimodal system engagements, and advancements in understanding human cognition, including perception, intuition, learning, cognitive load, and problem solving for human-in-the-loop systems.	2016: 734.2 \$ML 2017: 716.4 \$ML	In content technologies , where the current challenge is to maximise the potential for re-use and re-purposing of all types of digital content; improving its granularity; increasing its ability to dynamically adapt to the users; generating more realistic digital models; embedding semantic knowledge; and other approaches to make content "smarter" thanks to new and emerging technologies. Related to Interfaces for accessibility, it is supported the research on user-driven multimodal interface design to maximize the usability and accessibility from different categories of people, especially for those with different functional abilities. In robotics regarding decisional autonomy, dependability, interaction, perception and cognitive ability. In Pillar I, the FET Flagship Human Brain Project is supporting different features related to human brain research, such as: strategic human brain data; cognitive architectures; theoretical neuroscience; neuroinformatics; brain simulation; neuromorphic computing; neurorobotics.
Large-Scale Data Management and Analysis (LSDMA) Large-scale data management and analysis to develop the ability to analyze and extract knowledge and insight from large, diverse, and disparate sources of data, including structures for data capture, curation, management, and access.	2016: 289.6 \$ML 2017: 282.3 \$ML	The Content technologies and information management , as defined in H2020 LEIT ICT Work Programme, is structured around the data value chain, with research and innovation activities in the areas of Big Data, implementing the contractual Public Private Partnership Big Data Value' roadmap (cPPP BDV), and machine translation; the work will be coordinated with relevant activities on FETHPC – Future and Emerging Technologies High Performance Computing . The cPPP on Big Data will address research and innovation on a broad range of scientific and technical aspects related to Big Data, such as analytics, software, hardware, security, privacy, interfaces and data management, as well as the integration, validation, demonstration and deployment of Big Data technologies through large-scale pilots in candidate sectors selected by the industry.
Large Scale Networking (LSN) LSN focuses on coordinating Federal agency networking R&D in leading-edge networking technologies, services, and enhanced performance. This includes programs in fundamental networking	2016: 323.4 \$ML 2017: 386.4 \$ML	Within the Future Internet challenge, as defined in H2020 LEIT ICT Work Programme, the area related to Networks is defined by the 5G PPP industry roadmap. The current challenge is to eliminate the current and anticipated limitations of network infrastructures, including wireless access, radio network architecture

research and architectures, future Internet architectures, wireless networks, software-defined networks, heterogeneous multimedia networks, testbeds, and end-to-end performance and performance measurement. Program coordination also spans network security, privacy, and identity management; dynamic inter-domain networking; public service networks; the science and engineering of complex networks; network infrastructures for advanced discovery environments; network-enabling technology; networking education, training, and outreach; and cyberinfrastructure for scientific and applications R&D.		& technologies; high capacity elastic-optical networks as well as software networks. This challenge includes optimisation of cost functions (capex/opex) and of scarce resources (e.g. energy, spectrum), as well as migration towards new network architectures. The challenge also tackles scalability and usability of mixed network technological approaches. Network elements will become "computing equivalent" elements that gather programmable resources, interfaces and functions based on virtualisation technologies, to implement control functionalities ad-hoc as a function of the use case.
Robotics and Intelligent Systems (RIS) Robotics and intelligent systems to advance physical and computational agents that complement, augment, enhance, or emulate human physical capabilities or human intelligence. This includes robotics hardware and software design, application, and practical use; machine perception; intelligent cognition, adaptation, and learning; mobility and manipulation; human-robot interaction; distributed and networked robotics; increasingly autonomous systems; and related applications.	2016: 225.0 \$ML 2017: 220.5 \$ML	The aim of robotics and autonomous artefacts challenge, as defined in H2020 LEIT ICT Work Programme, is to endow robots and artefacts with additional perception, learning, adaptation, manipulation and autonomy capabilities enabling them to achieve a wider range of tasks and functionalities and to interact and collaborate more safely and easily with humans be it in the factory, at home, in hospitals, on the road or any other location. Further progress in robots is also essential to offer new and unique solutions to societal challenges ranging from ageing to health, security, transport, energy and environment. The support to the area of robotics will follow the Strategic Research Agenda defined under the SPARC contractual Public Private Partnership (SPARC cPPP). It will cover industrial and service robotics and underpinning cognitive systems research for autonomous systems. Actions addresses technology progress and its exploitation in innovative robotics products and services as well as support to the wider uptake of robotics and autonomous systems. Usability issues as well as ethical, legal and social aspects are addressed.
Software Design and Productivity (SDP) The SDP R&D agenda spans the science and the technology of software creation and sustainment (e.g., development methods and environments, Verification and Validation (V&V) technologies, component technologies, languages, and tools) and software project management in diverse domains. R&D will advance software engineering concepts, methods, techniques, and tools that result in more usable, dependable, cost-effective, evolvable, and sustainable software-intensive systems. The domains cut across information technology, industrial production, evolving areas such as the Internet, and highly complex, interconnected software-intensive systems. The core SDP R&D activities are software productivity, software cost, responsiveness to change, and sustainment. The success of these activities can have a major beneficial effect on high-confidence systems because such systems are critically dependent upon the quality of the software and on the many companies producing software-reliant products.	2016: 235.2 \$ML 2017: 234.0 \$ML	The challenge Software Technologies , defined in H2020 LEIT ICT Work Programme, responds to the need for more flexible, reliable, secure and efficient software. Some challenges are common across customised and low power computing , and Cloud Computing primarily in the areas of software quality and software evolution, in particular efficient parallel programming, complexity management, change management and energy efficiency.

Social, Economic, and Workforce Implications of IT and IT Workforce Development (SEW)

Research activities funded under the SEW PCA focus on the co-evolution of IT and social, economic, and workforce systems, including interactions between people and IT and among people developing and using IT in groups, organisations, and larger social networks. Collaborative science concerns are addressed including understanding and improving the effectiveness of teams and enhancing geographically distributed, interdisciplinary R&D to engage societal concerns, such as competitiveness, security, economic development, and wellbeing. Workforce concerns are addressed by leveraging interagency efforts to improve education outcomes through the use of learning technologies that anticipate the educational needs of individuals and society. SEW also supports efforts to speed the transfer of R&D results to the policymaker, practitioner, and IT user communities in all sectors.

2016:
201.4 \$ML

2017:
201.7 \$ML

Following H2020 LEIT ICT Work Programme, different areas arise from social, economic and workforce implications, such as:

Learning Technologies, where the actions of the *knowledge value chain* supports developments in advanced knowledge and learning technologies, as well as its uses in gaming and gamifications;

Collective Awareness Platforms for Sustainability and Social Innovation (CAPS), in order to capitalise participatory innovation in key sustainability areas, leveraging on open data, knowledge networks, open hardware and Internet of things.

Specific actions are envisaged for **responsible research and innovation** addressing ethical, legal, human, and social issues related to technological developments and by reframing and updating the concepts, meanings and expectations arising from the deployment of ICT technologies.

The **Societal Challenges – third Pillar** includes many Challenge-related research on different areas (health, public administration and governance, socio-economic studies).

In addition to the innovation actions integrated in the thematic areas, within H2020 LEIT ICT Work Programme in the area of **Innovation and entrepreneurship support**, there are actions of more horizontal nature supporting the take-up of innovation, through the “Open and Disruptive Innovation” and “Fast Track to Innovation” topics; Public Procurement of Innovation; support to digital entrepreneurship; networking of innovators and better use of Prizes.

The Multi-Agency R&D priorities for 2017³¹ show a strong alignment between EU and US ICT research orientation, listing the following as priorities under Information technology and high-performance computing:

Agencies should prioritize research guided by the Trustworthy Cyberspace: Strategic Plan for Cybersecurity R&D Programs to develop technologies that can protect U.S. systems against cyber-attacks. Agencies should coordinate with each other and with the private sector to promote innovation in high-performance computing; modeling and simulation; and advanced hardware technology to support national security, scientific discovery, and economic competitiveness. Agencies should also give priority to investments that address the challenges and opportunities afforded by the expansion of Big Data to advance agency missions and further scientific discovery and innovation while providing appropriate privacy protections for personal data.

³¹ Multi-Agency Science and Technology Priorities for the FY 2017 Budget, www.whitehouse.gov/sites/default/files/microsites/ostp/m-15-16.pdf

Overview of main ICT-related funding

Departments and Agencies

A number of different agencies contribute to Federal research priorities and in particular to the NITRD program, in accordance with their individual missions. The provisional budget distribution by agency, according to the NITRD Supplement to the President's Budget FY 2017³², gives an idea of priority research portfolios, and is showed by the tables below. Most of US federal resources for R&D are assigned to the National Science Foundation, the Department of Defense (including the Defense Advanced Research Projects Agency), the Department of Energy, and the National Institute of Health.

FY 2016 Budget Estimates (Dollars in Millions)

Agency/ Program Component Area	Cyber Security & Infor- mation Assurance	Enabling- R&D for High- Capability Computing Systems	Human Computer Interaction & Infor- mation Manage- ment	High- Capability Computing Systems Infrastruc- ture & Applica- tions	High Confi- dence Software & Systems	Large-Scale Data Manage- ment & Analysis	Large Scale Networking	Robotics & Intelligent Systems	Software Design & Productiv- ity	Social, Economic, & Work- force Implica- tions of IT	Total ^a
	CSIA	EHCS	HCI&IM	HCSIA	HCSS	LSDMA	LSN	RIS	SDP	SEW	
NSF	110.5	129.8	187.4	180.4	85.8	110.4	137.8	43.0	84.6	126.2	1,195.9
DoD ^b	146.5	264.6	182.7	80.8	13.3	36.2	84.6	101.8	9.5	3.2	923.1
DOE ^c	30.0	204.3		374.4	2.7	5.9	78.2	15.0		10.0	720.5
NIH ^d	3.0	23.1	313.0	194.6	30.0		8.0		129.0	54.0	754.7
DARPA	292.3	23.8				109.4					425.5
NIST	70.2	4.4	8.2	8.1	15.7	15.8	10.8	7.9	1.8	4.0	146.9
NASA		8.5	14.0	62.8	7.5	5.4	0.7	56.3	6.6		161.9
DHS	63.9		4.0			4.0					71.9
NOAA			0.2	29.7			3.3		3.7		36.9
NNSA		18.7								3.5	22.2
AHRQ			21.5								21.5
EPA		3.5	3.0								6.5
NIJ	1.5					2.5		1.0		0.5	5.5
NARA			0.2								0.2
Total ^{a, d}	718.0	680.7	734.2	930.8	155.0	289.6	323.4	225.0	235.2	201.4	4,493.3

³² <https://www.nitrd.gov/pubs/2017supplement/FY2017NITRDSupplement.pdf>

FY 2017 Budget Requests (Dollars in Millions)

Agency/ Program Component Area	Cyber Security & Infor- mation Assurance CSIA	Enabling- R&D for High- Capability Computing Systems EHCS	Human Computer Interaction & Infor- mation Manage- ment HCI&IM	High- Capability Computing Systems Infrastruc- ture & Applica- tions HCSIA	High Confi- dence Software & Systems HCSS	Large-Scale Data Manage- ment & Analysis LSDMA	Large Scale Networking LSN	Robotics & Intelligent Systems RIS	Software Design & Productiv- ity SDP	Social, Economic, & Work- force Implica- tions of IT SEW	Total ^a
NSF	111.0	131.0	182.8	183.2	86.5	111.3	139.0	43.5	82.7	127.1	1,198.0
DoD ^b	145.1	216.4	170.0	81.9	12.9	38.2	108.0	102.9	10.2	3.1	888.7
DOE ^c	30.0	208.3		393.6	17.5		88.0	11.7		10.0	759.1
NIH ^d	3.0	23.1	313.0	194.6	30.0		8.0		129.0	54.0	754.7
DARPA	300.1	6.0				106.6	27.6				440.4
NIST	70.2	18.0	8.2	8.1	15.7	15.8	10.8	7.9	1.8	4.0	160.5
NASA		11.0	14.0	60.9	4.9	5.4	0.8	53.5	6.6		157.0
DHS	66.8		2.0			5.0					73.8
NOAA			0.2	36.0			3.3		3.7		43.2
NNSA		30.0								3.5	33.5
AHRQ			22.9								22.9
EPA		3.7	3.1								6.8
NIJ	1.5						1.0	1.0			3.5
NARA			0.2								0.2
Total ^{a,d}	727.7	647.5	716.4	958.3	167.5	282.3	386.4	220.5	234.0	201.7	4,542.4

An analysis of each of the most important funding agencies follows, highlighting where possible each agency's approach to external funding (i.e. funding that is competitively assigned to different entities, such as universities, non-profit research organisations and small business) and to foreign funding.

NSF – National Science Foundation

NITRD Budget:

FY 2017 Total Budget Request:1,198.0

FY 2016 Total Budget Estimate:1,195.9

FY 2015 Total Budget Actual: 1,205.3

The National Science Foundation (www.nsf.org) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...". It represents the funding source for approximately 24 percent of all federally supported basic research conducted by America's colleges and universities.

NSF Office of International Science & Engineering (OISE)

The OISE has the specific mandate of promoting the development of an integrated, Foundation-wide international strategy, and manages international programs that are innovative, catalytic, and responsive to a broad range of NSF interests. Specifically, OISE supports international collaborations in NSF's priority research areas and in particular it encourages programs to expand and enhance leading-edge international research and education opportunities for U.S. scientists and engineers, especially at the early career stage, as well as funding applicants to include an international component in proposals submitted to the appropriate research directorate.

OISE representative offices are present worldwide, including in Europe. The NSF Europe Office has three major roles:

- **Facilitation:** Promotes collaboration between the U.S. and European science and engineering communities, namely highlighting available regional opportunities.

- Representation: Represents NSF to national and multi-national science organisations throughout Europe.
- Reporting: Monitors and reports on developments in the European scientific community.

They can be a valuable resource also for European researchers seeking for a first advice on available opportunities.

Funding conditions and eligibility

International activities are supported throughout the NSF portfolio. However, normally, foreign and international organisations are not eligible for NSF funding. NSF usually finances only the US part of effort, including travels abroad of US researchers. Foreign partners are expected to cover their-own part of effort.

In its website, the OISE highlights a selection of NSF-funded topics where international partnership or contribution is encouraged³³. Moreover, it provides a list of funding programmes that have been explicitly designed to foster international collaboration³⁴. For these particular opportunities, NSF suggests that: “foreign researchers interested in collaborating with U.S. researchers should ask their U.S. counterpart to contact his or her disciplinary program officer or the relevant ISE (International Science and Engineering) program officer at NSF to inquire about funding possibilities. ISE program officers work with disciplinary program officers to co-fund awards that involve international collaboration.”

DOD – Department of Defense

The Department of defense (www.defense.gov) budget includes funding for the OSD (Office of the Secretary of Defense) and the DoD Service research organisations, i.e.: Air Force Research Laboratory (AFRL), including the Air Force Office of Scientific Research (AFOSR); Army Research Laboratory (ARL), including the Army Research Office (ARO); Naval Research Laboratory (NRL); Office of Naval Research (ONR); Communications-Electronics Research, Development, and Engineering Center (CERDEC); Defense Research and Engineering Network (DREN); and the High Performance Computing Modernization Program (HPCMP).

NITRD Budget:

FY 2017 Total Budget Request:888.7

FY 2016 Total Budget Estimate:923.1

FY 2015 Total Budget Actual: 942.9

DARPA –Defense Advanced Research Projects Agency

DARPA (www.darpa.mil) is an independent research organisation under DoD.

DARPA’s scientific investigations span the gamut from laboratory efforts to the creation of full-scale technology demonstrations in the fields of physics, engineering, biology, medicine, computer science, chemistry, mathematics, material sciences, social sciences,

NITRD Budget:

FY 2017 Total Budget Request:440.4

FY 2016 Total Budget Estimate:425.5

FY 2015 Total Budget Actual: 395.9

³³ <http://www.nsf.gov/dir/index.jsp?org=OISE>

³⁴ www.nsf.gov/od/oise/europe/sample_programs.jsp

neurotechnology and more. As the Department of Defense's primary innovation engine, DARPA undertakes projects that are finite in duration but that seek to create lasting revolutionary change.

DARPA publicizes funding opportunities primarily by Broad Agency Announcements (BAAs) dedicated to specific areas of research and development. Each DARPA technical office also maintains an "open" BAA that is less restrictive in terms of defining the specific capabilities being sought. Open BAAs offer a mechanism to reach DARPA for researchers with an idea that may fall outside of DARPA's current priorities, but that the proposer feels could be valuable to national security.

DARPA BAAs and Requests for Proposals (RFPs) can be found on www.fedbizopps.gov³⁵, the official federal website for public procurement, and at www.grants.gov. A partial listing of DARPA opportunities can also be found at DARPA's Opportunities page. DARPA often hosts Proposers Days to provide information on recently released or soon-to-be released BAAs. The purpose of these conferences is to provide information on the program, promote additional discussion and address questions from potential proposers.

DARPA also offers [Young Faculty Award program](#) funding to promising junior faculty positions at U.S. academic institutions.

Funding conditions and eligibility

For reasons inherent to their mission, both DoD and DARPA might limit their research activities to US organisations and participants. However, especially on procurement funding opportunities, foreign entities are allowed to participate, provided that they comply with a number of confidentiality-related requirements.

Office of Naval Research – Science and Technology

The Office of Naval Research (ONR, www.onr.navy.mil) is constantly looking for innovative scientific and technological solutions to address current and future Navy and Marine Corps requirements. They are looking for collaboration with educational institutions, nonprofit and for-profit organisations with ground-breaking ideas, pioneering scientific research and novel technology developments. Opportunities are listed here: <http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx>

The Office of Naval Research is not part of the NITRD programme.

DOE – Department of Energy

The mission of the Department of Energy (www.energy.gov) is to ensure the U.S.'s security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions addressing electric power, energy sources and climate change issues. In particular, as stated in the website, "the Department catalyzes

NITRD Budget:

FY 2017 Total Budget Request: 759.1

FY 2016 Total Budget Estimate: 720.5

FY 2015 Total Budget Actual: 644.9

³⁵To view DARPA's solicitations on FedBizOpps, enter "Other Defense Agencies/Defense Advanced Research Projects Agency" in the "Agency" box within the search tool. The following shortcut link also will take you directly to the DARPA Opportunities page on FBO: <http://go.usa.gov/3W53j>

the transformative growth of basic applied scientific research, the discovery and development of new clean energy technologies and prioritizes scientific innovation as a cornerstone of US economic prosperity.”

The Energy Department supports a number of grant, loan and financing programs, which are all summarized at the page <http://energy.gov/public-services/funding-financing> and divided into three main groups of opportunities: energy businesses; energy projects; additional funding resources. In addition, the Department of Energy also encourages organisations and individuals to submit self-generated, unsolicited proposals that are relevant to DOE's research and development mission, according to specific guidelines³⁶.

For what concerns R&I activities in the area of PICASSO, research funding opportunities are managed by DOE's Office of Science (SC), and the Advanced Research Projects Agency - Energy (ARPA-E).

Of particular importance for PICASSO's focus area is also the work undertaken by the Energy Department's National Labs on high performance computing, counting on 32 of the 500 fastest supercomputers in the world. The National Labs make their high performance computing facilities available to researchers from industry and academia so that these public investments in state-of-the-art technology are able to generate the greatest possible intellectual and economic benefit.

Office of Science

The *Funding and Opportunities* section of the Office of Science website provides all information on available opportunities and on submission and evaluations procedures (<http://science.energy.gov/funding-opportunities>). Moreover it provides FAQs, a solid list of external portals, contract information, and contacts for information.

It is to be noted how all grant application procedures are externalized through the portal www.grants.gov and shall be submitted in response to an open Funding Opportunity Announcement (FOA). The Office of Science does not accept unsolicited applications for financial assistance.

There is no explicit policy regarding international participant eligibility, however in the *Funding Opportunity Announcements* page it is stated that per some FOAs, eligibility is limited to domestic organisations only, suggesting that the option exists for international applicant to participate to some FOAs.

ARPA-Energy – Advanced Research Projects Agency – Energy

In the *Apply for Funding* page is stated that “ARPA-E issues periodic Funding Opportunity Announcements (FOAs), which are focused on overcoming specific technical barriers around a specific energy area. ARPA-E also issues periodic OPEN FOAs to identify high-potential projects that address the full range of energy-related technologies, as well as funding solicitations aimed at supporting America's small business innovators.” A dedicated funding portal is available at <https://arpa-e-foa.energy.gov/>

³⁶<http://www.netl.doe.gov/business/unsolicited-proposals>

Funding conditions and eligibility

The participation of foreign entities is allowed, but eligibility criteria shall be checked in each specific FOA's. This is the typical "foreign entities" provision within a FOA:

Foreign entities, whether for-profit or otherwise, are eligible to apply for funding as Standalone Applicants, as the lead organisation for a Project Team, or as a member of a Project Team. All work by foreign entities must be performed by subsidiaries or affiliates incorporated in the United States (including U.S. territories). The Applicant may request a waiver of this requirement in the Business Assurances & Disclosures Form, which is submitted with the Full Application. Please refer to the Business Assurances & Disclosures Form for guidance on the content and form of the request.

Office of Energy Efficiency & Renewable Energy

This office provides funding for high-potential projects that address the full range of energy-related technologies, as well as funding solicitations aimed at supporting America's small business innovators. Opportunities are available through a dedicated portal: <https://eere-exchange.energy.gov>.

Funding conditions and eligibility

Also here, the participation of foreign entities is allowed, with specific provisions to be checked for each single FOA. The Prime Recipient of the funding might be asked to be incorporated (or otherwise formed) under the laws of a State or territory of the United States. If a foreign entity applies for funding as a Prime Recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a State or territory of the United States to be the Prime Recipient.

NIH – National Institutes of Health

The National Institutes of Health (www.nih.gov) is the nation's medical research agency, which comprises different Institutes and Centres (ICs) supporting specific areas of health-related research. Each Institute and Centre maintains a website with funding opportunities and areas of interest.

NITRD Budget:

FY 2017 Total Budget Request: 754.7

FY 2016 Total Budget Estimate: 754.7

FY 2015 Total Budget Actual: 729.7

In 2008 the National Institutes of Health (NIH) and the European Commission agreed on funding reciprocity for collaborative projects; this means that the respective US or EU funding agencies commit to fund participants from the other side of the ocean, when it deals with health-related research (see also paragraph "Participation Features" in Chapter I). This agreement makes the NIH the owner of the largest programmes in which direct funding of EU-based researchers and institutions is foreseen. In order to reduce further impediments to collaboration, mainly based on policy differences, including policy language, a bilateral working group was established for both the NIH and the EU.

NIH uses specific activity codes (e.g. R01, R43, etc.) to differentiate the different research-related programs they support. Research grants are identified by the R series, which comprises: NIH Research Project Grant Program (R01); NIH Small Grant Program (R03); NIH Support for Conferences and Scientific Meetings (R13 and U13); NIH Academic Research Enhancement Award (AREA); NIH Exploratory/Developmental Research Grant Award (R21); NIH Clinical Trial Planning Grant (R34)

Program; NIH High Priority, Short-Term Project Award (R56); Research Project Cooperative Agreement; and NIH Pathway to Independence (PI) Award (K99/R00). Each type of program is described here: http://grants.nih.gov/grants/funding/funding_program.htm.

Funding conditions and eligibility

NIH is one of the few agency having an explicit policy concerning foreign applicants. Regarding foreign eligibility, here is what the “who is eligible” page of the website states:

In general, foreign institutions and international organisations, including public or private non-profit or for-profit organisations, are eligible to apply for research project grants. Foreign institutions and international organisations are not eligible to apply for Kirschstein-NRSA institutional research training grants, program project grants, center grants, resource grants, SBIR/STTR grants, or construction grants. However, some activity codes, such as program project grants (P01), may support projects awarded to a domestic institution with a foreign component. For purposes of this policy, a “foreign component” is defined as performance of any significant element or segment of the project outside the United States (U.S.) either by the grantee or by a researcher employed by a foreign institution, whether or not grant funds are expended. Proposed research should provide special opportunities for furthering research programs through the use of unusual talent, resources, populations, or environmental conditions in other countries that are not readily available in the U.S. or that augment existing U.S. resources.

Foreign applicants are strongly encouraged to review the Eligibility section of the Funding Opportunity Announcement (FOA) to determine whether their non-domestic (non-U.S.) entity (foreign organisation) is eligible to respond to that particular FOA. Additional information on grants to foreign institutions, international organisations and domestic grants with foreign components is found in the [NIH Grants Policy Statement](#)³⁷.

Foreign applicants can find eligibility information in Section III of each funding opportunity announcement (FOA) since in general not all NIH Institutes and Centers (ICs) accept applications for all types of grant programs; participation of EU-based participant, however, remains governed by the above-mentioned existing agreement so in principle their eligibility shall be guaranteed.

NIST – National Institute of Science and Technology

NIST (www.nist.gov) is one of the nation's oldest physical science laboratories. Today, NIST measurements support the smallest of technologies—nanoscale devices so tiny that tens of thousands can fit on the end of a single human hair—to the largest and most complex of human-made creations, from earthquake-resistant skyscrapers to wide-body jetliners to global communication networks.

NITRD Budget:

FY 2017 Total Budget Request:160.5

FY 2016 Total Budget Estimate:146.9

FY 2015 Total Budget Actual: 138.3

³⁷<https://grants.nih.gov/policy/nihgps/index.htm>. See in particular: Part I: NIH Grants—General Information, 1- Glossary; definition of terms; “foreign component”; and Part II: Terms and Conditions of NIH Grant Awards, Subpart B: Terms and Conditions for Specific Types of Grants, Grantees, and Activities, 16- grants to foreign institutions, international organizations, and domestic grants with foreign components.

NIST is the Institute with direct mandate on Information Technology research, including areas such as: Cybersecurity; Cloud Computing; Computer security; Smart Grid; Biometrics; Data mining; Health IT; Imaging; Networking; Software Testing Metrics; Telecommunications/Wireless, and others.

Its section “Funding opportunities”, <http://www.nist.gov/director/grants/grants.cfm> contains all open applications providing link to the portal Grants.gov.

Funding conditions and eligibility

Eligibility criteria are provided in the Announcement of Federal Funding Opportunity (FFO) and are specific to each announcement. Some opportunities are limited to entities located in the United States or its territories, but others are opened to foreign public entities, foreign governments, organisations under the jurisdiction of foreign governments; international organisations. Other announcements, in presence of limitations linked to majority domestic ownership or control of applicants, may specify that “organisations that are ineligible to apply because they are majority foreign-owned or foreign-controlled may be included in a team or consortium as an unfunded collaborator, provided that they are organized and operated in the United States.”

Research opportunities and Open Calls

The following is a selection of relevant open calls in PICASSO's priority areas, selected by keyword search in Grant.Gov. The list does not mean to be exhaustive, but to provide a sense of US current priority targets in the given areas, as well as to show the approach differences in terms of description and eligibility policies between different agencies. Only calls admitting European participation have been included, although some of those do not foresee budget for foreign participants.

5G Networks

15-572 Computer and Network Systems (CNS): Core Programs

Funding Agency: NSF

Closing Date for Applications: Sep 26, 2016

Foreign entities eligibility: Eligible participation, no funding

Funding Opportunity Announcement (FOA):

Rationale summary:

CNS supports two core programs as described below -- Computer Systems Research (CSR) and Networking Technology and Systems (NeTS). In addition, CNS invites proposals that bridge the research areas of CSR and NeTS. Some of the topics specified below in the CSR and NeTS core program descriptions, along with others, are in the realm of "networked systems," requiring innovations and expertise in both networking and computer systems.

CSR Highlighted Areas: Embedded and Real-time Systems (ERS), Cloud Computing (CC), and Extensible Distributed Systems (EDS)

NeTS Highlighted Areas: Meta-Networking Research, Network Management, Optical Networks, Protocols for Pervasive Wireless Networking, Support of Next-Generation Virtualized Networks, and Wireless Networking Architectures.

Internet of Things (IoT)

Cybermanufacturing Systems (CM)

Funding Agency: NSF

Closing Date for Applications: Proposals accepted anytime

Foreign entities eligibility: Eligible participation, no funding

Funding Opportunity Announcement (FOA):

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505291

Rationale summary:

The Cybermanufacturing Systems (CM) Program supports fundamental research to enable the evolution of a wide range of network-accessed manufacturing services that: employ applications (or apps) that reside in the cloud and plug into an expansible, interactive architecture; are broadly accessible, guarantee reliable execution and have capabilities that are transparent to users; and are accessible at low cost to innovators and entrepreneurs, including both users and providers. There is an opportunity for researchers to pursue research and educational efforts to accelerate the creation of an interoperating, cross-process manufacturing service layer that enables the rapid, bottom-up transformation of access to manufacturing services. Such a service layer can allow creative entrepreneurs and companies to both furnish and access manufacturing apps that span the full spectrum from ideation to physical realization, giving rise to an era of cybermanufacturing. The

cybermanufacturing service layer differs from existing Internet services in that it needs an architecture that can incrementally incorporate and organize the rich and deep semantic elements of manufacturing knowledge, requiring an almost unlimited capacity to expand the range and depth of content contributed in the form of partitioned, but interoperating, manufacturing applications.

Cyber Physical Systems

Communications, Circuits, and Sensing-Systems (CCSS) Program

Funding Agency: NSF

Concept Paper Submission Deadline: Nov 01, 2016

Foreign entities eligibility: Eligible participation, no funding.

Funding Opportunity Announcement (FOA):

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505248

Rationale summary:

The Communications, Circuits, and Sensing-Systems (CCSS) Program is intended to spur visionary systems-oriented activities in collaborative, multidisciplinary, and integrative engineering research. CCSS supports systems research in hardware, signal processing techniques, and architectures to enable the next generation of cyber-physical systems (CPS) that leverage computation, communication, and algorithms integrated with physical domains. CCSS supports innovative research and integrated educational activities in micro- and nano-electromechanical systems (MEMS/NEMS), communications and sensing systems, and cyber-physical systems. The goal is to design, develop, and implement new complex and hybrid systems at all scales, including nano and macro, that lead to innovative engineering principles and solutions for a variety of application domains including, but not limited to, healthcare, medicine, environmental and biological monitoring, communications, disaster mitigation, homeland security, intelligent transportation, manufacturing, energy, and smart buildings.

Funding Agency: NSF

Closing Date for Applications: Nov 01, 2016

Foreign entities eligibility: Eligible participation, no funding.

Funding Opportunity Announcement (FOA):

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505249

Rationale summary:

Recent advances in communications, computation, and sensing technologies offer unprecedented opportunities for the design of cyber-physical systems with increased responsiveness, interconnectivity and automation. To meet new challenges and societal needs, the Energy, Power, Control and Networks (EPCN) Program invests in systems and control methods for analysis and design of cyber-physical systems to ensure stability, performance, robustness, and security. Topics of interest include modeling, optimization, learning, and control of networked multi-agent systems, higher-level decision making, and dynamic resource allocation as well as risk management in the presence of uncertainty, sub-system failures and stochastic disturbances. EPCN also invests in adaptive dynamic programming, brain-like networked architectures performing real-time learning, and neuromorphic engineering. EPCN supports innovative proposals dealing with systems research in such areas as energy, transportation, and nanotechnology. EPCN places emphasis on electric power systems, including generation, transmission, storage, and integration of renewables; power electronics and drives; battery management systems; hybrid and electric vehicles; and understanding of the interplay

of power systems with associated regulatory and economic structures and with consumer behavior. Also of interest are interdependencies of power and energy systems with other critical infrastructures.

Big Data

PD-12-8084 Computational and Data-Enabled Science and Engineering

Funding Agency: NSF

Closing Date for Applications: Sep 30, 2016

Foreign entities eligibility: Eligible participation, no funding.

Funding Opportunity Announcement (FOA):
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504813

Rationale summary: Advanced computational infrastructure and the ability to perform large-scale simulations and accumulate massive amounts of data have revolutionized scientific and engineering disciplines. The goal of the CDS-E program is to identify and capitalize on opportunities for major scientific and engineering breakthroughs through new computational and data analysis approaches. The intellectual drivers may be in an individual discipline or they may cut across more than one discipline in various Directorates. The key identifying factor is that the outcome relies on the development, adaptation, and utilization of one or more of the capabilities offered by advancement of both research and infrastructure in computation and data, either through cross-cutting or disciplinary programs.

DARPA-BAA-16-18: STRATEGIC TECHNOLOGIES

Funding Agency: DARPA

Concept Paper Submission Deadline: 12/8/2016 5:00 PM ET

Foreign entities eligibility: Eligible

Funding Opportunity Announcement (FOA):

https://www.fbo.gov/index?s=opportunity&mode=form&id=ca75353021370d80db072912da8dda66&tab=core&_cview=0

Rationale summary:

DARPA is soliciting innovative research proposals in the area of automated model discovery systems that create empirical models of real, complex processes from data. Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically excluded is research that primarily results in evolutionary improvements to the existing state of practice.

DARPA-BAA-16-43: Data-Driven Discovery of Models (D3M)

Funding Agency: DARPA

Concept Paper Submission Deadline: 12/8/2016 5:00 PM ET

Foreign entities eligibility: Eligible

Funding Opportunity Announcement (FOA):

https://www.fbo.gov/index?s=opportunity&mode=form&id=a93bd7c9187c88966b3ba078364a5970&tab=core&_cview=0

Rationale summary:

DARPA is soliciting innovative research proposals in the area of semi-automated discovery of machine learning and statistical models and processing pipelines. Proposed research should investigate innovative approaches that enable revolutionary advances in science, devices, or systems. Specifically

excluded is research that primarily results in evolutionary improvements to the existing state of practice.

PA-16-119: THE APPLICATION OF BIG DATA ANALYTICS TO DRUG ABUSE RESEARCH (R01)

Funding Agency: National Institutes of Health

Concept Paper Submission Deadline: 07/5/2019 5:00 PM ET

Foreign entities eligibility: Eligible

Funding Opportunity Announcement (FOA):

<http://grants.nih.gov/grants/guide/pa-files/PA-16-119.html>

Rationale summary:

The purpose of this FOA is to encourage the application of Big Data analytics to reveal deeper or novel insights into the biological and behavioral processes associated with substance abuse and addiction. NIDA recognizes that to accelerate progress toward understanding how the human brain and behavior is altered by chronic drug use and addiction, it is vital to develop more powerful analytical methods and visualization tools that can help capture the richness of data being generated from genetic, epigenetic, molecular, proteomic, metabolomic, brain-imaging, micro-electrode, behavioral, clinical, social, services, environmental studies as well as data generated from electronic health records. Applications for this FOA should develop and/or utilize computational approaches for analyzing large, complex datasets acquired from drug addiction research. The rapid increase of technologies to acquire unprecedented amounts of neurobiological and behavioral data, and an expanding capacity to store those data, results in great opportunity to bring to bear the power of the computational methods of Big Data analytics on drug abuse and addiction.

PA-14-156: EXTENDED DEVELOPMENT, HARDENING AND DISSEMINATION OF TECHNOLOGIES IN BIOMEDICAL COMPUTING, INFORMATICS AND BIG DATA SCIENCE (R01)

Funding Agency: National Institutes of Health / BISTI

Concept Paper Submission Deadline: 08/5/2017 5:00 PM ET

Foreign entities eligibility: Eligible

Funding Opportunity Announcement (FOA):

<http://grants.nih.gov/grants/guide/pa-files/PA-14-156.html>

Rationale summary:

The goal of this program announcement is to support the extended development, maintenance, testing, evaluation, hardening and dissemination of existing biomedical software. The NIH is interested in promoting a broad base of research and development of technologies in biomedical computing, informatics, and Big Data Science that will support rapid progress in areas of scientific opportunity in biomedical research. It is expected that this research and development is conducted in the context of important biomedical and behavioral research problems and that domain researchers are consulted to make sure that the software is relevant to users. As such, applications are intended to develop enabling technologies that could apply to the interests of most NIH Institutes and Centers and range from basic biomedicine and including research to all relevant organ systems and diseases. Major themes of research include collaborative environments; data integration; analysis and modeling methodologies; and novel computer science and statistical approaches. New opportunities are also emerging as large and complex data sets are becoming increasingly available to the research community. The proposed work should apply best practices and proven methods for software design, construction, and implementation to extend the applicability of existing technologies in biomedical computing, informatics and big data science to a broader biomedical research community.

PA-14-155: EARLY STAGE DEVELOPMENT OF TECHNOLOGIES IN BIOMEDICAL COMPUTING, INFORMATICS, AND BIG DATA SCIENCE (R01)**Funding Agency:** National Institutes of Health / BISTI**Concept Paper Submission Deadline:** 08/5/2017 5:00 PM ET**Foreign entities eligibility:** Eligible**Funding Opportunity Announcement (FOA):**<http://grants.nih.gov/grants/guide/pa-files/PA-14-155.html>**Rationale summary:**

The NIH is interested in promoting a broad base of research and development of technologies in biomedical computing, informatics, and Big Data Science that will support rapid progress in areas of scientific opportunity in biomedical research. It is expected that this research and development is conducted in the context of important biomedical and behavioral research problems. As such, applications are intended to develop enabling technologies that could apply to the interests of most NIH Institutes and Centers and range from basic biomedicine and including research to all relevant organ systems and diseases. Major themes of research include collaborative environments; data integration; analysis and modeling methodologies; and novel computer science and statistical approaches. New opportunities are also emerging as large and complex data sets are becoming increasingly available to the research community. This initiative aims to address biomedical research areas in biomedical computing, informatics, and Big Data science through the early stage development of new software, tools and related resources, as well as the fundamental research (e.g., methodologies and approaches) leading up to that development.

Smart cities and Smart energies

Funding opportunities in the area of smart cities, intended as technology pilots applied to a given territory, were normally opened only to local entities. However, some opportunities are present at the level of the underlying enabling technologies, especially in the energy sector.

DE-FOA-0001495: ENABLING EXTREME REAL-TIME GRID INTEGRATION OF SOLAR ENERGY (ENERGISE)**Funding Agency:** Golden Field Office**Concept Paper Submission Deadline:** Aug 26, 2016**Foreign entities eligibility:** Eligible**Funding Opportunity Announcement (FOA):** <https://eere-exchange.energy.gov/#Foald736ccdfb-d65d-49bb-9156-8ce9788802a7>**Rationale summary:**

As part of the Department of Energy's Grid Modernization and SunShot Initiatives, this Enabling Extreme Real-Time Grid Integration of Solar Energy (ENERGISE) Funding Opportunity Announcement (FOA) supports the research and development of highly scalable distribution system planning and real-time operation solutions that enables seamless interconnection and integration of high penetration solar generation onto the electricity grid in a cost-effective, secure, and reliable manner. The envisioned ENERGISE solutions will require the extensive use of sensor, communication, and data analytics technologies to gather up-to-the-minute measurement and forecast data from diverse sources and perform continuous optimization analysis and active control for existing and new PV installations in real time. The solutions need be compatible with the existing grid architecture in the

near term and with the advanced grid architecture in the long term. The solutions should also be designed with consideration of the interoperability and cybersecurity requirements.

DE-FOA-0001566: ENERGY-EFFICIENT LIGHT-WAVE INTEGRATED TECHNOLOGY ENABLING NETWORKS THAT ENHANCE DATACENTERS (ENLITENED)

Funding Agency: ARPA-E

Concept Paper Submission Deadline: 25/7/2016 5:00 PM ET

Foreign entities eligibility: Eligible.

Funding Opportunity Announcement (FOA):

<https://arpa-e-foa.energy.gov/FileContent.aspx?FileID=859e388e-9d5e-4ba9-b021-f3b25b61aea8>

Rationale summary:

The growing demand for datacenter services across a range of applications has resulted in significant and sustained growth in electrical energy consumption in the Information Communications Technology (ICT) sector. Currently, datacenters consume more than 2.5 % of US electricity and this percentage is projected to double in about 8 years. Efficiency improvements due to more efficient cooling, power delivery, and electronic processor chips via Moore's law improve overall efficiency, but do not significantly slow the current growth trend; to do so requires a transformative improvement. The overall objective of the ENLITENED (ENergy-efficient Light-wave Integrated Technology Enabling Networks that Enhance Datacenters) program, therefore, is to provide a transformative change - to achieve an overall doubling in datacenter energy efficiency in 10 years through deployment of novel network topologies enabled by integrated photonics technologies. ARPA-E estimates that if the technical challenges posed by ENLITENED can be overcome, these alone would reduce projected US energy use by about 1% after 10 years and realize at least twice the number of datacenter transactions with the same amount of energy.

DE-FOA-0001428: INNOVATIVE DEVELOPMENT IN ENERGY-RELATED APPLIED SCIENCE (IDEAS)

Funding Agency: ARPA-E

Concept Paper Submission Deadline: 30/9/2016 5:00 PM ET

Foreign entities eligibility: Eligible.

Funding Opportunity Announcement (FOA): <https://arpa-e-foa.energy.gov/FileContent.aspx?FileID=4e5fbc08-e795-4740-8bd9-73a03450d158>

Rationale summary:

This Funding Opportunity Announcement (FOA) provides a continuing opportunity for the rapid support of early-stage applied research to explore innovative new concepts with the potential for transformational and disruptive changes in energy technology. IDEAS awards are intended to be flexible and may take the form of analyses or exploratory research that provides the agency with information useful for the subsequent development of focused technology programs. IDEAS awards may also support proof-of-concept research to develop a unique technology concept, either in an area not currently supported by the agency or as a potential enhancement to an ongoing focused technology program. Applications must propose concepts that are not covered by open ARPA-E focused FOAs and that also do not represent incremental improvements over existing technology.

Other opportunities in ICT

The following is a selection of currently open opportunities in the ICT field which find correspondence in current EU priorities and allow EU participation.

PD-14-1464 Engineering and Systems Design**Funding Agency:** NSF**Closing Date for Applications:** Sep 15, 2016**Foreign entities eligibility:** Eligible, with no funding.**Funding Opportunity Announcement (FOA):**http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13340**Rationale summary:**

The Engineering and Systems Design (ESD) program supports fundamental research leading to new engineering and systems design methods and practices for specific global contexts. In particular, ESD seeks intellectual advances in which the theoretical foundations underlying design and systems engineering are operationalized into rigorous and pragmatic methods for a specific context. In addition, the program funds the rigorous theoretical and empirical characterization of new or existing methods for design and systems engineering, identifying in which global contexts and under which assumptions these methods are effective and efficient. Such a global context includes both a domain (such as energy systems, consumer products, cyber-physical systems) and an economic, socio-political, environmental and technological context. Application of existing design methods or tools to new domains is out of scope. Research in ESD should advance the state of knowledge of design methodology, for instance, by adapting existing methods to a new context or by carefully characterizing existing or new design methods in a new context. [...] ESD supports research towards novel integrated frameworks that combine preference and belief elicitation, concept generation, gradual specification refinement, modeling at different levels of abstractions, uncertainty characterization, optimization, HPC, visualization, etc.

DARPA-BAA-16-18 Strategic Technologies Department of Defense DARPA - Strategic Technology Office**Funding Agency:** DARPA**Concept Paper Submission Deadline:** Dec 21, 2016**Foreign entities eligibility:** allowed.**Funding Opportunity Announcement (FOA):**https://www.fbo.gov/index?s=opportunity&mode=form&id=ca75353021370d80db072912da8dda66&tab=core&_cview=0**Rationale summary:**

DARPA is seeking innovative ideas and disruptive technologies that offer the potential for significant capability improvement across the Strategic Technology Office focus areas. This includes technology development related to Battle Management, Command and Control (BMC2), Communications and Networks, Electronic Warfare, Intelligence, Surveillance, and Reconnaissance (ISR), Position, Navigation, and Timing (PNT), Maritime, and Foundational Strategic Technologies and Systems.

N00014-16-R-FO05: Multidisciplinary Research Program of the University Research Initiative**Funding Agency:** Office of Naval Research**Concept Paper Submission Deadline:** Nov 15, 2016**Foreign entities eligibility:** Eligible participation, no funding.**Funding Opportunity Announcement (FOA):**

<http://www.onr.navy.mil/Contracts-Grants/Funding-Opportunities/Broad-Agency-Announcements.aspx>

Rationale summary:

The MURI program supports high risk basic research in science and engineering at U.S. institutions of higher education (hereafter referred to as "universities") that is of potential interest to DoD. The program is focused on multidisciplinary research efforts where more than one traditional discipline interacts to provide rapid advances in scientific areas of interest to the DoD. As defined in the DoD Financial Management Regulation: Basic research is systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. It includes all scientific study and experimentation directed toward increasing fundamental knowledge and understanding in those fields of the physical, engineering, environmental, and life sciences related to long-term national security needs. It is farsighted high payoff research that provides the basis for technological progress (DoD 7000.14-R, vol. 2B, chap. 5, para. 050201.B). DoD's basic research program invests broadly in many specific fields to ensure that it has early cognizance of new scientific knowledge. The FY 2017 MURI competition is for the topics listed below.

White papers and full proposals addressing the following topics should be submitted to the Air Force Office of Scientific Research (AFOSR):

Topic 1 (AFOSR): Foundations of Interactive Protocols for Quantum Computation and Communications

Topic 2 (AFOSR): Bioinspired Low-Energy Information Processing

Topic 3 (AFOSR): Autonomous Research Systems for Materials Development

Topic 4 (AFOSR): Beam/Wave Dynamics in Geometrically Complex Systems with Emitting Boundaries

Topic 5 (AFOSR): Atmospheric disturbances at high altitudes

Topic 6 (AFOSR): Revolutionary Advances in Computational Quantum Many Body Physics

Topic 7 (AFOSR): Melanin: Unique Biopolymers for Functional Precision Nanoscale Materials

Topic 8 (AFOSR): Adaptive Oxides for Biomimetic Synapse Design via Modulation of Internal States

White papers and full proposals addressing the following topics should be submitted to the Office of Naval Research (ONR):

Topic 9 (ONR): Physics, Chemistry and Mechanics of Polymer Dielectric Breakdown

Topic 10 (ONR): Percept formation and scene analysis in echolocating systems

Topic 11 (ONR): Phase Change Materials for Photonics

Topic 12 (ONR): Event Representation and Episodic Memory

Topic 13 (ONR): Nonlinear Phenomena and Interactions Induced by Short and Ultra-Short Pulsed Lasers in the Long-Wave Infrared Regime

Topic 14 (ONR): High-Fidelity Simulation Methodologies for Multi-Phase Flows

Topic 15 (ONR): Novel Approaches to Modeling Factions and Conflict

Topic 16 (ONR): Assuring Composability and Correctness for Intelligent and Learning Systems that Interact with Unstructured Physical Environments

White papers and full proposals addressing the following topics should be submitted to the Army Research Office (ARO):

Topic 17 (ARO): Additive 3D Self-Assembly of Responsive Materials

Topic 18 (ARO): Anyons in 2D materials and cold Atomic gases

Topic 19 (ARO): Characterization of Information Content in Data for Multimodal Data Analysis

Topic 20 (ARO): Nutritional and Environmental Effects on the Gut Microbiome and Cognition

Topic 21 (ARO): Spectral Decomposition and Control of Strongly Coupled Nonlinear Interacting Systems

Topic 22 (ARO): Toward Room Temperature Exciton-Polaritonics

Topic 23 (ARO): Cyber Deception through Active Leverage of Adversaries' Cognition Process

Conclusions

Information provided in this document aims at drawing a sufficiently representative panorama of what is currently being funded or opened for collaboration both in the US and the UE in the priority areas that are object of PICASSO. However, given the fast-changing character of the funding and access opportunities panorama, the utility of this tool lies especially in its capacity to describe the higher priority-setting landscape of relevant funding institutions, and to orient the participants amongst the wide set of opportunities and initiatives that are relevant for our ICT priority areas. Information, links, and references to specific calls and initiatives shall be intended also as a gateway for future opportunities.

Any relevant updated information on upcoming opportunities or orientations will be made available on the PICASSO website. At this purpose, the PICASSO team also welcomes any external contribution, suggestion or comment on the information currently available, with a view to provide a more complete photography of the present and future opportunities' landscape.

Annex I - Acronyms

US Departments and Agencies

NITRD Member Agencies

The following Federal agencies conduct or support R&D in advanced networking and information technologies, report their IT research budgets in the NITRD crosscut, and provide support for program coordination:

Department of Commerce (DOC)
 National Institute of Standards and Technology (NIST)
 National Oceanic and Atmospheric Administration (NOAA)
 Department of Defense (DoD)
 Defense Advanced Research Projects Agency (DARPA)
 National Security Agency (NSA)
 Office of the Secretary of Defense (OSD)
 Service Research Organisations (Air Force, Army, Navy)
 Department of Energy (DOE)
 National Nuclear Security Administration (DOE/NNSA)
 Office of Electricity Delivery and Energy Reliability (DOE/OE)
 Office of Science (DOE/SC)
 Department of Health and Human Services (HHS)
 Agency for Healthcare Research and Quality (AHRQ)
 National Institutes of Health (NIH)
 Office of the National Coordinator for Health Information Technology (ONC)
 Department of Homeland Security (DHS)
 Science and Technology Directorate (S&T)
 Department of Justice (DOJ)
 National Institute of Justice (NIJ)
 Environmental Protection Agency (EPA)
 National Aeronautics and Space Administration (NASA)
 National Archives and Records Administration (NARA)
 National Reconnaissance Office (NRO)
 National Science Foundation (NSF)

NITRD Participating Agencies

The following Federal agencies participate in NITRD activities and have mission interests that involve applications and R&D in advanced networking and information technologies:

Department of Commerce (DOC)
 National Telecommunications and Information Administration (NTIA)
 Department of Defense (DoD)
 Defense Health Agency (DHA)
 Department of Defense Intelligence Information Systems (DoDIIS)
 Joint Improvised Explosive Device Defeat Organisation (JIEDDO)
 National Computer Security Center (NCSC)
 National Geospatial-Intelligence Agency (NGA)
 Telemedicine and Advanced Technology Research Center (TATRC)
 Department of Education (ED)
 Department of Energy (DOE)
 Office of Environmental Management (DOE/EM)
 Department of Health and Human Services (HHS)
 Centers for Disease Control and Prevention (CDC)
 Food and Drug Administration (FDA)
 Department of Homeland Security (DHS)
 Customs and Border Protection (CBP)
 Federal Protective Service (FPS)
 Transportation Security Administration (TSA)
 Department of Interior (Interior)
 National Park Service (NPS)
 U.S. Geological Survey (USGS)
 Department of Justice (DOJ)
 Federal Bureau of Investigation (FBI)
 Department of Labor (DOL)
 Bureau of Labor Statistics (BLS)
 Department of State (State)
 Department of Transportation (DOT)
 Federal Aviation Administration (FAA)
 Federal Highway Administration (FHWA)
 Department of the Treasury (Treasury)
 Office of Financial Research (OFR)
 Department of Veterans Affairs (VA)
 Federal Communications Commission (FCC)
 Federal Deposit Insurance Corporation (FDIC)
 General Services Administration (GSA)
 Nuclear Regulatory Commission (NRC)
 Office of the Director of National Intelligence (ODNI)
 Intelligence Advanced Research Projects Activity (IARPA)
 National Counterterrorism Center (NCTC)

U.S. Agency for International Development (USAID)
U.S. Department of Agriculture (USDA)
Agricultural Research Service (ARS)
National Institute of Food and Agriculture (NIFA)

EU Acronyms

<p>AC Associated Country Beneficiary Participant or Partner in a funded Horizon 2020 project Call Call for Proposals CA Consortium Agreement CFS Certificate on the Financial Statement (Audit) Coordinator Organisation or individual (representing the organisation) leading an application or project CORDIS Community Research and Development Information Service cPPP Contractual Public-Private Partnerships CR Consensus Report CSA Coordination and Support Action DG Directorate General (a “department” within the European Commission) DOW Description of Work (Annex I of Grant Agreement) ECAS European Commission Authentication Service (secure website access) EEN Enterprise Europe Network ERA European Research Area ERC European Research Council ESR Evaluation Summary Report FET Future and Emerging Technology FP Framework Programme for Research and Innovation FP7 Seventh Framework Programme (2007-13) FTI Fast Track to Innovation GA Grant Agreement H2020 Horizon 2020 IA Innovation Action ICPC International Cooperation Partner Country ICT Information and Communications Technology IER Individual Evaluation Report IF Individual Fellowship (MSCA) IPR Intellectual Property Rights ITN Innovation Training Network JTI Joint Technology Initiative (a PPP) KET Key Enabling Technology LEAR Legal Entity Appointed Representative LEIT Leadership in Enabling and Industrial Technologies MSCA Marie Skłodowska Curie Action (formerly Marie Curie Action) MS Member State NCP National Contact Point Partner Participant in a Horizon 2020 application (not a funded project)</p>	<p>PIC Participant Identification Code PPP Public Private Partnership (includes Joint Technology Initiatives) RI Research Infrastructure RIA Research and Innovation Action RISE Research and Innovation Staff Exchanges (MSCA) STI Science, Technology and Innovation TC Third Country VAT Value Added Tax (i.e. GST) WP Work Programme</p>
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