Selection of calls
FUNDING OPPORTUNITIES FOR PHOTONICS
H2020, Work Programme 2018-2020

Information obtained from the Work Programme
Published calls for 2018-2020

This document includes a selection of calls for 2018-2019 obtained from the whole collection of calls published under H2020, 2018-2020 Work Programmes. The criteria used for the selection is the relationship with Photonics Technologies (e.g. optics, lasers), both if they are directly mentioned in the text of the call or maybe if a *photonics application* fits in some part of the call (e.g. sensing, imaging, lighting, communications, manufacturing, etc.).

It is highly recommended to read carefully the original Work Programme published and updated by the EC prior to the preparation of a proposal.

Source:ec.europa.eu/research/participants/portal/desktop/en/funding/reference_docs.html#h2020-work-programmes-2018-20

Important notice: The parts that relate to 2019 are provided at this stage on an indicative basis. Such Work Programme parts will be decided during 2018.

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2. Future and Emerging Technologies

FETPROACT-01-2018: FET Proactive: emerging paradigms and communities

RIA ☑ IA ☒ CSA ☒

Specific Challenge

To explore and consolidate a new technological direction in order to put it firmly on the map as a viable **paradigm for future technology**. To foster the interdisciplinary communities that are able to drive this forward, extending from the participating consortia to a wider European pool of expertise. To stimulate the emergence of a European innovation eco-system around a new technological paradigm, well beyond the world of research alone.

Scope

Proposals are sought for cutting-edge **high-risk / high-reward research and innovation projects** that aim to demonstrate a new technological paradigm within the scope of one of the following sub-topics:

a. **Artificial organs, tissues, cells and sub-cellular structures**. Merging the growing understanding of genome, proteome, metabolome and cell behaviour with strategies for the engineering and use of biological and hybrid functional constructs is the core of this initiative. Proposals should build on recent advances in integrative biology (including modelling and simulation) and bio-engineering for engineering biological, artificial or hybrid sub-cellular systems (e.g., synapses, organelles, vesicles), highly specific cell assemblies (including microbial) and proper differentiation, tissues, organs or multi-organ systems. Examples of long-term research targets include synthetic cell building, cell assembly, and organ reproduction, replacement, control or repair of vital organ functions (e.g., following ageing, trauma or disease), their use in the development of personalised treatment, drugs or vaccines, and high-throughput organ- and body-on-chip technologies.

b. **Time**. This initiative seeks new technological possibilities inspired by notions of time, not seen as a given and singular background against which things unfold, but rather as a resource that can be experienced and used in different ways. Highly interdisciplinary research could address, for instance, technologies for subjective time awareness (and its neural basis) and distortion (e.g., contextual, emotional, pathological); for studying the role of time in processes like aging, healing, learning or evolution and how this can be influenced (e.g., stimulation) or changed in different 'materialities' (combining insights from biological or computational evolution, for instance); or modeling to understand and better anticipate non-linear temporality in complex systems (such as in economies, societies, climate ...). Technologies in, for instance, extreme electronics/photonics, data-streams analytics, time aware artificial intelligence, virtual and augmented reality, bio-engineering or neuroprosthetics could demonstrate new ways to represent, modulate, duplicate or differently experience and use time, thus altering our relationship with time (at individual and collective but differentiated level – e.g., according to gender or culture) and with impacts on, for instance, quality of life, therapy, learning, productivity, social and environmental awareness or the better understanding and management of natural hazards.

c. **Living technologies.** This initiative seeks to build on the emerging understanding from evolutionary biology, ethology, micro-, plant- and animal biology of essential features of living systems such as physical autonomy, growth, interaction and enaction, adaptation and evolution, among others. The aim is to create new functional biological, technological or hybrid artefacts, with similar capabilities of purposeful stability and change. This can also lead to hybrid materials and systems with programmable features of shape, structure, functionality and evolvability (including for their use in bio-robotics or bio-engineering), potentially constructed from naturally existing complexes, through synthetic biology, systems biology and /or chemical biology. New insights into the multi-level mathematics and complexity of living systems or the boundaries/characteristics of life may also emerge from this. Work on ethical implications should be included.

d. **Socially interactive technologies.** There is a growing understanding of the changes at cognitive, neural and physiological levels from group interactions in realistic settings, from pairs to large groups and crowds. Based on this, this initiative seeks new technologies for deeper social interaction involving, for instance, context, culture, emotion, and factors of embodiment and cognition. Realistic and larger contexts require new experimental tools and paradigms, combining social sciences and humanities with neuroscience, engineering and computing in new ways. This will lead to new socially interactive media with radical improvement for building trust and understanding, social integration, engagement, collaboration, learning, creativity, entertainment, education and wellbeing, among others. Work on ethical implications and gender should be included.

e. **Disruptive micro-energy and storage technologies.** This initiative seeks radically new approaches to energy for embedded, personal or local use (including bio-mimicking, the use of soft or intelligent materials to generate, capture or store energy or the development of new types of batteries). Proposals could target in particular the lower end (i.e., micro-energy or nano-scale energy transfer, dissipation and conversion) and/or new technologies for optimal local (close to where-needed) energy storage/release and their smart integration within hybrid/distributed energy systems. Proposals should also address aspects of sustainability and environmental impact.

f. Topological matter, strongly based on topology and quantum physics, is a rapidly emerging area that after an initial focus on insulators now touches the whole range of material properties, providing advances in spintronics, photonics, plasmas, mechanics, superconductivity, elasticity, acoustics and their combinations, among others. Here concept development together with design, realisation and testing of topological devices are called for to unleash the promise of topological matter beyond the pure physics and mathematics aspects. The much expected robustness, wide spectral range and topologically-protected spin- and transport properties call for an engineering approach to apply the multi-physics of wave-matter interactions to novel, potentially lossless communication components and circuits. Challenges to be addressed include compact designs and fabrication technologies, setting figures of merit and benchmarks relevant to functions.

FET Proactive projects shall establish a solid baseline of knowledge and skills and assemble the interdisciplinary communities around them. They shall further foster the emergence of a broader innovation ecosystem and create a fertile ground for future take-up of its new technological paradigm (e.g., public engagement, informal education, policy debate).

The Commission considers that proposals requesting a contribution from the EU of EUR 4 to 7 million (but up to EUR 5 million for proposals on the sub-topics of 'Time' and 'Topological matter') and with a duration of up to 5 years would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals of different size and duration.

This topic allows for the provision of financial support to third parties established in an EU member state or country associated with Horizon 2020 in line with the conditions set out in General Annex K, either to enhance impacts through punctual small scale experimentation and use of project results by third parties, or to award a prize following a contest organised by the beneficiaries.

Expected Impact

- Scientific and technological contributions to the foundation and consolidation of a radically new future technology.
- Potential for future returns in terms of societal or economic innovation or market creation.
- Spreading excellence and building leading innovation capacity across Europe by involvement of key actors that can make a difference in the future, for example excellent young, researchers, ambitious high-tech SMEs or first-time participants to FET under Horizon 202010.
- Build-up of a goal oriented interdisciplinary community (within and beyond the consortium).
- Emergence of an innovation ecosystem around a future technology in the theme addressed from outreach to and partnership with high potential actors in research and innovation, and from wider stakeholder/public engagement, with due consideration of aspects such as education, gender differences and long-term societal, ethical and legal implications.

FETFLAG-01-2018: Preparatory Actions for new FET Flagships

RIA ☒ IA ☒ CSA ☑

Specific Challenge

FET Flagships are science- and technology-driven, large-scale, multidisciplinary research initiatives built around a visionary unifying goal. They tackle grand science and technology (S&T) challenges requiring cooperation among a range of disciplines, communities and programmes. FET Flagships should provide a strong and broad basis for future innovation and economic exploitation, as well as novel benefits for society of a potential high impact. The overarching nature and magnitude implies that they can only be realised through a collaborative, long-term sustained cooperation effort. This topic aims at launching Coordination and Support Actions (CSA) to prepare new candidate FET Flagships.

Scope

Proposals should contain a description of a potential FET Flagship and how this is to be matured over the course of the preparatory action into a more complete blueprint.

Firstly, proposals should describe the FET Flagship initiative they propose to further develop through this preparatory action, by specifically addressing the following three key issues:

- What makes this a FET Flagship: what is the unifying goal, the grand S&T challenge and the underlying vision; why is this a grand challenge and what makes it a "game-changer"; what are its main goals and objectives; and what are the technologies, including digital technologies, that it would advance.
- **Impact (why it is good for Europe)**: will it bring major impact on economy and society as well as on science and technology; why and how is it relevant for the European industry; how does it build on existing scientific excellence in Europe; what is its innovation potential that would benefit Europe's economy and/or society; how would it uniquely position Europe with respect to relevant developments and initiatives existing in other regions in the world.
- **Integration and European added value**: is it well positioned to address its grand S&T challenge in terms of large-scale integration across disciplines and the involvement of relevant stakeholders from academia, industry and society at large; does critical mass in terms of research excellence and industrial capabilities exist in Europe needed to address the challenge; what is the estimated scale of the effort required to reach the objectives and how long will it take to do so; and, are there similar initiatives existing at regional, national or European level and what is the added value of such an effort.

Secondly, proposals should describe how the activities of the preparatory action will involve stakeholders over the course of up to 12 months (indicative), to arrive at a complete design and description of a candidate FET Flagship initiative. Specifically, they should describe the proposed activities for further developing the Flagship's unifying goal and its underlying S&T roadmap; attracting industry's endorsement and participation; further developing their consortium and its governance structure and attracting large public support.

Proposals should consider multidisciplinary aspects, including where relevant social sciences and humanities. They must also describe a clear strategy for dissemination and citizen engagement; and, in close cooperation with other proposals for preparatory actions that will be selected from this call, jointly organise and participate in an event addressing stakeholders including scientific communities, policy makers and the wider public and aiming at disseminating the main objectives and findings of the actions.
At the end of the action, the design and description of the candidate Flagship should include the following elements:

- **A consolidated vision** based on a well-defined unifying goal articulated in terms of S&T objectives and of its targeted impact on economy and society.
- **A strategic long-term research roadmap**, showing how the unifying goal can be realised and what the major milestones are, situating the Flagship in the global landscape and demonstrating a credible path towards societal impact, technology development, innovation and exploitation.
- **A blueprint for the Flagship's implementation** setting out the overall collaboration and S&T framework, the identification of necessary competencies and resources including infrastructure aspects, and openness of the initiative.
- **An effective scientific leadership and governance structure** based on lessons learned from the present Flagships, describing the coordination and decision-making structures of the Flagship, the role of industry and the relations with Member States and countries associated with Horizon 2020, with the Commission and with the relevant funding agencies and national research initiatives.
- **Support from and involvement of industry**, giving a view on avenues for exploitation and further strengthening of European industry in the global landscape, including stimulating the emergence and growth of innovative value chains.
- **An approach to address responsible research and innovation**, in particular aspects such as education, gender aspects and societal, ethical and legal implications.

Proposals for candidate FET Flagships must target a visionary unifying goal within one of the following three main areas: **ICT and Connected Society; Health and Life Sciences; or Energy, Environment and Climate change**. They should present a multidisciplinary approach that brings together the relevant communities to address their unifying goal. Proposals must clearly specify which of the three areas they target. In each of these areas at least one and at most two proposals for Flagship preparatory actions will be selected for funding.

(1) ICT and Connected Society

The proposal should address any of the following sub-areas in part or in whole:

- **Smart Materials and Nanoscale Engineering:** Novel nano-engineered materials and systems with properties enabling the design and manufacturing of radically new ICT components and devices creating disruptive technologies and market opportunities, for example in energy efficiency, data processing, smart manufacturing, smart interfaces, nano-bio devices, etc.
- **Robotics, Interfaces and Artificial Intelligence:** a new generation of robotics technologies including soft and flexible robotics, bio-inspired robotics, new approaches to human-machine interaction and cooperation, cognition and artificial intelligence, giving rise to much smarter systems performing sophisticated functions opening radically new opportunities to address societal and economic challenges.
- **ICT for Social Interaction and Culture:** new ICT technologies and approaches for empowering deep social interactions across diverse cultures, languages, goals, values, etc.; for understanding large-scale complex socio-technical systems and their interactions, interdependencies and evolutions and avenues for exploiting this understanding; and/or for collecting, preserving, studying and promoting Europe's

(2) Health and the Life Sciences

The proposal should address any of the following sub-areas in part or in whole:

- **Disruptive technologies to Revolutionise Healthcare**: New technologies and approaches aiming at a paradigm shift in the field of individualised prevention, prediction and treatment of diseases. This includes among others bioinformatics and modelling approaches to use patients' genetic expression patterns, metabolism and derived systems; novel and innovative nano-medicine approaches (e.g. technologies for novel sensors and imaging, organ-on-a-chip and bio-electronic medicine, drug delivery, …); network medicine; neuro-prosthetic technologies; regenerative medicine and biofabrication techniques to reprogram or replace human cells, tissues and whole organs and to integrate these in functioning body systems.
- **Understanding Life by Exploring the Genome and the Cell:** Novel technologies and approaches that enable a paradigm shift in studying and understanding the foundational building blocks of life, for example the functioning of the cell, and of cells within organisms, including structure and dynamics, and the full multi-omics (genome/epigenome/proteome/metabolome/connectome etc.) and their interactions. This will open up radically new opportunities such as developing novel nano-bio devices and technologies, advanced screening methods and analytical and morphological technologies, advanced therapies and contribute

(3) Energy, Environment and Climate change

The proposal should address any of the following sub-areas in part or in whole:

- **Earth, Climate Change and Natural Resources:** New technologies and approaches for high-precision modelling and simulation, including the necessary data integration, that enable an in-depth understanding of the earth, natural hazards and climate change. Their exploitation and use should open up new opportunities for helping to manage/mitigate their effects and impacts on human activity and natural resources in a sustainable way in specific areas such as: agriculture (ensuring food security and sustainable farming), forestry, fisheries, protecting/restoring natural ecosystems, energy supply and demand, etc.
- **Radically new Energy Production, Conversion and Storage devices and systems:** Disruptive technologies aiming at a paradigm shift in renewable energy by exploring and exploiting radically new principles and novel materials that can substantially reduce Europe's dependence on fossil fuels and open new industrial opportunities for their exploitation and sustainable development.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 1 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact for the CSA

- Fully developed candidate FET Flagship initiatives supported by key stakeholders (e.g., academic research communities, industry, public authorities …).

For the proposed Flagships:

- Key benefits for economy and society based on significant advances on science and technology. This should be demonstrated by e.g. potential for S&T breakthroughs, industrial support, added value for Europe, potential for increasing European competitiveness, potential for societal benefits, etc.
- Long-lasting structuring effect on research efforts in Europe, anchor point for international cooperation and the nurturing of talent through the training of a new generation of researchers.)

FETFLAG-03-2018: FET Flagship on Quantum Technologies

RIA ☑ IA ☒ CSA ☒

Specific Challenge

To build a strongly networked European Quantum Technologies (QT) community around the common goals defined in the Strategic Research Agenda19. To create the European ecosystem that will deliver the knowledge, technologies and open research infrastructures and testbeds necessary for the development of a world-leading knowledge-based industry in Europe, leading to long-term economic, scientific and societal benefits. To move advanced quantum technologies from the laboratory to industry with concrete prototype applications and marketable products while advancing at the same time the fundamental science basis, in order to continuously identify new applications and find better solutions for solving outstanding scientific or technology challenges.

Scope:

A. Research and Innovation Actions

Proposals are expected to address a mix of quantum technology challenges addressing one or more of the following areas, integrating different aspects like physics, engineering, computer science, theory, algorithms, software, manufacturing, control, infrastructures, etc. Each activity should clearly move the technology up the TRL scale20. For areas a. to d., proposals can integrate various activities covering the whole value chain, from fundamental to applied research, and with other types of activity, including demonstrators, etc., as appropriate.

a. **Quantum Communication**21: Development of state-of-the art network devices, applications and systems (memories, quantum repeaters, network equipment, high throughput miniaturised quantum random number generators, etc.) for quantum communication mesh-networks. Proposals should target cost-effective solutions, devices and systems compatible with existing communication networks and standard cryptography systems, as well as device-independent protocols. Each proposal should address aspects like engineering, protocols, certification, software, algorithms. Actions should include validation of the proposed solution, proof of its suitability for the targeted application and benchmarking with respect to relevant targets set by the CSA22 in this area.
b. **Quantum Computing Systems**: The development of open quantum computer experimental systems and platforms23, integrating the key building blocks such as quantum processors (>10qubits) with limited qubit overhead, control electronics, software stack, algorithms, applications, etc. Work should address the scalability towards large systems (>100 qubits), the verification and validation of the quantum computation, fault-tolerance and solving a concrete computational problem to demonstrate the quantum advantage. Projects should foresee benchmarking activities. Benchmarks will be identified by the CSA24 for all the platforms selected in this area.
c. **Quantum Simulation**: Proposals should aim at delivering operational demonstrators, based on existing physical platforms that have shown a clear perspective to achieve more than 50 interacting quantum units and / or full local control. They should work towards demonstrating a certified quantum advantage for solving difficult scientific or industrial problems (e.g. material design, logistics, scheduling, machine learning, optimisation, artificial intelligence, drug discovery, etc.). The proposed solutions need to include the development of protocols, validation schemes and control, simulation software, system configuration and optimisation. Work should address the scalability towards larger systems with more qubits. Projects should foresee benchmarking activities related to real life applications. Benchmarks will be identified by the CSA25 for all the platforms selected in this area. Hybrid architectures are also to be considered under this area when relevant.
d. **Quantum Metrology and Sensing**: Quantum sensors for specific application areas such as imaging, healthcare, geo-sciences, outdoor and indoor navigation, time or frequency, magnetic or electrical measurements, etc. … as well as novel measurement standards26, making use of the advances in controlling the fundamental quantum properties. It is expected that the work will lead to practical sensing devices, imaging systems and quantum standards that employ quantum coherence and outperform classical counterparts (resolution, stability) targeting TRL 3 and 4 and showing potential for further miniaturisation/integration into industrial systems.
e. **Fundamental science:** Research and development of basic theories and components, addressing a foundational challenge of relevance for the development of quantum technologies in at least one of the four areas a.-d. described above, to improve the performance of the components or subsystems targeted in those areas. Proposals must clearly indicate how they support a challenge for one or more of these areas.

For areas a. to d., proposals should be based on a close cooperation between academia and industry, define output and impact KPIs27, include technology benchmarking against other approaches, and include user requirements.

For areas a. to c. above, proposals should seek synergies with relevant national / regional research and innovation programmes running in these areas. They shall clearly specify how they are connected to the programmes and / or how they will incorporate the platforms, testbeds and infrastructures existing in Europe, how they will attract and build communities around them for openly promoting further technology developments as well as testing and

benchmarking in the field and how they build on top of these to create European added value. Proposals combining different sources of financing should include a concrete financial plan detailing the use of these funding sources for the different parts of their activities.

The Commission considers that proposals for Research and Innovation Actions of a 3-year duration and requesting a contribution from the EU up to EUR 10 million would allow the areas a. to d. to be addressed appropriately; and proposals requesting a contribution from the EU between EUR 2 and 3 million would allow the area e. to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals of another duration and/or requesting other amounts.

When appropriate, proposals may provide financial support to third parties established in a EU member state or country associated with Horizon 2020 and in line with the conditions set out in General Annex K, for example to access specific expertise or infrastructure. The consortium will define the selection process of third parties for which financial support will be granted (with a maximum of EUR 100 00028 per party). A maximum of 10% of the EU funding requested by the proposal should be allocated to this purpose.

All projects shall make provisions to actively participate in the common activities of the Quantum Flagship and in particular: coordinate technical work with the other selected projects of the Flagship; and contribute to the activities of the Coordination and Support Action defined under item B. below.
Note that special Grant Conditions will apply for projects granted under this topic. Please see under Call Conditions.

B. Coordination and Support Action
Proposals should aim at coordinating the relevant stakeholders, notably academia, RTOs and industry participating in the Flagship initiative. In particular, it is expected to establish a communication platform, facilitate dialogue, promote the objectives of the Flagship and monitor the progress, support the governance structure, organize outreach events (including addressing the impact of technology development on economy and society), identify training and education needs and promote European curricula in quantum engineering, identify and coordinate relevant standardisation, IPR actions, and international collaboration and help networking of respective national and international activities in the field. The action will also identify, together with the community, benchmarks for all communication/computing/simulation platforms selected under areas a. to c. of the Research and Innovation Actions described under item A. above.

It is expected that such an activity is driven by the relevant actors of the field including academia, RTOs and industry. The Commission considers that proposals for Coordination and Support Actions requesting a contribution from the EU of up to EUR 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:
A. Research and Innovation Actions

- Contribute to the strategic objectives of the Flagship;
- Expand European leadership and excellence in quantum technologies;
- Scientific breakthroughs that form the basis for future technologies;
- Synergetic collaboration with existing European platforms and infrastructures;
- Kick-start a competitive European quantum industry;
- Availability of open platforms and infrastructures accessible to the European Quantum technologies Community.

B. Coordination and Support Action

- A well-coordinated European initiative on Quantum Technologies, involving all relevant stakeholders and linked with relevant international, national and regional programmes, while assuring an efficient support to the governance of the Flagship;
- Spreading of excellence on Quantum Technologies across Europe, increased awareness of European activities and availability of European curricula in the field.

4. European Research Infrastructures (including e-Infrastructures)

INFRADEV-01-2019-2020: Design Studies

RIA ☑	IA ☒	CSA ☒

Specific Challenge

New leading-edge research infrastructures in all fields of science and technology are needed by the European scientific community in order to remain at the forefront of the advancement of research, and to be able to help industry strengthen its base of knowledge and its technological know-how. The aim of this activity is to support the conceptual and technical design for new research infrastructures which are of a clear European dimension and interest. Major upgrades of existing infrastructures may also be considered if the end result is intended to be equivalent to a new infrastructure.

Scope

Design studies should tackle all the key questions concerning the technical and conceptual feasibility of new or upgraded fully fledged user facilities (proposals considering just a component for research infrastructures are not targeted by this topic). A design study proposal should demonstrate the relevance and the advancement with respect to the state-of-art of the proposed infrastructure. It should indicate the gaps in the research infrastructure landscape the new facility will cover as well as the research challenges it will make possible to address. All fields of research are considered.

The main output of a design study will be the 'conceptual design report' for a new or upgraded research infrastructure, showing the maturity of the concept and forming the basis for identifying and constructing the next generation of Europe's and the world's leading research infrastructures. Conceptual design reports will present major choices for design alternatives and associated cost ranges, both in terms of their strategic relevance for meeting today's and tomorrow's societal challenges, and (where applicable) in terms of the technical work underpinning the development of new or upgraded research infrastructures of strategic importance for Europe.

The activities to be performed in a Design Study proposal should include both:

- Scientific and technical work, i.e. (1) the drafting of concepts, architecture and engineering plans for the construction, taking into due account resource efficiency and environmental (including climate-related) impacts, as well as, when relevant, the communities exploit the new facility from the start with the highest efficiency; (3) plans to organise the efficient curation, preservation and provision of access to data collected or produced by the future infrastructure, in line with the FAIR principles.
- Conceptual work, i.e. (1) plans to coherently integrate the new infrastructure into the European landscape of related facilities in accordance, whenever appropriate, with the EU objective of a balanced territorial development; (2) the estimated budget for construction and operation, and initial ideas on how to achieve long-term sustainability; (3) plans for an international governance structure; (4) the planning of research services to be provided at international level, (5) procedure and criteria to choose the site of the infrastructure.

The Commission considers that proposals requesting a contribution from the EU of between EUR 1 and 3 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Conceptual and technical designs of new leading edge research infrastructures are crucial to keep the European scientific community at the forefront of the advancement of research and to trigger the process leading to their establishment.

- Funding bodies for research infrastructures become aware of the strategic and funding needs of the scientific community.
- Policy bodies at the national level (e.g. funding bodies, governments), at European level (e.g. ESFRI) and internationally (e.g. the Group of Senior Officials on Research Infrastructures – GSO) have a sound decision basis to establish long-range plans for new research infrastructures of pan-European or global interest.
- The technical work carried out under this topic will contribute to strengthening the technological development capacity and effectiveness as well as the scientific performance, efficiency and attractiveness

of the European Research Area.

- When relevant, the improvement of the environmental (including climate-related) impact as well as the optimisation of resource and energy use are integrated in the very early phase of development of new research infrastructures.

INFRADEV-02-2019-2020: Preparatory Phase of new ESFRI projects

RIA ☒ **IA** ☒ **CSA** ☑

Specific Challenge

The ESFRI roadmap, updated periodically, identifies the needs of the European scientific community in terms of research infrastructures. However, inclusion in the ESFRI roadmap does not guarantee that these needed infrastructures will be built. Before proceeding with the construction and/or implementation of the identified infrastructures, many preliminary decisions need to be taken with respect to issues such as the identification of funders, the financial plan for sustainability, the governance by involved stakeholders, the site and legal form of the managing organisation (and of the research infrastructure, if different), the architecture and the service policies. The aim of this activity is to provide catalytic and leveraging support for the preparatory phase of ESFRI projects leading to the construction of new research infrastructures or major upgrades of existing ones.

Scope

The preparatory phase aims to bring the project for the new or upgraded research infrastructure identified in the ESFRI roadmap to the level of legal, financial, and, where applicable, technical maturity required for implementing it. Proposal consortia should involve all the stakeholders necessary to move the project forward, to take the decisions, and to make the financial commitments, before construction can start (including, but not limited to, national/regional ministries/governments, research councils or funding agencies from the countries that have already declared their commitment in the application to ESFRI). Appropriate contacts with ministries and decision-makers should be continuously reinforced, thus further strengthening the consortia. Operators of research facilities, research centres, universities, and industry may also be involved whenever appropriate. Technical work should be carried out when necessary to complete the final technical design, providing a sound technical base for establishing a cost baseline and detailed financial planning. The financial needs of the project should be mapped out to the extent necessary for funding agencies to establish their own medium- and long-term financial planning. Societal and economic benefits of the infrastructure should be analysed to carry out a Cost-benefit analysis.

The preparation of the legal and financial agreements (including site, governance, internal rules, financing of the new research infrastructures) is one of the main activities and deliverables and should be finalised before the end of the project (e.g., through the signature of a Memorandum of Understanding).

The detailed list of activities that can be included in a preparatory phase proposal is given in part A of the section "Specific features for Research Infrastructures". Proposals should explain any synergies and complementarities with previous or current EU grants.

(a) 2019 deadline: Preparatory Phase of the new projects in the 2018 ESFRI Roadmap

Following the update of the ESFRI Roadmap in 2018, support under this work programme will be provided to the Preparatory Phase for research infrastructure projects which enter the ESFRI roadmap in 2018.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 4 million would allow this challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- This topic triggers the decision making processes leading to the construction and/or implementation of the research infrastructures identified in the ESFRI Roadmap.
- A landscape of first-class sustainable RIs and services, open to researchers, industry, and other interested groups such as policy makers and the public, is progressively established, which will impact on the acceleration of scientific discovery as well as on innovation and competitiveness.
- Funding bodies are able to take funding decisions and to conclude the legal agreements necessary for the construction of new research infrastructures.

- The technical work carried out under this topic will contribute to strengthening the technological development capacity and effectiveness as well as the scientific performance, efficiency and attractiveness of the European Research Area.
- Synergies and complementarity between the new and existing research infrastructures are developed, thus contributing to the development of a consistent European research infrastructures ecosystem.

INFRADEV-03-2018-2019: Individual support to ESFRI and other world-class research infrastructures

RIA ☑	IA ☒	CSA ☒

Specific Challenge

The implementation phase of new pan-European research infrastructures, such as those identified in the ESFRI roadmap, is the most delicate and difficult as financial sustainability must be proved and the trust and awareness of users must be earned

Scope

This topic targets the long-term sustainability of new research infrastructures, ESFRI and other world-class research infrastructures of European Interest, with established governance and legal structure, notably on the basis of the European Research Infrastructure Consortium (ERIC) or any other suitable structure with international membership. Infrastructures having submitted a first step application to the Commission for establishing an ERIC may also apply to this topic. Support will be provided to activities aimed at ensuring long-term sustainability, including enlargement of the membership, European coverage, international cooperation1, limited pilots of access provision for testing and improving user services to increase reliability and create trust, definition of service level agreements and business/funding plan, outreach, and technology transfer activities. Proposals should explain any synergies and complementarities with previous or current EU grants.

Specific attention should be given to the interaction with industry and SMEs and the fostering of the innovation potential of the infrastructures. Activities may also facilitate the development of Regional Partner Facilities and their integration in the European research infrastructure landscape. The detailed list of activities that can be supported under this topic is given in part B of the section “Specific features for Research Infrastructures”.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 5 million would allow this challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- contribute to providing Europe with a comprehensive landscape of sustainable Research Infrastructures helping to respond to challenges in science, industry and society;
- strengthen the ERA position and role in the global research environment;
- reinforce the partnership between the Commission, Member States, Associated Countries and relevant stakeholders in establishing pan-European research infrastructures;

  enhance the role of the Union in international organisations and multilateral fora;
- support progress towards the development of global research infrastructures;
- enable researchers to address societal challenges with a global dimension;
- foster capacity-building and Research Infrastructure human capital development in targeted/relevant regions.

INFRAIA-01-2018-2019: Integrating Activities for Advanced Communities

RIA ☑	IA ☒	CSA ☒

Specific Challenge

[1] In line with the strategy for EU international cooperation in research and innovation (COM(2012)497)

European researchers need effective and convenient access to the best research infrastructures in order to conduct research for the advancement of knowledge and technology. The aim of this action is to bring together, integrate on European scale, and open up key national and regional research infrastructures to all European researchers, from both academia and industry, ensuring their optimal use and joint development.

Scope

Advanced Communities' are scientific communities whose research infrastructures show an advanced degree of coordination and networking at present, attained, in particular, through Integrating Activities awarded under FP7 or previous Horizon 2020 calls.

An Integrating Activity will mobilise a comprehensive consortium of several key research infrastructures in a given field as well as other stakeholders (e.g. public authorities, technological partners, research institutions) from different Member States, Associated Countries and other third countries20 when appropriate, in particular when they offer complementary or more advanced services than those available in Europe.

Funding will be provided to support, in particular, the trans-national and virtual access provided to European researchers (and to researchers from Third Countries under certain conditions21), the cooperation between research infrastructures, scientific communities, industry and other stakeholders, the improvement of the services the infrastructures provide, the harmonisation, optimisation and improvement of access procedures and interfaces. Proposals should adopt the guidelines and principles of the European Charter for Access to Research Infrastructures.

To this extent, an Integrating Activity shall combine, in a closely co-ordinated manner:

I. Networking activities, to foster a culture of co-operation between research infrastructures, scientific communities, industries and other stakeholders as appropriate, and to help develop a more efficient and attractive European Research Area;
II. Trans-national access or virtual access activities, to support scientific communities in their access to the identified key research infrastructures;
III. Joint research activities, to improve, in quality and/or quantity, the integrated services provided at European level by the infrastructures.

All three categories of activities are mandatory as synergistic effects are expected from these different components.

Access should be provided only to key research infrastructures of European interest, i.e., those infrastructures able to attract significant numbers of users from countries other than the country where they are located. Other national and regional infrastructures in Europe can be involved, in particular in the networking activities, for the exchange of best practices, without necessarily being beneficiaries in the proposal.

Proposals from advanced communities will have to clearly demonstrate the added value and the progress beyond current achievements in terms of integration and services, of a new grant. The strongest impact for advanced communities is expected typically to arise from focusing on innovation aspects and widening trans-national and virtual access provision, both in terms of wider and more advanced offer of scientific services, than in terms of number of users and domains served. Furthermore, in particular for communities supported in the past under three or more integrating activities, the creation of strategic roadmaps for future research infrastructure developments as well as the long-term sustainability of the integrated research infrastructure services provided at European level, need to be properly addressed. The latter requires the preparation of a sustainability plan beyond the grant lifecycle as well as, where appropriate, the involvement of funders.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), Integrating Activities should, whenever appropriate, pay due attention to any related international initiative (i.e. outside the EU) and foster the use and deployment of global standards.

Integrating Activities should also organise the efficient curation, preservation and provision of access to the data collected or produced under the project, defining a data management plan, even when they opt out of the extended Pilot on Open Research Data. Data management (including ethics and privacy issues), interoperability, as well as advanced data and computing services should be addressed where relevant. To this extent, proposals should build upon the state of the art in ICT and e-infrastructures for data, computing and networking, and ensure connection to the European Open Science Cloud.

Integrating Activities should in particular contribute to fostering the potential for innovation, including social

innovation, of research infrastructures by reinforcing the partnership with industry, through e.g. transfer of knowledge and other dissemination activities, activities to promote the use of research infrastructures by industrial researchers, involvement of industrial associations in consortia or in advisory bodies.

Integrating Activities are expected to duly take into account all relevant ESFRI and other world-class research infrastructures to exploit synergies, to reflect on sustainability and to ensure complementarity and coherence with the existing European Infrastructures landscape.
Proposals should include clear indicators allowing the assessment of the progress towards the general and specific objectives, other than the access provision.

As the scope of an integrating activity is to ensure coordination and integration between all the key European infrastructures in a given field and to avoid duplication of effort, advanced communities are expected to submit one proposal per area.

Further conditions and requirements that applicants should fulfil when drafting a proposal are given in part D of the section "Specific features for Research Infrastructures". Compliance with these provisions will be taken into account during evaluation.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 10 million would allow this topic to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

On the basis of a multiannual plan drafted taking into account the assessment and the timing of previous grants as well as strategic priorities and needs, in term of research infrastructures services, emerging from other parts of Horizon 2020, this work programme invites proposals addressing the following areas listed under the different domains. A balanced coverage of the various domains, in line with the distribution of areas per domain, is expected as outcome of this topic.

(a) 2018 deadline
Biological and Medical Sciences
Microbial Resource Centres. This activity aims at integrating the key Microbial Resource Centres and opening them up to European researchers for biotechnology research and development. Emphasis should be on widening the user base, enlarging and strengthening the offered services, sharing resources at global level, fostering the innovation role of such infrastructures and ensuring long term sustainability to their integration.

Facilities for high throughput DNA sequencing. This activity aims at integrating the key research infrastructures in Europe as well as leading-edge research infrastructures located in third countries, to open them up to European researchers and offer services beyond the state- of-art which is already ensured by commercial providers. Adequate consideration should be taken of the produced data and its availability for research.

Centres for replacement, reduction and refinement (3 Rs) of non-human primate testing. This activity aims at integrating the key non-human primate centres in Europe promoting 3 Rs, i.e. replacement, reduction, and refinement. The proposal will contribute to the objective of 3Rs, reinforcing the implementation of ethical and good practices at European level, and the protection of animals used in scientific experiments22. The proposal should also develop the necessary collaborations outside Europe.

High throughput facilities for proteome analysis. This activity aims at integrating the key high throughput facilities in Europe for proteome analysis, based on state-of-the-art proteomics techniques and tools for data handling and analysis, including structural proteomics and structural bioinformatics. Emphasis should be on widening the user base, enlarging and strengthening the offered services, fostering the innovation role of such infrastructures and ensuring long term sustainability to their integration.

Energy
Research Infrastructures for solar energy: concentrating solar power. This activity should bring together the key European research infrastructures in solar concentrating systems (solar concentrators and relating research infrastructures) for carrying out energy and materials research as well as research in other fields using the extreme temperature conditions in solar concentrators, e.g. thermal storage equipment and reuse of stored energy. This topic would support the European Strategic Energy Technology Plan (SET-Plan).

Research Infrastructures for solar energy: photovoltaic. This activity aims at integrating and opening the key

research infrastructures in Europe for all aspects of photovoltaic research: buildings, transport, new materials, grid connection, efficiency, etc. This topic would support the European Strategic Energy Technology Plan (SET-Plan).

Environmental and Earth Sciences

Research infrastructures for forest ecosystem and resources research. This activity aims at further integrating and facilitating broad access to forest research facilities, methodologies and data on genetic and species diversity to enable environmental and biological research including biological effects of air pollution, mitigation and adaptation to climate change, and development of forest management approaches. Emphasis will be on widening the user base and ensuring long term sustainability to the service integration.

Natural history collections. This activity aims at integrating and improving access to key European Natural History collections and to their related instrumentation facilities. Emphasis should be on improving accessibility to collections to a wide range of scientists, on developing innovative research services to answer the needs of a broader scientific community of users from climate change to human health and food security, and on ensuring long term sustainability of the integrated services.

Research aircrafts for environmental and geo-science research. This activity aims at integrating key research aircrafts and improving their availability to European researchers from larger multidisciplinary scientific communities. It should develop a long-term strategy towards sustained integrated services and innovative synergies with complementary observing systems and models to study atmospheric processes and the Earth's surface.

Research vessels. This activity aims at further providing, integrating and improving access to the key European research vessels and associated major equipment. It should include innovative initiatives to ensure a more efficient and coordinated operation of European fleets, to develop synergies with complementary observing systems and infrastructures and to set-up sustained integrated services to the user communities.

Research infrastructures for Earth's climate system modelling. This activity aims at further integrating and opening the research infrastructures (e.g. data repositories, models) used by the climate modelling community in Europe, promoting the ongoing development of a common distributed modelling infrastructure. Emphasis should be on widening the user base, expanding the interdisciplinary research fields addressed, enlarging and strengthening the offered services, and ensuring long term sustainability to the service integration.

Sites and experimental platforms of anthropogenic impacts for ecosystem functioning and biodiversity research. This activity aims at bringing together highly instrumented experimental, analytical and modelling facilities, across all major European ecosystem types and all major pressures on them. It will optimise the collaborative use of these sites by a wider scientific community and develop efficient methods and techniques for rapid data sharing and processing at the European level.

Mathematics and ICT

Visualisation facilities. This activity aims at further integrating and opening key virtual reality visualisation facilities, holographic image processing facilities and other computer graphics and animation facilities for advanced visualisation of scientific information and massive data, either resulting from academic research or being produced in collaboration with the industrial sector. Emphasis should be on widening the user base, enlarging and strengthening the offered services, and fostering the innovation role of such infrastructures.

Material Sciences, Analytical facilities and Engineering

Electron Microscopies for advanced imaging, diffraction, spectroscopy and metrology of materials. This activity aims at further integrating and opening advanced electron microscopies for material research and technological development. Emphasis should be on widening the user base, strengthening and enlarging the offered services, stimulating new scientific activities, facilitating access, fostering the innovation role of such infrastructures and ensuring long term sustainability to their integration.

High and low energy ion beam labs. This activity aims at further integrating and opening key ion beam facilities for material, biomedical and environmental research and technological development. Emphasis should be on widening the user base, enlarging and strengthening the offered services, fostering the innovation role of such infrastructures and ensuring long term sustainability to their integration.

Infrastructures for Neutron Scattering and Muon Spectroscopy. This activity will provide and facilitate wider access

to the key research infrastructures in Europe for Neutron scattering and Muon Spectroscopy. It should present a long-term sustainable perspective on the integration of these facilities and related resources.

Facilities for research on materials under extreme temperature conditions. This activity aims at integrating research facilities in physics and materials science dealing with extreme low and high temperature conditions, e.g. nanoscience at microkelvin temperatures. Emphasis should be on widening the user base, enlarging the offered services, fostering the innovation role of such infrastructures and ensuring long term sustainability to their integration.

Infrastructures for studying turbulence phenomena and applications. This activity aims at further integrating key facilities enabling the study of high turbulence phenomena in various areas of science and technology. Emphasis should be on combining modelling and experimental in situ testing, widening the user base, enlarging the offered services, fostering the innovation role of such infrastructures and ensuring long term sustainability to their integration.

Physical Sciences
Research Infrastructures for hadron physics. This activity will provide and facilitate access to key research infrastructures in Europe for studying the properties of nuclear matter at extreme conditions, turning advances in hadron physics experimentation into new applications. It should present a long-term sustainable perspective on the integration of relevant facilities and related resources.
Research Infrastructures for high resolution solar physics. This activity aims at further integrating and opening key research infrastructures in the field of high resolution solar physics. It should foster cooperation between theory and observations.

Social Sciences and Humanities
Research infrastructures for the assessment of science, technology and innovation policies. This activity aims at further integrating and opening research data infrastructures in the field of science, technology and innovation (including social innovation). Emphasis should be on facilitating trans-national access and widening the user base, enlarging and strengthening the offered services, fostering the innovation role of such infrastructures and ensuring long term sustainability to their integration.

Digital archives and resources for research on European history. This activity aims at further integrating and opening key data collections and services in Europe for European History. Emphasis should be on widening the user base, enlarging and strengthening the offered services, e.g. by covering further historical periods, and ensuring long term sustainability to their integration.

Archaeological data infrastructures for research. This activity aims at further integrating and opening key archaeological data infrastructures to facilitate research in all fields of archaeology (from prehistory to contemporary society). Emphasis should be on widening the user base, enlarging and strengthening the offered services, including fields such as paleo-anthropology, bioarchaeology and environmental archaeology, sharing resources at global level, and ensuring long term sustainability to their integration.

(b) 2019 deadline
The areas to be addressed under the different domains will be defined at a later stage, before the opening of the related call.

Expected Impact

- Researchers will have wider, simplified, and more efficient access to the best research infrastructures they require to conduct their research, irrespective of location. They benefit from an increased focus on user needs.
- New or more advanced research infrastructure services, enabling leading-edge or multidisciplinary research, are made available to a wider user community.
- Operators of related infrastructures develop synergies and complementary capabilities, leading to improved and harmonised services. There is less duplication of services, leading to an improved use of resources across Europe. Economies of scale and saving of resources are also realised due to common development and the optimisation of operations.
- Innovation is fostered through a reinforced partnership of research organisations with industry.
- A new generation of researchers is educated that is ready to optimally exploit all the essential tools for their research.

- Closer interactions between larger number of researchers active in and around a number of infrastructures facilitate cross-disciplinary fertilisations and a wider sharing of information, knowledge and technologies across fields and between academia and industry.
- For communities which have received three or more grants in the past, the sustainability of the integrated research infrastructure services they provide at European level is improved.
- The integration of major scientific equipment or sets of instruments and of knowledge-based resources (collections, archives, structured scientific information, data infrastructures, etc.) leads to a better management of the continuous flow of data collected or produced by these facilities and resources.

  When applicable, the integrated and harmonised access to resources at European level can facilitate the use beyond research and contribute to evidence-based policy making.
- When applicable, the socio-economic impact of past investments in research infrastructures from the European Structural and Investment Funds is enhanced.

5.i. Information and Communication Technologies

ICT-03-2018-2019: Photonics Manufacturing Pilot Lines for Photonic Components and Devices

RIA ☒ IA ☑ CSA ☒

Specific Challenge

Photonics is driving innovation in many different application areas. The challenge is to help European companies become more competitive by improving their business/production processes as well as products and services by means of photonics technology. The aim is to accelerate the design, development and uptake of photonics technology, by a wide range of industrial players, in particular SMEs by providing low-barrier access to volume production of advanced photonics components available to a wide range of industrial players, in particular SMEs which would otherwise not have easy access. Photonics Manufacturing Pilot Lines should form the basis for future Photonics Digital Innovation Hubs.

Scope

The focus is on **Manufacturing Pilot Lines**: actions should provide open access to manufacturing of advanced photonics components and systems and offer related services including design and characterization. They should cover all stages of manufacturing through to testing, provide a low entry barrier access to low and medium production volumes and the processes used should be scalable to high production volumes. Actions should include a validation of the pilot line offer with involvement of externals users in pre-commercial production runs. Activities should aim at long-term sustainability, including development of or integration into photonics innovation hubs.

Actions should make use of existing infrastructure and develop close links with on-going European and national initiatives in order to maximise impact. Proposals must present industrially relevant business cases for the manufacturing pilot line, a plan for long-term sustainability and a credible strategy for future high volume production in Europe at competitive cost.

Actions must address one or more of the following technologies.

1. **Indium Phosphide (2018 call):** providing open access to photonics integrated circuits based on Indium Phosphide, going beyond multi-project wafers and offering generic solutions for a wide class of applications.
2. **Silicon Photonics (2018 call):** providing open access to photonics integrated circuits based on Silicon Photonics, going beyond multi-project wafers and offering generic solutions for a wide class of applications.
3. **Next generation free-form optics (2019 call):** maturing a technology platform and providing access to optics with free-form shapes and exceptional surface finish, exploiting new optical materials and/or combining and integrating diffractive/refractive/reflective optical components, to obtain improved performances and capabilities.
4. **Advanced optical medical device technologies for medical diagnostics (2019 call):** maturing a technology platform and providing access to novel, reliable, robust optical based devices for in-vivo and/or in-vitro medical diagnosis.

At least one proposal will be selected to cover each of these technologies. The Commission considers that proposals requesting a contribution from the EU between EUR 8 and 15 million would allow these to be addressed appropriately. Nevertheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

Proposals should describe how the proposed work will contribute to the listed corresponding expected impacts and include baseline, targets and metrics to measure impact.

- Improve significantly the uptake of photonics technology by end-user industry, in particular SMEs, enabling a demonstrably more competitive European industry.
- Greatly accelerate the time to market.
- Create sustainable manufacturing capability in Europe.

ICT-04-2018: Photonics based manufacturing, access to photonics, datacom photonics and connected lighting

RIA ☑	IA ☑	CSA ☒

Specific Challenge

Photonics research in Europe is widely recognized for its excellence; researchers however experience difficulties in demonstrating their conceptual breakthroughs. The challenge is to reinforce the innovation ecosystem by providing access to advanced photonics technology to researchers and thereby accelerating the deployment of the next generation of disruptive photonics technologies.

Photonic integration combined with cost-effective assembly and packaging processes enables a drastic level of miniaturization, reducing the costs of implementation and energy consumption. The challenge is to build capabilities for automated mass manufacturing of datacom photonics in Europe.

LED/OLED lighting is now becoming the dominant lighting technology and the market focus is shifting from energy efficiency to additional smart features. The challenge is the integration of lighting with the Internet of Things, offering new functionalities beyond illumination.

The development and application of innovative photonics based manufacturing solutions will open new ways of producing more goods with fewer raw materials, less energy and less waste. The challenge is to develop systems which deliver improved accuracy, power and control and which will enable the next generation of manufacturing in a range of industrial sectors.

Scope

a) Innovation Actions

i. **Access to advanced photonics for researchers:** The objective is provide photonics and non-photonics researchers with a one-stop-shop access to a wide range of existing cutting edge technology platforms as well as services needed to facilitate their use (such as design, measurement and packaging).

ii. **Enabling automated mass-manufacturing of datacom photonics products:** Actions should demonstrate automated manufacturing of optical transceivers with transfer rates above 1Tb/s at competitive costs according to the interconnection distance. Actions should cover all manufacturing steps of proven designs from chip manufacturing to photonic/electronic integration through to packaging and testing, and final demonstration in a real environment. Standardisation should be addressed.

iii. **Connected Lighting:** The action should focus on integrating lighting infrastructure with the Internet of Things and demonstrating new functionalities such as visible light communication for indoor positioning and broadband data communication. Development and integration of new technologies as security and multicast communication into open architectures must be demonstrated in real environments. Standardisation of a reference architecture must be one of the main goals of the action.

Maximum one proposal will be selected to cover each of the themes i and iii. The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 6 million would allow these themes to be addressed appropriately. Nevertheless this does not preclude submission and selection of proposals requesting other amounts.

b) Research and Innovation Actions

i. **Highly Productive Ultra-Short Laser Systems for Fast Materials Processing:** the development of ultra-short pulse laser systems with pulse durations in the nanosecond regime down to the femtosecond regime and with average beam power levels of at least 1kW enabling fast materials processing with minimal heat impact on the work piece. Pulse energies and wavelengths must be appropriate for the intended application. Proposals may include also the related monitoring and closed loop control aspects. The developed system should be demonstrated with a relevant industrial application.

ii. **Tailored Laser Beams for Laser-based Manufacturing**: new methods and schemes of beam shaping providing the optimal energy delivery on the work piece with a high spatial and temporal resolution. Proposals may include also the related monitoring and closed loop control aspects. The developed system should be demonstrated with a relevant industrial application.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 6 million would allow these themes to be addressed appropriately. Nevertheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Proposals should describe how the proposed work will contribute to the listed corresponding expected impacts and include baseline, targets and metrics to measure impact.

a) Innovation Actions

i. A strengthening European innovation ecosystem and improved cross fertilisation between photonics and other technology areas.

ii. Reduced manufacturing cost of PIC-based optical transceivers with transfer rates above 1Tb/s enabling massive deployment in datacenter environments (<1€/Gbps between racks and <0.1€/ Gbps inside racks).

iii. European industrial leadership in a wide range of photonic applications and technologies enabling penetration of new markets as well as for established telecom and datacom applications. Demonstrable performance advantages in terms of sensitivity, speed, energy efficiency and robustness.

b) Research and Innovation Actions

i. Strengthening industrial manufacturing based on ultra-short pulse lasers and extending its field of applications by simultaneous improvement of precision and productivity; significant contribution to the digitization of European industry.

ii. Substantial contribution to digital photonic production with increased productivity, flexibility and customized products ("first time right") at significantly reduced costs.

ICT-05-2019: Application driven Photonics components

RIA ☑	IA ☑	CSA ☑

Specific Challenge

Photonic technologies for health applications is a very promising field, where the EU has produced significant results during the past decades; however, industrialization is still lagging behind. The challenges are to develop methods that provide the clinicians with photonics enabled tools to improve or to assess the successes of therapies and to transform low TRL technologies into robust medical devices answering to clinician needs.

Photonic circuits are typically employed in combination with high performance electronics, micro-optics while the thermal management and the efficient integration of these technologies is accordingly of major importance.

The challenge is to create and develop advanced techniques for intimate integration of sub-systems incorporating multiple technologies enabling application across multiple domains.

The European continuous process industries as well as the piecewise manufacturing sector are facing the continuous struggle to keep a leading role in the worldwide competition. The challenge is to deploy photonic sensor technologies for the exact monitoring of process and product parameters so as to optimize those processes, saving resources whilst guaranteeing optimum product quality.

Scope

Innovation Actions

i. **Photonics devices to support monitoring therapeutic progress:** Actions should develop reliable (high sensitivity, specificity and accuracy), safe to operate, cost- effective and fast photonics enabled devices to support assessing the effects of treatments of major diseases like cancer (excluding skin cancer), infectious, degenerative and cardiovascular diseases, including determining individual dispositions (eg methods to assess drug resistance) and monitoring of therapy progress. The feasibility and validity of the proposed approach should already have been validated in clinical settings. A medical equipment manufacturer should drive the action, and physicians/ clinicians/ surgeons must be closely involved. Validation should take gender specificities into account. Small scale clinical studies should be included, but clinical trials are excluded.

ii. **Sensor-Based Optimization of Production Processes:** Sensor-Based Optimization of Production Processes: Actions should address prototyping, demonstration, optimization and validation in real industry settings of highly advanced smart broadband multimodal photonic sensing solutions operating in the spectral range from the ultraviolet to the far infrared, and intended for improving production process through the monitoring of relevant process and product parameters (e.g. physical, chemical, imaging, geometrical and environmental). The focus is on cost-effective process-integrated solutions that are optimized in terms of speed, quality, and resource efficiency. The solutions should also address embedded pre-processing and suitably interpreting the acquired raw data for the optimization of the processes.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 6 million would allow these themes to be addressed appropriately. Nevertheless this does not preclude submission and selection of proposals requesting other amounts.

Research and Innovation Actions

i. **Photonics System on Chip/ System in Package for optical interconnect applications:** Actions should address advanced techniques for the intimate combination of photonic integrated circuit technology with other enabling circuits, devices and mother boards to realise major advances in the capability, performance and complexity of photonic system-on-chip and system-in-package components targeting photonic interconnect applications in the network, datacentre and consumer communication space. A holistic approach from design through to test is required. The targeted component technologies need to have demonstrable performance advantages in terms of speed, energy efficiency, cost and reliability and fit in the system and network architecture roadmaps of vendors.

ii. **Photonics systems for advanced imaging to support diagnostics driven therapy:** Actions should research ground-breaking, reliable (high sensitivity, specificity and accuracy), safe to operate, cost-effective and fast photonics enabled imaging system to support diagnostics during intervention and treatments of major diseases like cancer (excluding skin cancer), infectious, degenerative and cardiovascular diseases. Physicians/clinicians/surgeons and a medical equipment manufacturer must be closely involved from requirement specifications to validation in clinical settings. Validation should take gender specificities into account. Clinical trials are excluded.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 6 million would allow these themes to be addressed appropriately. Nevertheless this does not preclude submission and selection of proposals requesting other amounts.

Coordination and Support Actions

i. **Fostering careers in photonics**: Actions should reach out to STEM graduates/PhD students and young postdocs in order to encourage more of them to pursue a career in photonics. Actions should help make students more industry ready and should provide the appropriate training, encourage innovation and entrepreneurship. Gender issues must also be addressed.

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 1.5 million (for theme i) would allow this to be addressed appropriately. Nevertheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Proposals should describe how the proposed work will contribute to the listed corresponding expected impacts and include baseline, targets and metrics to measure impact.

Innovation Actions

i. Strengthened Europe industrial competitiveness in the biophotonics related market.
ii. Increased competitiveness of the European production industry and significant contribution to the digitization of European industry.

Research and Innovation Actions

i. A massive deployment of Photonic Integrated Circuit (PIC)-based optical transceivers in data center environments thanks to the drastically reduced cost.
ii. Increased European competiveness in the biophotonic areas and more effective medical interventions and treatments.

Coordination and Support Actions

i. More and better prepared professionals in the photonics sector

5.ii. Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing

DT-NMBP-01-2018: Open Innovation Test Beds for Lightweight, nano-enabled multifunctional composite materials and components (IA)

RIA ☒ IA ☑ CSA ☒

Specific Challenge

The field of new smart lightweight nano-enabled materials has made remarkable progress in recent years. Many different types of materials, with radically enhanced properties and functionalities, are today available for a wide range of industrial applications; e.g. lightweight solutions for transportation and construction, enhanced properties for packaging materials and processes, incorporating smart interacting sensors or indicators, and materials offering enhanced electrical performance and reliability, high-performance thermal and/or electrical conductivity, and UV shielding. The challenge is to scale up and enable industry and users, in a cost-effective and sustainable way, to develop, test, and adopt new lightweight, high performance, multifunctional, and environmentally friendly materials for high-value composite components and structures

Scope

- Open Innovation Test Beds should upgrade or develop materials facilities and make available to industry and interested parties, including SMEs, services for the design, development, testing, safety assessment, and upscaling of specific materials compositions, including nano-particle/objects;
- Attention should be given to materials new functions, features, capabilities, and properties (functionalisation), and to processing techniques and optimisation of process parameters, from uniform dispersion and distribution of nano-particles within the materials (or nanoparticle aggregates) to the association of dissimilar materials;
- Potential regulatory, economic and technical barriers should be identified and assessed;
- A methodology for providing open access at fair conditions and cost as well as outreach and dissemination across Europe;

- Quality control processes and tools should be validated to allow on-line quality controls;
- Materials should be demonstrated in relevant industrial environments.

Proposals submitted under this topic should include actions designed to facilitate cooperation, across Europe, with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

Activities should start at TRL 4 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 7 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Open and upgraded facilities at the EU level for the design, development, testing, safety assessment, and upscaling of lightweight, nano-enabled and multifunctional materials and components, easily accessible to users across different regions of Europe;
- Attract a significant number of new SME users, with at least a 20% increase for existing test beds;
- Increased access to finance (for SMEs in particular) for investing in these materials or in applications using them;
- At least 15% improved industrial process parameters and 20% faster verification of materials performance for highly promising applications;
- At least 20% improvement in industrial productivity, reliability, environmental performance, durability, and reduction of life-cycle costs of these materials;
- At least 15% indirect reduction in energy consumption across sectors using lighter materials in their products and processes.
- Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-NMBP-02-2018: Open Innovation Test Beds for Safety Testing of Medical Technologies for Health (IA)

RIA ☒	IA ☑	CSA ☒

Specific Challenge

The medical technology industry is an important economic and social player in Europe. The challenge is to provide companies and users in this sector access to affordable and advanced testing facilities and services to facilitate the development of new and safe medical technologies. The two new EU regulations[2] governing medical technologies (medical devices and in-vitro diagnostics) are introducing a new set of rules to improve the safety of medical devices for the benefit of patients. To preserve timely access to innovative healthcare solutions and support the competitiveness of the European industry, testing facilities support services are needed to help industry and users develop and test medical devices in compliance with EU safety regulations. A bonus would be to define new methodologies for clinical testing, when relevant.

Scope

- Open Innovation Test Beds should upgrade or develop materials facilities and make available to industry and interested parties, including SMEs, services for the design, development, testing, safety assessment, and upscaling of new/existing medical devices in compliance with EU regulatory frameworks since the beginning of the development process;
- Test Beds could also contribute to develop methodologies to accelerate and simplify the subsequent pre-clinical and clinical testing in accordance with EU rules;
- Potential regulatory, economic, organisational and technical barriers should be identified and assessed. Where applicable, considerations regarding risk-assessment procedures that take into account potential gender differences should be considered;

[2] Regulation (EU) 2017/745 of the European Parliament and of the Council of 5 April 2017 on medical devices, amending Directive 2001/83/EC, Regulation (EC) No 178/2002 and Regulation (EC) No 1223/2009 and repealing Council Directives 90/385/EEC and 93/42/EEC

Regulation (EU) 2017/746 of the European Parliament and of the Council of 5 April 2017 on in vitro diagnostic medical devices and repealing Directive 98/79/EC and Commission Decision 2010/227/EU

Open access at fair conditions and cost as well as outreach and dissemination across Europe, based on a distinct methodology;
- Quality control processes and tools should be validated to allow on-line quality controls;
- Medical devices should be demonstrated in relevant industrial environments.
- Proposals submitted under this topic should include actions designed to facilitate cooperation, across Europe, with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

Activities should start at TRL 4 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 7 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Open and upgraded facilities at the EU level for the design, development, testing, safety assessment, and upscaling of new medical devices easily accessible to users across different regions of Europe;
- Attract a significant number of new SME users, with at least a 20% increase for existing test beds;
- Cost effective, innovative, and safe healthcare medical devices in compliance with EU safety regulations;
- Faster assessment of new medical devices' compliance with EU safety regulations;
- Reduced time to market of new medical devices (earlier determination of safety profile and facilitation of subsequent pre-clinical and clinical testing);
- Indirect substantial benefits for European citizens' safety and access to new and innovative medical products;
- New market opportunities for providing services to non-EU players interested in testing facilities to ensure compliance with EU regulatory frameworks for their export products to Europe.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-NMBP-03-2019: Open Innovation Test Beds for nano-enabled surfaces and membranes (IA)

RIA ☒ IA ☑ CSA ☒

Specific Challenge

Nano-enabled surfaces and membranes have a vast range of applications in final products across many industry sectors. The challenge is to enable a cost effective and sustainable industrial upscaling and deployment of nano-enabled surface and membrane technologies, including thin film architecture, coating, surface structuration for improved properties (optical, surface energy, durability, reduced friction, etc.), and nanostructured membrane's functionalities. This will require the integration of state-of-the-art nano-scale processes for modification, functionalisation, and structuring/coating of surfaces or membranes.

Scope

- Open Innovation Test Beds should upgrade or develop materials facilities and make available to industry and interested parties, including SMEs, services for the design, development, testing, safety assessment, and upscaling of new nano-enabled surfaces and membranes;
- New materials functionalities may include, among others, improved scratch and abrasion resistance, super hardness and mechanical resistance, improved corrosion, wear and friction properties, bio-functionality, bio-compatibility, control of reflectivity, sensing ability, self-cleaning, antimicrobial, permeability and selectivity properties;
- Open access at fair conditions and cost as well as outreach and dissemination across Europe, based on a distinct methodology;
- Applications can cover industrial as well as consumer products. Potential regulatory, economical and technical barriers should be identified and assessed;
- Quality control processes and tools should be validated to allow on-line quality controls;
- Materials should be demonstrated in relevant industrial environments;

Proposals submitted under this topic should include actions designed to facilitate cooperation, across Europe, with other projects and existing Pilot Lines; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

Activities should start at TRL 4 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 7 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Open and upgraded facilities at the EU level for the design, development, testing, safety assessment, and upscaling of nano-enabled surfaces and membranes;

  Attract a significant number of new SME users, with at least a 20% increase for existing test beds;
- Increased access to finance (for SMEs in particular) for investing in these nano-enabled surfaces or membranes or in applications using them;
- At least 15% improved process parameters and 20% faster verification of nano-enabled surfaces or membranes performance for highly promising applications;
- At least 20% improvement in industrial productivity, reliability, environmental performance, durability, and reduction of life-cycle costs of these nano-enabled surfaces or membranes;
- At least 15% indirect reduction in energy consumption for applications using novel nano-enabled surfaces or membranes.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-NMBP-07-2018: Open Innovation Test Beds for Characterisation (IA)

RIA ☒	IA ☑	CSA ☑

Specific Challenge

Efficiency of materials up-scaling and use in new products in European manufacturing industries depends on advances in characterisation and testing. Essential industry competencies comprise technologies, know-how and proficiency in interpretation of results, data, and characterisation standards in order to help bring new materials into products. The challenge is to establish open user-driven characterisation test beds including all aspects of novel multi-scale and multi-modal characterisation solutions management, analytics and mining of the resulting data (Materials Informatics). Interaction is required between the stakeholders regarding the latest technological solutions, such as non-destructive characterisation approaches. There is the need to provide industrial users with central access to models and characterisation tools that can meet their specific requirements throughout the value chain. This should be achieved via user-driven Open Innovation Test Beds dedicated to characterisation and to modelling.

Scope

Proposals should establish an open innovation characterisation test beds that will create, sustain and drive the use of novel materials characterisation techniques to support industrial innovation and will network materials characterisation stakeholders and concretely implement an integrated approach. In particular:

- Collectively develop novel advanced solutions for specific and relevant industrial problems. Support advanced data analysis and storage, standardisation, reference materials, regulation and safety;
- Facilitate common approaches to common problems for fast adoption of innovative tools for characterisation by industry and strengthen the interface between academia and industry;
- Enable the integration of information based on materials modelling and characterisation through the development of widely agreed and standardised datasheets to enhance value chain interactions;
- Network relevant stakeholders across Europe for defining roadmaps, application of real-time methods, implementation of regulatory and safety requirements, training and management of information (including Materials Informatics) and development of new skills.

Proposals submitted under this topic should include actions designed to facilitate cooperation with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project by agreeing on metadata for the description of materials characterisation and databases.

Activities should start at TRL 4 and achieve TRL 6 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU around EUR 9 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Translation of industrial needs into characterisation workflows, increased awareness and uptake by industry, and effective access of materials manufacturing companies to the know-how and advanced tools;
- Measurable reduction of costs for product design and time-to-market by means of faster and cheaper evaluation of production process deviations;
- Increased ability and quantifiable cost reduction for industry to comply with regulations.

DT-NMBP-08-2019: Real-time nano-characterisation technologies (RIA)

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Enterprises using and producing nanomaterials face a constant increase of requirements in regard to fast process and product quality control, regulatory compliance and quicker market introduction of high quality products. This calls for real-time measurements, necessitating process-adapted nanoscale metrology for the manufacturing industry. Tools and devices for materials characterisation need increased speed and reliability, suitable for industrial demands, while at the same time retaining the same or better measurement accuracy and precision.

Scope:

Proposals should advance and establish nano-scale, multimodal and multi-scale materials characterisation tools and methods, allowing rapid and reliable high-resolution analyses. These should be suitable for characterisation during processing and manufacturing of advanced materials, i.e. real-time and reliable. This includes the optimisation of existing or the development of new technologies, characterisation equipment, data processing routes and data analysis strategies, or a combination of these. In particular:

- Proposals should deal with one or more industrial applications;
- In addition to the characterisation speed (relative to the manufacturing process), proposals should cover the requirements for real-time nano-scale characterisation during manufacturing (e.g. in situ characterisation, multiple acquisition etc.);
- Proposals should demonstrate measurable improvement with respect to the state of the art of nano-scale characterisation technologies adequate for industrial use (adaptability to the industrial process, product quality, etc.);
- Developed characterisation protocols should consist of faster methods to be exploited in close connection with manufacturing enterprises, or be suitable online or inline use in the factory;
- Detailed training and dissemination activities should be planned to ensure appropriate transfer of knowledge and/or expertise to industry, and SMEs in particular.

Funded proposals will be invited to participate in clustering activities, to agree on metadata for the description of materials characterisation and databases.
Proposals submitted under this topic should include actions designed to facilitate cooperation with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

Activities should start at TRL 4 and achieve TRL 6 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Measurable improvement of speed by at least a factor 2 of nanoscale characterisation procedures, in comparison to already established performance and reliability for the application leading to a significant increase in industrial competitiveness;
- Significant reduction of the time and resources needed for nanomaterial development and upscaling, and for nanomaterials-based product development, which should be quantified with respect to established conditions for specific market sectors, with a return of investment in less than 5 years;
- Quantifiable enhancement of the ability to control the quality and reliability of products, with consequent improvement of product lifetime and associated environmental benefits.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-FOF-01-2018: Skills needed for new Manufacturing jobs (CSA)

RIA ☒ IA ☒ CSA ☑

Specific Challenge

Breakthrough education and training paradigms for continuous training of the existing workforce are needed, that will enable the European industrial workforce to develop new skills and competences in a quick and efficient way. This should put workers, both women and men, at the forefront of innovation and drive industry towards a smooth transition to the use of increasingly sophisticated machines and new technologies.

Advanced Manufacturing, one of the six Key Enabling Technologies (KETs), is a highly innovative sector in Europe. In line with the New Skills Agenda for Europe, there is a need to strengthen human capital, employability and competitiveness for this KET. The Blueprint for Sectoral Cooperation on skills is one of the ten actions in this Agenda. This topic will support the implementation of the Blueprint beyond Additive Manufacturing within several areas from the Factories of the Future priorities.

Scope

- Identify shortages and mismatches in technical and non-technical skills, knowledge and competences in Advanced Manufacturing (including digital capabilities);
- Map the most relevant existing national initiatives upskilling the existing workforce in order to develop an EU wide strategy;
- Put in place activities related to lifelong learning and granting of qualification for personnel in industrial settings. Develop real case scenarios providing efficient methodologies that can be applied in a variety of industrial areas;
- Innovative and hands-on approaches, including Social Sciences and Humanities (SSH) elements, in upskilling of the existing workforce and attracting more women to the field, through training activities (including training of trainers) and knowledge management with direct involvement of senior employees. On-site, modular and e-learning education should be offered free of charge for re-use;
- Exchange of information between industry, trade unions, educational centres, national employment agencies at European scale.
- Proposals are also encouraged to seek synergies with national initiatives funded under the European Social Fund, projects from the Skills Alliances and, where relevant, other future initiatives launched at European level.

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Real and measurable steps towards the reduction of identified skill gaps leading to the upskilling of the existing workforce in Europe and, as a consequence, increased innovation performance in the industry concerned;
- At least 15 new job profiles per industrial area analysed, leading to a longer work life for jobholders;
- Close and continuous engagement between relevant industry, trade union, academia, educational centres (including vocational schools) across Europe to stimulate networks in the European Research Area as a whole.

DT-FOF-03-2018: Innovative manufacturing of opto-electrical parts (RIA)

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Optoelectronics and opto-electrical components involve the interactions of photons and electrons. They are used in parts such as lasers, photodiodes, image sensors, optical amplifiers, modulators, solar cells, embedded optics and light-emitting diodes.

Previous research led to rapid developments and new applications in optoelectronics and photonics. However, new processes need to be introduced into production systems. When going into the scale-up phase, many processes need to be adjusted to fit the production of complex, often free-form components. The adjustments include both component specific changes as well as standard process steps. Due to the need to produce large varieties of parts in small batches, process adjustments have to be both rapid and accurate.

The equipment for testing, failure analysis and control equipment needs to follow a fast pace of technical advancement, and cover a range of sensors, such as electrical, optical, magnetic and thermal sensors.

Scope

Proposals need to present a variety of new processes applicable to the production of opto-electrical components, for instance material handling, material strain engineering, patterning, material deposition, assembly, joining and bonding. Furthermore, quality needs to be ensured by reliable sensors throughout the production line. The processes need to include a level of sustainability that allows the final products to be recycled and reintroduced into the value chain. Proposals need to cover all of the following areas:

- New, flexible, and innovative process chains to handle complex designs that include opto-electrical functionalities;
- Improved sensor equipment for quality control in the different processing steps as well as the final functionality of the component;
- Methodologies for improving quality through high-precision automation using the sensor data, including non-destructive in-process evaluation of material and functional component properties;
- Re-use and requalification of key components and precious materials within the process chain from products at their end of life.

Proposals are expected to include a variety of use-case demonstrations of typical opto-electrical components, in which the robustness of the processing, work piece handling, sensing and the automation approach can be demonstrated.
Activities should start at TRL 4 and achieve TRL 6 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- 15% yield improvement because of the introduction of new sensor equipment, related metrology and automatic non-destructive control;
- 15% time reduction for reconfiguration of key process tools in a production line due to change of type of component;
- A tangible part (> 10%) of the production cost of the parts should originate from recycled products and materials.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-FOF-04-2018: Pilot lines for metal Additive Manufacturing (IA 50%)

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Costs and unpredictable defects in final parts and products are preventing complete deployment and adoption of Additive Manufacturing (AM) in the metalworking industries.

The industrial demonstration in a pilot line will show the full potential of metal AM in real manufacturing conditions and it will serve as a flagship example for other stakeholders. Quality aspects to be significantly improved include robustness, stability, repeatability, speed and right-first-time manufacturing.

Scope

- Multi-scale and multi-physics simulations of the process and of the whole system from the early design phase, to avoid costly trial and error runs. The prediction and minimisation of distortion and their effect on durability and expected lifetime for post processing steps will also avoid propagation of defects to downstream stages;
- In-line non-destructive testing and in-situ analysis of product, including metrology aspects;
- Integration and inter-operability of AM processes into multi-stage production systems, with in-process monitoring, feedback and control;
- Hybridisation of Additive Manufacturing with other manufacturing and assembling processes;
- Certification, regulatory and standardisation activities related to the proposed solutions and AM produced parts;
- Occupational exposure in terms of health, safety and environment should be carefully observed together with the recycling of unused materials.

Proposals are expected to cover demonstration activities driven by the industrial community.
Activities should start at TRL 5 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 12 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

As an exception from General Annex D, the funding rate for eligible costs in grants awarded under this topic will be differentiated: 100% of the eligible costs for beneficiaries and linked third parties that are non-profit legal entities; and 50% of the eligible costs for beneficiaries and linked third parties that are for profit legal entities.

Expected Impact

- Increase in robustness of metal AM-based processes by 40% and production speeds by 25%;
- Reduction of time to market by 25% and 'right first time' capability by 40%;
- Reduction of uncertainties of selected material quality parameters by 50%, resulting in improving product quality by 40%;
- New certification schemes for industrial "3D-Printed" parts and products in collaboration with relevant certification stakeholders;
- New standardisation of specific categories not included in current ISO/ASTM/CEN CENELEC TCs.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-FOF-08-2019: Pilot lines for modular factories (IA 50%)

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Rapid changes in a production line require a significant flexibility of reconfiguration. Modular production equipment can create highly adaptable production lines to enable efficient production of small series tailored to customer demands. Previous research has shown that the modularity can be at two levels, either as complete machines with their own interface and material handling system or as interchangeable tool heads. In both cases, the advantage of modularity should be demonstrated by the ease of use and plug-and-produce features allowing for rapid modification.
The functionality of the modules should enable the production of the widest variety of complex products. The modules need to allow rapid physical rearrangements, through either automated processes or manual intervention; and have accessible, secure interfaces in order to be connected to a common data system for production control. The interfacing with the existing hardware and legacy software is another aspect that needs to be covered.

Scope

- Proposals are expected to start from existing test beds that are flexible enough to allow for the introduction of multiple modular process units. Proposals should cover all of the following areas:
- The development of a range of production modules covering several different disciplines such as mechanical cutting tools, thermal processes, laser treatments and additive manufacturing technologies, taking into account safety aspects;
- The integration of comprehensive production management systems, including real-time process control in a reconfigurable line, which includes considerations for data interoperability between modules and process line (including legacy hardware and software);
- Pilot production of different products covering processing technologies and features such as multi-functionality (mechanical, electrical, thermal, optical, etc.), multi materials, and complex shapes.

The production modules could be considered as demonstrators on their own. However, their integration in the pilot line as well as an actual production demonstration with a variety of components or product prototypes should be achieved before the end of the project.

Proposals are expected to cover demonstration activities driven by the industrial community.Activities should start at TRL 5 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 12 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

As an exception from General Annex D, the funding rate for eligible costs in grants awarded under this topic will be differentiated: 100% of the eligible costs for beneficiaries and linked third parties that are non-profit legal entities; and 50% of the eligible costs for beneficiaries and linked third parties that are for profit legal entities.

Expected Impact:

- At least 15% reduction of time to reconfigure the production line (alternatively 15% reduction in downtime);
- 10% higher resource efficiency due to more suitable processing equipment for customised products;
- Reduction of at least 15% of the overall cost of production;
- Measurable yield improvement from run-to-run for small lot sizes.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-NMBP-19-2019: Advanced materials for additive manufacturing (IA)

RIA ☒ IA ☑ CSA ☒

Specific Challenge

Additive manufacturing (AM) is now applied in the processing of most industrial metals, ceramics, polymers and composites, albeit at quite different levels of industrial readiness. The challenge is to develop equipment that allows the additive layer manufacturing of multi-materials items and multi-functional materials (for research, transport including aeronautic, consumer customised goods, communications, biomaterials and energy).
The development of novel materials is a primary challenge in the future development of AM. The challenge is also to use nanotechnologies to aggregate multiple materials within a single process, while improving or expanding their functionality, and enhancing their performance. This may include optical, rheological, mechanical, RF, electrical, magnetic, surface, thermal or process properties, controlled release, durability (accelerated aging and life time prediction) and quality.

Scope

By combining several materials, proposals should advance the state of the art through the development of ready assembled multifunctional devices. Proposals should demonstrate several simultaneous activities:

- Quantification of improved functionalities, properties, quality and lifespan of fabricated pieces;
- Evaluation of matching materials properties to the production process to enable the joining of dissimilar materials for AM tools;
- Demonstration of a better understanding of the nanotechnology integrated materials properties and manufactures;
- Integration and validation at early stage of the qualification and certification considerations of the materials;
- Joint development with material suppliers and end-users is required for a rapid uptake by industry;
- Modelling, standardisation and regulatory aspects (especially safety and nanosafety) and the process and materials qualification.

Activities should start at TRL 4 and achieve TRL 6 at the end of the project. The Commission considers that proposals requesting a contribution from the EU of between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Improvement of the efficiency, quality and reliability of the product by at least 40%;
- Better use of raw materials and resources with reduced environmental impact and to lower cost by 35% as demonstrated by Life Cycle Assessment;
- New opportunities and business for SMEs across Europe (which are key players in advanced materials research for Additive Manufacturing).

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

NMBP-22-2018: Osteoarticular tissues regeneration (RIA)

RIA ☑ IA ☒ CSA ☒

Specific Challenge

EU demographic change requires innovation to enhance active ageing, whereby a growing market for osteoarticular tissue regeneration is created. To reduce patients' sufferings, mitigate the economic burdens to health systems and exploit market opportunities it is crucial to conceive innovative designs and development of innovative biomaterials that enables the delivery of smart, nanostructured and functionalised tissues to regenerate and integrate bones, cartilages, tendons and joints.

Scope

To design and develop user-centred innovative and smart nanobiomaterials which may be also adaptable to remote control, that will lead to a personalised regeneration of osteoarticular tissues (bones, cartilages, tendons, joints). The nanobiomaterials should be designed to perform in host tissues affected by severe degenerative and/or inflammatory processes, which typically characterise Osteoarticular pathologies. Proposals should cover at least one of the following technologies, leading to a convergence of processes:

(i) 3D-bioprinting; (ii) stem cells seeding, recruiting, activation, functionalisation, and cell printing; (iii) nano functionalisation; (iv) 3D-printable biophoto-polymerisation; (v) use of light to expose/mask tethered signalling molecules, incorporating immune-modulatory materials such as complement regulators; (vi) additive manufacturing by laser sintering, rapid prototyping technologies, stereolithography, inkjet techniques; (vii) relevant cross-cutting KETs; (viii) electrospinning.

The research design should be developed by means of a multidisciplinary approach and involve relevant stakeholders. As relevant, proposals should consider sex and gender specific aspects.
Proposals submitted under this topic should include actions designed to facilitate cooperation with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

Activities should start at TRL 3 and achieve TRL 5 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU of between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Alleviate heavy burdens on patients and healthcare systems by developing smart nano-engineered affordable biomaterials for tissue self-healing and regeneration; improve the well-being, health, quality of life and active ageing of populations;
- Boost industrial competitiveness and leadership of EU companies in personalised bio-intelligent materials responding to patients' clinical specificities;
- Enhanced incorporation of digitalisation and Internet of Things for innovative and affordable biomaterials;
- Increase EU attractiveness for the clinical development of regenerative medicine;
- reinforce the EU sector ecosystem to generate new markets and opportunities for SMEs, translating innovative biomaterials into pre-clinical tests for market uptake.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants (IA)

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Shortage in raw materials, increased energy prices and environmental constraints require the European process industry to improve its performance and flexibility and there are unexploited opportunities for digitising a large range of enterprises of very different size in the process industry.
Digitisation endows the production system with capabilities for analysis. This should enable the autonomous operation of the system based on embedded cognitive reasoning, while relying on high-level supervisory control. As a consequence, changes in the production process need to be detected and the system needs to be able to respond to these dynamic fluctuations, by adapting the production to stay within the target ranges of production costs and rate, as well as those of and sustainability parameters. A fully up-to-date interactive and self-learning process control integrated with management tools is essential to obtain an optimal efficiency, while maintaining adequate flexibility of the system in regard to changing feedstock, energy sources and product demand.

Scope

Proposals need to develop new technologies to realise cognitive production plants, with improved efficiency and sustainability, by use of smart and networked sensor technologies, intelligent handling and online evaluation of various forms of data streams as well as new methods for self-organizing processes and process chains. Furthermore, proposals should cover the full digital transformation of a complete plant or site(s) including e.g. data acquisition, communication, automation, analytics, modelling, prediction and standardisation of relevant data interfaces. The following elements should be considered:

- Improvement of online monitoring and innovative control technologies in terms of process performance and flexibility, maintenance needs and product quality;
- Digital retrofitting of existing assets, integration towards and holistic optimisation of operations, data-analytics, real-time capability, use role-specific representation of information, feedback control & detect deviations and adjust operations immediately decision support (e.g. advanced process control, reactive scheduling);
- Several among the following concepts: apply low-cost sensors for on-line assessment of product quality and integration into process control; robust optimisation methods to distributed targeted process monitoring; simulation methods for the analysis, characterisation and study of systems for enhanced operations and decision-making combination of various forms of data with cognitive insight to optimise and enhance resources;
- Replicability and scalability of the concepts should be considered appropriately.

Proposals submitted under this topic should include actions designed to facilitate cooperation with other projects; to enhance user involvement; and to ensure the accessibility and reusability of data produced in the course of the project.

Activities should start at TRL 5 and achieve TRL 7 at the end of the project.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Improved capabilities for valid, reliable and real-time control logics of the properties, efficiency and quality of process streams and final products for existing and for more flexible process operation concepts:

- Show potential for improved performance in cognitive production plants;
- Increased production performance, energy and resource consumption, or waste or by-products production will be significantly improved by more than 20%. The targets should be quantified in the proposal and validated during the execution of the demonstration;
- Project outcomes should demonstrate a positive environmental impact, by reducing CO_2 emissions compared to the state of the art and in the scale relevant for the different applications;
- Effective dissemination of major innovation outcomes to the current next generation of employees of the SPIRE sectors, through the development, by education/training experts, of learning resources with flexible usability. These should be ready to be easily integrated in existing curricula and modules for undergraduate level and lifelong learning programmes.

Relevant indicators and metrics, with baseline values, should be clearly stated in the proposal.

5 iii. Leadership in Enabling and Industrial Technologies - Space

SPACE-10-TEC-2018-2020: Technologies for European non-dependence and competitiveness

RIA ☑	IA ☒	CSA ☒

Specific Challenge

The space sector is a strategic asset contributing to the independence, security and prosperity of Europe and its role in the world. Europe needs non-dependent access to critical space technologies, which is a *sine qua non* condition for achieving Europe's strategic objectives. "Non-dependence" refers to the possibility for Europe to have free, unrestricted access to any required space technology. Reaching non-dependence in certain technologies will open new markets to our industries and will increase the overall competitiveness of the European Space sector.

Research in technologies for European non-dependence and competitiveness has been undertaken within the frame of the Commission-ESA-EDA Joint Task Force (JTF) on Critical Technologies for European non-Dependence, launched in 2008.

In 2016, the JTF established the List of Actions for 2018-2020 (hereinafter JTF List of Actions 2018-2020), aiming at enhancing the TRL of the technologies identified in the list.

Scope

Selected actions from the JTF List of Actions 2018-2020 shall be implemented sequentially in 2018 and in 2019 as follows.

Group A (2018):

- JTF-2018/20-3 – High Capacity FPGAs [U12]
- JTF-2018/20-8 – ASICS: 28nm Deep Sub-Micron (DSM) [U22b]
- JTF-2018/20-16 – Active discrete power components [U14]
- JTF-2018/20-18 – RF components [N27]
- JTF-2018/20-19 – Passive components [U13]
- JTF-2018/20-22 – High temperature packaging [N49]

Group B (2019):

- JTF-2018/20-2 – ASICS for mixed signal processing [U11]
- JTF-2018/20-11 – Design and qualification of µcontroller for space applications [N52]
- JTF-2018/20-12 – Design and prototype of nvRAM for SPACE with serial interface ((quad)-SPI) [N53]
- JTF-2018/20-21 – High density (1000 pins and beyond) assembly capabilities and PCBs [U17]
- JTF-2018/20-28 – Photonics components [U15]
- JTF-2018/20-31 – Advanced laser crystals for high power space applications [N63]

Group C (2020):

- JTF-2018/20-5 – Very high performance microprocessors [U20]
- JTF-2018/20-9 – Design and prototype of ultra-reprogrammable SoCs [N50]
- JTF-2018/20-14 – Fiber optic or photonic integrated technology gyro-based inertial measurement unit (IMU) [U6]
- JTF-2018/20-17 – Power amplification: travelling wave tube materials [U7]
- JTF-2018/20-23 – SW tool: automatic generation of code [N64]
- JTF-2018/20-33 – Advanced materials and material technology for combustion chambers [U4]

Context information and high-level requirements, including description of scope, initial and target TRLs, and, where applicable, references and information of related activities, are provided in the JTF List of Actions 2018-2020. Accordingly, a technical guidance document12, based on the JTF List of Actions 2018-2020, is published together with this work programme outlining all relevant information to the selected actions.

Activities shall be complementary and create synergy with other European activities in the same domain either in the space or non-space fields. Technological spin in and/or bilateral collaborations should be enhanced between European non-space and space industries, including technology research institutes and academia. To this end, proposals shall include the following tasks:

- Analysis of relevant available roadmaps, including roadmaps developed in the context of actions for Key Enabling Technologies supported by the Union;
- Analysis of how their selected critical space technologies can contribute to different space applications or, where applicable, to non-space sectors (such as through technology transfer or spin off);
- Commercial assessment of the supply chain technology in the space or non-space domains and, if applicable, a business plan for commercialisation with a full range (preload) of recurring products.

The Commission considers that proposals requesting a contribution from the EU of between EUR 1 and 3 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- To reduce the dependence on critical technologies and capabilities from outside Europe for future space applications, as identified in the JTF List of Actions 2018-2020;
- To develop or regain in the mid-term the European capacity to operate independently in space, e.g. by

developing in a timely manner reliable and affordable space technologies that in some cases may already exist outside Europe or in European terrestrial applications;

- To enhance the technical capabilities and overall competitiveness of European space industry vendors on the worldwide market;
- To open new competition opportunities for European manufacturers by reducing dependency on export restricted technologies that are of strategic importance to future European space efforts;
- To improve the overall European space technology landscape and complement and/or create synergy with activities of European and national either in the space or non-space fields.

Type of Action: Research and Innovation action

LC-SPACE-14-TEC-2018-2019: Earth observation technologies

RIA ☑ **IA** ☒ **CSA** ☒

Specific Challenge

The challenge is to mature application-oriented technologies in the domains of Earth Observation (EO) which are expected to underpin competitiveness and contribute to the integration of space in society and economy.
The overarching objective is to improve the performance of EO systems, building on previous activities supported by the Union, Member States and ESA.

Activities in EO will focus on improving timeliness and reactivity of observations, their resolution and swath, the performance of sensors and the underlying technologies, while addressing the new challenges associated to larger data collection in remote sensing missions, including at ground segment level (e.g. massive data processing, machine learning, knowledge-based systems).

Moreover, some technologies and building blocks such as deployable antennas and/or (electrically) steerable antennas and mechanisms/structures, high mechanical/thermal stability aperture solutions, high efficiency power components, data processing and networks, or data links can provide synergies with SATCOM application domains.

Scope

The aim of this topic is to demonstrate, in a relevant environment, technologies, systems and sub-systems for EO. Proposals should demonstrate significant improvements in such areas as miniaturisation, power reduction, efficiency, versatility, and/or increased functionality, and should demonstrate at the viable extent complementarity to activities already funded by Member States and the European Space Agency. Proposals should also ensure system readiness for operational services and provide leverage on industry competitiveness, particularly on export markets. Each proposal shall address only one of the following subtopics:

a) Very high resolution optical EO for LEO and/or high resolution optical EO for GEO/HEO instrument technologies, with focus on improving payload (e.g. radiometric and spectral parameters, spatial resolution, swath), including detectors, materials and solutions for stable and large optomechanical elements and systems (e.g. lightweight telescope mirrors with metre-level diameter) focal planes, wave front error and line of sight control, high performance actuators, multispectral filters for large focal plane;.
b) Competitive remote sensing instruments and space systems: innovations supporting readiness advancements for next generation systems in the optical and radio frequency domains (active/passive), technologies enabling advanced system solutions (including small satellites possibly in convoy with existing space assets), on-board image processing and detectors for video imaging with increased swath and resolution, technologies for super- and hyperspectral imaging instruments with high performance, radio occultation sensors, low cost high resolution telescopes and radar imaging systems;
c) Disruptive technologies for remote sensing, as technology building blocks for innovative LiDAR (Light Detection And Ranging) and radar instruments (including cost-effective wide-swath altimetry and imaging systems), super-spectral and hyperspectral payloads with wide spectral and/or coverage, limb sounders and gravimetry payloads; high quantum efficiency photo detectors and high-precision optical beam scanning and pointing; advanced infrared (IR) technologies (optical filters, detectors and electronics);
d) On-board data processing: integrated multi-instrument on-board payload data processing for resource-constrained missions; solutions for high observation reactivity and real-time applications such as very high performance payload processing; on board data/image optimisation and compression for advanced video and image pre-processing as well as smart on-board data/image analysis; data flow optimisation for new missions, including impacts on the evolution of associated ground segment, for enhancement of overall processing power and speed over the full chain and for supporting massive data processing and machine learning in EO applications;
e) Advanced SAR/Radar technologies: step up maturity in new sensing concepts and technologies such as large and

active antennas and reflectors, including multi-frequency concepts; enablers for digital beam-forming and beam-hopping interferometric systems, and for other concepts, such as large swath maritime surveillance radar, active sensing/processing of SAR ships, data fusion integration with new generation Automatic Identification Systems (AIS);

Low cost solutions based on components off the shelf (COTS) are encouraged. Participation of industry, in particular SMEs, is encouraged.

Activities shall be complementary and create synergy with other European activities in the same domain.
To this end, proposals shall include the following tasks:

- Analysis of relevant available roadmaps, including roadmaps developed in the context of actions for the development of Key Enabling Technologies supported by the Union;
- Commercial assessment of the supply chain technology in the space or non-space domains and, if applicable, a business plan for commercialisation with a full range (preload) of recurring products.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 3 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Improvement in the capability, including through miniaturisation and power reduction, precision, efficiency or other characteristics with respect to existing Earth observation missions, opening new avenues for future space systems;
- Substantial improvement in state-of-the-art technologies in key areas such as optical and radar systems, radio occultation sensors, sounders, LiDARs for Earth observation, and related key technologies, as for instance detectors and antennas;
- Enabling synergic use of heterogeneous Earth Observation constellations;
- Strengthening Europe's position in industrial competitiveness in technologies for Earth observation payloads and missions;
- Greater industrial relevance of research actions and output as demonstrated by deeper involvement of industry, including SMEs, and stronger take-up of research results.
- Fostering links between academia and industry, accelerating and broadening technology transfer.

SPACE-15-TEC-2018: Satellite communication technologies

RIA ☑	IA ☒	CSA ☒

Specific Challenge

The context and customer field of satellite communication services is currently undergoing changes. Broadband TV applications are decreasing in importance and the importance of internet connectivity is increasing. New EU targets have been set to achieve a connectivity of 100 Mbps for all by 202517, for which satellite communication solutions are important, for instance in remote and offshore areas, for backhauling, or for mobile users andunder emergency situations. The demand for Very High Throughput satellite communications is increasing. The 5G concept combines various access technologies, such as cellular, wireless, satellite and wireline, for delivering reliable performance for critical communications and improve area coverage1819 making interconnectivity an important challenge. New markets are emerging, such as for example the connectivity needed for Internet of Things. New mission concepts are currently being established, such as mega constellations or satellite networks based on micro-mini satellites. Finally, security aspects are becoming more and more important, in particular for governmental users of satellite communications. The challenge for the EU is to prepare the ground to maintain the technological leading edge and maintain its global competitiveness in satellite communications in those rapidly changing conditions and markets (e.g. towards and beyond the 1 Tbps high throughput satellites and/or fully flexible satellites)

Scope

Proposals shall address one of the following sub-topics:
a) Secure and robust satellite communications, such as key generation and distribution, adapting to quantum technologies, anti-jamming technologies and products, anti-spoofing techniques, advanced coding, signal modulation and cryptography, secured uncoordinated multiple access, threats simulation, secure and robust telemetry, tracking and command (spread spectrum);
b) Bandwidth efficient transmission techniques to serve multiple users with high throughput satellites, e.g.

frequency reuse techniques, multiple antenna communications, beamforming, cooperative gateway diversity, user clustering and interference mitigation;
c) High speed processing and flexible and reprogrammable telecommunication payloads, able to adapt to changing service needs such as capacity flexibility and geographic redistribution of the traffic and to satellites integration in the 5G protocol and system. Simulation and end-to-end resources management shall be addressed;
d) Optical communications, including photonics, for very high throughput systems with more than 10 Gbps (e.g. hybrid RF/optical payloads use of optical up- and down links), on-board and ground aspects focusing on feeder links, system and architecture aspects encompassing technologies such as enhanced space-to-ground/RPAS; low complexity on-board processing and limited coherent processing; orbit to ground mission data download focussing on very high throughput optical feeder links (up to 1 Tbps) and very high speed rates optical ground station for feeder links (towards 1Tbps);
e) Flexible broadband passive and active antenna techniques, such as phased array antennas for very high throughput spaceborne or airborne satellite communication applications (consisting of broadband conformal antenna arrays, broadband beamforming and broadband RF front-ends), including multi-beaming smart antennas and integration ofPart 5.iii - Page 41 of 85
antennas in the platform, active antenna critical technologies, lens antenna techniques, 5G dedicated active arrays;
f) Inter-satellite links, data relay solutions and on-board switching, for potential future LEO constellations (including constellations of small satellites), supporting high data rates relay (up to 40 Gbps), including terminals, in such diverse contexts as GEO/MEO to LEO, airborne (including RPAS) to GEO;
g) Advanced RF equipment in terms of higher frequency bands (e.g. Q, V/W) and re-configurability (e.g. GaN HPAs, optimised TWTA, LNAs);
h) Ground systems technologies for satellite communication services and applications: evolution of ground control stations and teleports, also enabling full interoperability with future terrestrial telecommunication networks (including 5G) and optimising performance, coverage, costs, reliability and security in the provision of differentiated services and applications to diverse user categories.
Proposals shall consider enabling technologies and solutions aiming at exploiting the potential synergies between the Satellite Communication domain and the Navigation and Earth Observation domain (such as EO/SatCom hybrid mission satellites, smart satellites, high data rate solutions, high speed links, high performance processors, antennas/reflector/structures, ground segment).

Participation of industry, in particular SMEs, is encouraged.Activities shall be complementary and create synergy with other European activities in the same domain. Emphasis shall be given to the preparation of future and advanced satellite communications technologies up to TRL 4-5. Technological spin in and/or bilateral collaborations should be enhanced between European non-space and space industries.

To this end, proposals shall include the following tasks:

- Analysis of relevant available roadmaps, including roadmaps developed in the context of actions for the development of Key Enabling Technologies supported by the Union;

- Commercial assessment of the supply chain technology in the space or non-space domains and, if applicable, a business plan for commercialisation with a full range (preload) of recurring products.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 3 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- To ensure and enhance the life-cycle cost reduction (including manufacturing and operations) and increased performance, resulting in the enhanced competitiveness of the European space manufacturing and service industry in the rapidly evolving field of satellite communication.
- To develop European research and technology ecosystems consisting of different parties involved in satellite communications, i.e. manufacturers of user equipment, ground segment technologies, service providers and operators, validation and simulation tool developers, and end users.
- To contribute to the integration of satellite communication into the 5G.
- Greater industrial relevance of research actions and output as demonstrated by deeper involvement of industry, including SMEs, and stronger take-up of research results.

SU-SPACE-22-SEC-2019: Space Weather

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Commonly occurring space weather events have the potential to impact the performance of critical space and ground infrastructure disrupting operations and communications in multiple sectors of society. Extreme events could have devastating societal and economic consequences with potential costs for disruptions and damages estimated in tens or even hundreds of billions of Euros.

Space weather must be monitored and forecasted just like terrestrial weather. However, current space weather services are generally not capable of forecasting events over several days. A longer forecasting horizon would require access to data from new observation infrastructure coupled with new and improved modelling capabilities. Preparations are underway for future instruments to be placed in suitable vantage points (Lagrange 1 and 5 as well as on Earth orbiting satellites and on ground). The challenge is to prepare for a full exploitation of such data by a renewed effort on modelling and forecasting using currently available data.

The Space Strategy recognises that growing threats emerge in space from space debris to the impact of space weather. Accordingly, the Commission announced that its intention to address threats and vulnerabilities including the impact of space weather on satellites and on ground infrastructure such as transport, energy grids and telecommunication networks.

Scope

Proposals shall address the development of modelling capabilities and/or the delivery of prototype services able to interpret a broad range of observations of the Sun's corona and magnetic field, of the Sun-Earth interplanetary space and of the Earth magnetosphere/ionosphere coupling relying on existing observation capacities.
The goal is to pave the way for forecasting horizons for space weather events in the order of tens of hours or days and to identify potential indicators (or proxies) of extreme events potentially through the joint analysis of interdisciplinary data.

Proposals shall address application domains which may include space as well as terrestrial infrastructure.
Proposals shall include architectural concepts of possible European space weather services in relation to the application domains addressed and they shall demonstrate complementary to and, if relevant, utilize precursor Space Weather services already available through the Space Situational Awareness programme of ESA21 and take into account the global space weather service developments by the World Meteorological Organisation (WMO).
This action is also open to cooperation with international partners with relevant expertise.

A guidance document will be published together with this work programme.The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 3 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.
This topic contributes to the Horizon 2020 focus area "Boosting the effectiveness of the Security Union ".

Expected Impact:

- Improved scientific understanding of the origin and evolution of space weather phenomena;
- New models and forecasting techniques capable of extending the time horizon of a future space weather forecasting capability to several days;
- Inventory of potential early indicators of extreme space weather events.

7. Innovation in SMEs

INNOSUP-01-2018-2020: Cluster facilitated projects for new industrial value chains

RIA ☒ IA ☑ CSA ☒

Specific Challenge

To develop new cross-sectoral industrial value chains across the EU, by building upon the innovation potential of SMEs. The EU needs to support the development of emerging industries, which will provide the growth and

employment of the future. The reindustrialisation of the EU's industrial base has to focus on the development of long-term internationally competitive goods and services that require combining different competences and innovative solutions. The development of new industrial value chains calls for the collaboration and integration of different innovation actors, including large enterprises and especially SMEs, across different sectors towards the implementation of a joint vision.

SMEs need help to generate, take up and better capitalise on all forms of knowledge, creativity, craftsmanship and innovation - including for the application of existing crosscutting or emerging technologies, advanced manufacturing, ICT, eco-innovative and resource- efficient solutions, new business models, service innovation and design. Thepotential of clusters - that represent favourable ecosystems for innovation and entrepreneurship - need to be better exploited in this respect.

Scope

Cross-border and cross-sectoral collaboration, innovation and entrepreneurship across different regions and value chains shall be promoted. The coordination and facilitation shall be led by cluster organisations and other intermediary organisations, by following a systemic approach that combines different resources, tools and instruments. Innovation actors, especially SMEs with mutually reinforcing competences, shall be supported in view of creating new industrial value chains that foster the development of emerging industries in Europe.
To this end, proposals shall outline a strategic vision for building new industrial value chains across the EU Member States and Associated Countries. They shall specifically focus on integrating and supporting groups of SMEs in collaboration with other innovation actors in addressing specific problems and challenges. Cluster organisations or other SME intermediaries shall be invited to set up collaboration and networking activities for SMEs and create a favourable "open space" for cross-sectoral fertilisation and value chain innovation to take place. Each proposal should demonstrate the capacity to:

1. validate ideas for structured innovation projects driven by SMEs from different sectors and countries in collaboration with other innovation actors and facilitate the coordination towards new industrial value chains through this collaboration space.

2. support innovation activities and/or channel a mix of different targeted entrepreneurial and innovation support measures (such as mentoring, coaching, innovation and technical assistance vouchers, etc.) directly to the innovation actors of the validated innovation projects to further support their development, integration and large-scale demonstration in a strategic manner. At least 75% of the total proposed budget shall be allocated to support innovation in SMEs directly, whereby the SMEs benefit by either participating in the consortium or by receiving financial and/or other support as a third party (enterprise) in line with the conditions set out in General Annex K of the work programme.

Background information and guidance on the systemic approach and strategic focus to be envisaged is provided to applicants at the EU Cluster Portal2 and in the background note3 being part of this call. Synergies will be sought with other measures that are supporting such large-scale demonstration projects, in particular under the European Structural and Investment Funds (ESI Funds) and COSME. This includes the thematic Smart Specialisation Platforms4- notably the one on Industrial Modernisation, European Strategic Cluster Partnerships, the European Cluster Collaboration Platform and the European Observatory for Clusters and Industrial Change as well as partnerships under the pilot action for interregional partnerships for innovative projects. These synergies will be actively encouraged in the applicants' project partnership building and project implementation, notably through the engaged SME intermediaries. “Large-scale” does not necessarily refer to the amount of financial support provided for a particular project but to the extent of the roll-out of a staged process of experimentation and implementation with accompanying support that reaches out to groups of mutually reinforcing SMEs. This approach aims at “demonstrating at large scale” the potential impact of innovative solutions to specific challenges, rather than supporting isolated projects or SMEs.

For the first stage of the submission procedure, applicants should provide a concept note (of max. 10 pages), which should include a clear description of the ideas and objectives for an innovation action towards the development of new industrial value chains as well as an explanation of the main activities, implementation modalities (including for financial support to third parties, if applicable, and how to achieve the target of allocating at least 75% of the total proposed budget to support innovation in SMEs directly) and expected results foreseen (please refer to the grant conditions for this topic).

The concept note should further describe how the proposed systemic approach and strategic focus promises significant impact on economic growth and job; demonstrates a European dimension and added value; and has the

potential to act as a catalyst by contributing to and/or leveraging other activities supported, for instance, under the European Structural and Investment Funds, e.g. in the context of smart specialisation strategies.

An estimate of the total costs of the proposed action and contribution to be requested from the Commission shall also be provided. Only proposals that pass the evaluation threshold for the first stage will be invited to a second stage of submission for a full proposal with a detailed description of the budget and activities planned to be undertaken. The Commission considers that proposals requesting a contribution from the EU of between EUR 2.5 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Strengthen industrial leadership in the EU Member States and Associated Countries by reinforcing value chains that integrate innovative solutions in SMEs, along and across existing value chains.
- Stimulate the creation of new globally competitive industrial value chains across the EU Member States and Associated Countries to accelerate the development of emerging industries, which will boost industrial competitiveness and underpin future economic growth, jobs, and progress towards a resource-efficient economy.
- Further leverage and complement support for innovation in SMEs and other funding, which may be provided by national or regional authorities (including under the European Structural and Investment Funds) and/or by private investors (upfront or as follow-up investments), including in relation to the European Fund for Strategic Investments.
- Contribute to the implementation of regional and national research and innovation strategies for smart specialisation strategies (RIS3), modern cluster policies as well as of strategic inter-regional collaboration under thematic Smart Specialisation Platforms and cluster partnerships supported by the European Cluster Collaboration Platform and the European Observatory for Clusters and Industrial Change by capitalising upon concentrated and complementary competences for the development of new industrial value chains and emerging industries with a clear EU added-value.
- Provide a clear and measurable contribution to the innovation performance of the supported SMEs in the short-term - as revealed by indicators such as numbers of new or significantly improved products (goods and/or services), processes, new marketing methods, or new organisational methods -, and to its impact on resource efficiency and/or turnover. A wider impact is also expected in the medium-term.
- Improve the business environment of the supported SMEs by establishing open collaboration spaces that can involve innovation actors from different sectors and countries. This will lead to the creation of new ideas for innovation and new collaboration partnerships, which will be subject of further development and with the potential for further impact on business turnover.

INNOSUP-02-2019-2020: European SME innovation Associate - pilot

RIA ☒	IA ☒	CSA ☑

Specific Challenge

The lack of access to skills, to latest knowledge and capacity to manage innovation processes effectively, have been identified as major barriers for innovation in SMEs. Individual SMEs are at a disadvantage to recruit specialised knowledge as they often lack Europe-wide networking connections and do not tend to have established brands as large enterprises. Enterprise-led mobility programmes, supporting enterprises in recruiting expertise, show a high level of satisfaction and return on investment. This methodology is not currently used at European level and this enterprise-led approach is to be further developed and tested, using the first experiences of this pilot action financed by the work programme 2016-2017. This action complements Marie Skłodowska Curie actions (MSCA) which focus on developing research careers, by providing additional work opportunities for experienced researchers in innovating SMEs.

This action is a continuation of the pilot action which is part of the Innovation in SMEs work programme 2016-2017. The first "innovation associates" supported by the 2016-2017 pilot are expected to start working in SMEs from September 2017 onwards. The detailed provisions and the conditions of the action in 2019-2020 are therefore subject to revision based on the conclusions from the first pilot, including the findings of the accompanying study to INNOSUP-02-2016 that will be conducted in parallel to INNOSUP-02-2016.

Scope

This SME-led pilot is an innovation capacity building action to provide a grant at European level to visionary6 SMEs

who can demonstrate that the skills required for a particular innovation idea are not within reach for them at national level (for example because the required skills are not available or not affordable for SMEs). SMEs are supported to employ a highly-skilled experienced researcher (referred to as an 'innovation associate') for a continuous period of one year. The innovation associate's task will be to explore, during the course of his/her contract, the potential of their innovative idea and turn it into an innovation project.

SMEs are highly encouraged to publish a vacancy notice for highly specialised skills before submitting a proposal. SMEs deciding to do so must use the EURAXESS portal for this purpose. Any other relevant platforms and media are optional. This will help them liaise with potentially interested specialists and to assess the attractiveness of the proposed package in order to fine-tune their application to the pilot. SMEs would indicate in the vacancy notice their intention to apply for support under the Innovation Associate action7 and, if applicable, any conditionality of the job offer on the award of a grant. SMEs are free to sign a contract to recruit immediately interested specialists; this would however prevent them from receiving a grant under the pilot action.

The evaluation of proposals will focus on the demonstrated benefits of recruiting transnationally i.e. the impact for the SME to get access to skills not available on the national labour market; the excellence and impact of the innovative idea, as well as the coherence and effectiveness of the recruitment plan which should offer the same opportunities for male/female candidates.

SMEs that will receive a grant will be obliged to advertise their vacancy on EURAXESS, unless a contract with an innovation associate has already been signed in line with the provisions above. They are also encouraged to publish the vacancy notice on any other relevant platform or media, with a clear indication that the grant was awarded.

SMEs who are awarded a grant are obliged to employ an "innovation associate" for a continuous period of one year8. The innovation associate's tasks shall be to identify the potential of the company's innovation idea with the objective and turn it into an innovation project and - hopefully - a continuation of the employment of the innovation associate. During these 12 months of employment, every associate is requested to participate in a core training programme on industrial innovation and business management9. Also during that period, SMEs get financial support to implement a training and development plan specifically for the associate, tailored to the needs of the associate and the enterprise to make the associate fully operational in the company. Proposals shall outline how the proposed tailored training contributes to this end and why it is necessary within the context of the innovation idea and the tasks of the innovation associate.
In line with the orientation of the action and with the aim to accelerate the integration of the associate in the company's staff, the following costs shall be eligible for reimbursement under the grant:

- Personnel costs of the associate.
- Relocation costs of the associate, which may include removal cost, travel cost of the associate and his/her immediate family (if applicable) to the new place of employment, visa cost (if applicable), translation cost of certificates (if applicable), a temporary transition allowance to cover extra cost upon arrival in the place of employment, as well as other clearly justified expenditure directly related to relocation.
- Travel and subsistence costs of the associate to the core training programme and travel and subsistence for tailored training (as described in the personal development plan). Travel cost and subsistence for the supervisor may be eligible for up to two training sessions.
- Travel and subsistence cost for the innovation associate and the supervisor in the enterprise to one kick-off meeting in Brussels (one day), organised by the European Commission10.
- External cost for the tailored training of the associate (for example course fees or other cost required to implement the training and development plan). Activities that fall under normal induction training11 for any new employee in a company will not be eligible under this call.

Other costs like recruitment costs or travel costs to action-specific workshops by the supervisor in the enterprise are covered by the flat rate indirect cost.

Any cost not directly related to the employment and training of the innovation associate - for example cost of research, dissemination or promotion activities and other cost relating to the actual implementation of the innovation idea/project - are not eligible under this call.

It is intended to support an indicative total number of 115 assignments from the indicative budget. These will be spread over two cut-offs, one for projects starting in 2019 and one for projects starting in 2020.

The following criteria will have to be met by the associate: i) PhD holder, ii) an expertise in line with the job

requirements as outlined in the vacancy notice; iii) compliance with transnational mobility criteria as defined in the mobility rule of the Marie Skłodowska Curie Actions (MSCA)12.

As the purpose of this pilot is to test the concept with a variety and diversity of SMEs, SMEs which have received a grant under the previous pilot action carried out in 2017/2018 (work programme 2016/2017) are not eligible under this call.

The preferred start date of the innovation associates' employment is in September of the year following the call opening in order to align the timing of the action with the academic year. The execution of the action will start on the starting date of the associates' employment (exact date to be determined during the grant preparation phase).
In case of non-execution, the Commission reserves the right to terminate the grant agreement according to the provisions of the General mono-beneficiary grant agreement for the Horizon 2020 programme.

The innovation associates are expected to be offered employment contracts or equivalent by the hosting SMEs. In return, the innovation associates must commit to a full-time position, for the full duration of the grant.
To promote the pilot, innovating SMEs experiencing skills shortages will be contacted by Enterprise Europe Network innovation consultants who are able to provide assistance in formulating a vacancy notice to address the identified skills shortages.

An accompanying study will evaluate the impact of the 2016-2017 pilot action and the satisfaction levels of awarded SMEs and associates as well as of a sample of SMEs who were not awarded a grant. The study will provide outcomes and recommendations for this second phase of the pilot, based on the factual evidence from benefiting SMEs and associates in the first phase.

Expected Impact
Test that:

- An idea can be transformed into an innovation strategy and a subsequent research and innovation projects once SMEs have access to the right skills;
- Public intervention at European level, can support innovating SMEs to overcome challenges in accessing scarce skills through a transnational mobility mechanism, increase their innovation potential;
- Experienced researchers develop appealing career opportunities in SMEs

8. Health, demographic change and well-being

SC1-BHC-03-2018: Exploiting research outcomes and application potential of the human microbiome for personalised prediction, prevention and treatment of disease

RIA ☑	IA ☒	CSA ☒

Specific Challenge
The human microbiome plays an important role for health. Many different projects in 'metagenomics' and epidemiological research in recent years have delivered new knowledge on associations between the microbiome and a wide range of diseases. International initiatives such as the International Human Microbiome Consortium (IHMC) have generated large-scale data. These research efforts were first of all made to identify host-microbe-interactions and links of the microbiome with diseases. Now the challenge is to accelerate the translation of data and knowledge to define balanced healthy conditions and to predict and prevent diseases through the development of personalised approaches and clinical tools. Building on existing data it is necessary to produce also new data with the aim to make the research more comprehensive or more holistic and to achieve more valuable clinical tools. Whilst the promise of such tools is evident, they need to be validated and be part of personalised medicine.

This topic will focus on the clinical aspects of personalised prediction and prevention of disease. Other aspects of microbiome research in relation to food/nutrition will be addressed by a cluster of topics in Societal Challenge 2. Further topics may be launched under the IMI2 JU.

Scope
The aim is to achieve understanding of balanced states of health and on that basis to deliver personalised approaches and clinical tools for predicting and preventing diseases. Proposals should integrate and use high quality microbiome,

metabolome and other -omics data produced by large scale international initiatives. They should combine and expand these data with approaches including disease-oriented functional analysis, endogenous and exogenous factors, innovative imaging, functional, structural and lifestyle, ageing, dietary data, environmental data, mental disorders and/or any other comorbidity.

Proposals should build on data from existing microbiome projects and, as appropriate, on data from other international initiatives. Focussed production of new data should make subject coverage more comprehensive with the aim of delivering more valuable clinical tools. Proposals should address relevant ethical implications, take into account sex and gender differences, the effect of country-specific issues and should include a section on research data management. The proposed work should be connected to the future European Open Science Cloud16 to enable sharing and re-use of resources as well as interoperability with other types of data and tools across disciplines.

Proposals should contribute to standardisation of sample collection and storage, methods (Standard Operating Procedures) and study designs. SMEs participation is encouraged. Proposals addressing rare diseases are not in scope of this action.

The Commission considers that proposals requesting a contribution from the EU of between EUR 10 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Personalised medicine approaches for the prediction and prevention of diseases through exploitation, integration and combination of data from existing microbiome projects and appropriate other international -omics studies.
- More valuable clinical tools built on existing data and new complementary data in relevant repositories.
- Identification and validation of microbial functionalities; robust healthy conditions and determinants of resilience for defined populations at specific body sites.
- Better prediction and prevention of diseases through validated novel clinical tools that are helpful for end-users.
- More intensive collaboration and strategic synergies between scientists across disciplines and sectors.

SC1-BHC-28-2019: The Human Exposome Project: a toolbox for assessing and addressing the impact of environment on health

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Despite the general acknowledgement by the scientific community that *'Genetics load the gun but environment pulls the trigger*'110 when it comes to the causation of major non-communicable diseases (NCDs)111**,** there is persistent uncertainty as to the global burden of disease attributable to environmental (including life-style and climatic) factors, including healthcare costs and negative economic impact. Deciphering the human exposome112 is a novel way of addressing the challenge to improve health and reduce the overall burden of disease. This will require improved knowledge of health risks, including combinations of several risk factors, and the mechanisms by which they affect health at different stages throughout the life course, including exposures in foetal life. Effective preventive action will need to be designed, building on knowledge of various risk factors, including exposure to pollutants in daily life, individual behaviour and the social context, taking into account gender issues.

Developing a Human Exposome Project would present a fundamental shift in looking at health, by moving research away from 'one exposure, one disease' understanding to a more complex picture upon which to build solid, cost-effective preventive actions and policies in the future. It would respond to the need for more complete and accurate individual-level exposure data in order to estimate the largely unknown environmental component of NCDs.

Scope

Applicants should take advantage of the last decade's rapid technological advances which have opened up new opportunities to collect, combine and analyse large data sets offering new possibilities to understand the contribution of environmental factors to the global health burden of common chronic diseases. Proposals should use innovative approaches to the systematic and agnostic identification of the most important environmental risk factors for the development of major NCDs across the life course (including *in utero*), leading to preventive interventions at the individual, group or population level and contribute to sustainable healthcare. Well-designed retrospective epidemiological studies may be included and proposals may envisage the creation of a prospective Europe-wide exposomics cohort and biobank, integrating behavioural, socio-economic factors and clinical records.

The following components should be considered: agnostic evaluation of the role of multiple and unknown exposures; assessment of individual exposure to multiple stressors; sensors that combine external exposure and health data measurements; integration of external exposome data with cross-omics responses and (epi)genetic data; systematic evaluation and simulations of the health impacts; socio-economic modelling and econometric analysis including ethical and sex/gender aspects where relevant; better data mining tools, including advanced statistical analysis of complex data and high-performance/high throughput computing and storage; a long-term host and a single shared data infrastructure, taking into account existing structures and ensuring open access to data generated.

Innovation and connections with industry are expected in the areas of sensor development (external exposome), omics technology and novel biomarker development (internal exposome), bioinformatics, and data processing and management. Proposals are expected to respond to a persistent or long-standing policy/regulatory need where the exposome approach would be useful to solve a scientific issue to underpin better regulation now or in the future (examples: indoor and outdoor air quality, waste, occupational health, noise).

In order to establish an overarching Human Exposome Project, an overall coordination mechanism between the projects funded will be required and will be added at the grant preparation stage to all selected proposals as a common work package. Grants awarded under this topic will be complementary. The respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement will be applied.

The Commission considers that a proposal requesting an EU contribution between EUR 8 to 12 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

- Innovation in environmental health sciences, in particular for external and internal exposure assessments and data management.
- Enabling researchers and policy makers to continuously include new knowledge in the policy making processes by using the toolbox to generate data and information.
- Better prediction of disease risk by acquisition of new knowledge on the influence of external exposures on biological pathways at different life-stages and identification of early signs of health damage caused by environmental factors.

DT-TDS-01-2019: Smart and healthy living at home

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Citizens in a rapidly ageing European population are at greater risk of cognitive impairment, frailty and multiple chronic health conditions with considerable negative consequences for their independence, quality of life and for the sustainability of health and care systems. The challenge is to foster large-scale deployment of integrated digital solutions which will bring improved quality of life to citizens while demonstrating significant efficiency gains in health and care delivery across Europe.

Scope

A mix of advanced ICT ranging from biophotonics to robotics, from artificial intelligence to big data and from IoT to smart wearables can address these challenges. A platform for smart living at home should integrate these technologies in an intelligent manner.

The pilots should build on open platforms, standardised ontologies, APIs and results from IoT-based smart living environments, service robotics and smart wearable & portable systems and clearly go beyond current state of the art in terms of scale, the capabilities for personalisation, adaptation, and user acceptance.

Pilots in the selected areas should clearly cover the supply and demand sides. For further expanding with other users, developers of additional applications, replication of the pilot through new sites, and complementary assessment of the acceptability of the use cases where appropriate, the actions in this topic may involve financial support to third parties as outlined in the chapeau 'Platforms and Pilots'.

A clear methodology and impact indicators for socio-economic impact assessment from using the platform should be included, where possible using the MAFEIP161 framework. The number of users involved and duration of pilot services should be sufficient to ensure significance in impact analysis, with a minimum of 4 pilot sites in 4 countries. The proposed pilots should also demonstrate feasibility of integration with other relevant application domains such as energy, transport, or smart cities, including interoperability, along with data security and integrity, and models for data sharing and valorisation are to be developed in order to create incentives for data aggregation across different platforms and application areas. Regulatory aspects and legal aspects of data ownership should be addressed. Relevant ethics and gender issues should be taken into account.

Proposals should address one of the two following areas:

1. **Intelligent and personalised digital solutions for sustaining and extending healthy and independent living.** The objective is to develop and deploy innovative and user-led digital solutions capable of supporting and extending healthy and independent living for older individuals who are facing permanently or temporarily reduced functionality and capabilities. Innovative ways for ensuring user-friendly and accessible interface design and new intuitive ways of citizen interaction and trust creation are needed. Special emphasis should be given to viable concepts that ensure security and privacy by design, data protection, safety, security and trust in the resulting system and service delivery inside and outside the home.

2. **Personalised early risk detection and intervention.** The objective is to develop and deploy innovative and user-led solutions building on big data for personalised risk detection, advanced health monitoring and early interventions for people facing increased health and social risks. Proposals should design and demonstrate innovative personalised treatments and therapies based on early detection and risk avoidance. Because of the personal and sensitive nature of health data, special attention needs to be paid to trust, privacy and data protection.

For this topic, the four activities and impact criteria described in the chapeau 'Platforms and Pilots' have to be applied. Pilot projects are expected to contribute to the consolidation and coherence work that will be implemented by the CSA supporting the activities defined under " DT-ICT-14-2019: Digital Platforms/Pilots Horizontal Activities" below. This requires that they contribute to clustering their results of horizontal nature (interoperability approach, standards, security and privacy approaches, business validation and sustainability, methodologies, metrics, etc.).

The Commission considers that proposals requesting a contribution from the EU between 15 and 20 EUR million for Innovation Actions would allow the areas to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. At least one proposal should be funded for each of the above-mentioned areas

Expected Impact

- Emergence of European-led platform for smart and healthy and independent living at home;
- Increased competitiveness of the European ICT industry in the domain, through enhanced interoperability, best practices for viable business and financing models and scalable markets;
- Demonstrate links and build synergies with Member States' and regional initiatives in this area;
- Improved and evidence-based efficiency of health and care systems with demonstrated added-value of underlying technologies;
- Improved quality of life and health status for involved users and carers, with demonstrated added-value of underlying technologies;
- User accepted, validated innovative solutions addressing accessibility, privacy, security, vulnerability, liability, and trust in connected data spaces.

9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy

SFS-05-2018-2019-2020: New and emerging risks to plant health

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Trade and the movement of goods and people have facilitated the introduction, spread and establishment of plant pests and diseases. While new pests and diseases are likely to arise, existing ones might become more severe as a result of intensification, climatic variations and changes in agricultural and forest management practices. They can have a significant impact on agricultural and forest productivity. Appropriate and rapid responses from decision-makers need to be informed by scientific knowledge which addresses pest and disease management in a comprehensive manner.

Scope

Proposals will target one or more new or emerging plant pests and/or diseases (regulated or non-regulated, introduced or native) that are causing, or likely to cause, significant (socio-)economic and/or environmental losses to EU agriculture/forestry. The choice of target pest and/or disease will consider the potential threat in terms of development and spread, its potential exacerbation under climate change as well as the potential impact on agricultural production, forestry, trade and the wider environment. Proposals will increase knowledge of the biology, development and spread of pests/diseases. They will improve methods and strategies for early detection, prevention and control as well as enlarge the range of tools for integrated and sustainable pest/disease management.

International cooperation with countries affected or threatened by the same pest(s)/disease(s) is encouraged. Proposals should fall under the concept of the 'multi-actor approach'24 including a range of actors to ensure that knowledge and needs from various sectors such as research, plant health services and the farming/forestry sector are brought together.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Activities will contribute to finding adequate responses to new and/or emerging plant pests/diseases. More specifically knowledge and solutions generated by these actions will contribute to:

- the understanding of drivers of plant pest/disease emergence including the influence of climate change;
- the development of efficient tools for the prevention, detection and control of pests/diseases;
- the development of environmentally sound solutions for pest/disease management in farming and forestry in line with the principles of Integrated Pest Management;
- the reduction of economic, social and/or environmental losses by the farming/forestry sector;
- support for relevant EU plant health policies.

In the longer term, project outputs will help the agricultural/forestry sector to remain productive and contribute to sustainable agriculture and/or forest health.

SFS-06-2018-2020: Stepping up integrated pest management

RIA ☑	IA ☒	CSA ☒

Specific Challenge

There is a need to develop and promote more cost-effective and sustainable Integrated Pest Management (IPM) options which are based on a holistic view of agro-ecosystems. IPM is part of EU legislation promoting the sustainable use of plant protection products (SUD26). The various IPM solutions being developed across Europe all differ depending on the crops, the available climate monitoring systems, the underlying knowledge of pest populations, on pedo-climatic conditions and on the agro-ecological environment. IPM decision support systems and models developed as part of national or regional research projects usually only deal with limited aspects of crop production and are validated in regional circumstances. As a consequence, it remains often unclear what the value of such a model/system may be in other parts of Europe and what the impact of climate change could be on the validity of the model. Sharing IPM decision supporting tools at EU level therefore has great potential for synergies. Furthermore, on-farm demonstration of novel IPM tools would boost peer-to-peer learning across Europe and help farmers with daily management practices, as well as enable the integration of these tools into precision agriculture.

Scope

Proposals shall address only one of the following sub-topics:

A. [2018] Decision support systems (RIA)

Activities shall bring together the various individual IPM models and decision support systems into a platform to make them available for a wider range of geographic conditions. This user-friendly system shall be developed based

on epidemiological parameters of existing decision support systems and made easily accessible to farmers and local advisers. Most processes (such as pest and disease development, crop growth, water balances, etc.) described in models/decision support systems, need detailed climate data and continuous improvement/updates. Therefore, proposals shall integrate the various local agro-meteorological networks across the EU to make it possible for all models/decision support systems offered on the platform to access and use these weather data. Activities should focus on pests and diseases for which IPM solutions are most urgently needed. The platform should enable country stakeholders such as research centres, producer organisations and advisors to select and adapt the relevant individual models/decision support systems to their specific country/region/crop context and make them available to the farmers concerned. Proposals must use an open-source approach and should fall under the concept of the 'multi-actor approach'27 including scientists, farmers, advisors and ICT specialists.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

B. [2020] EU wide demonstration farm network (CSA)

Expected Impact

Activities shall contribute to give farmers throughout the EU broader access to the existing knowledge on integrated pest management. They will also help them to incorporate IPM solutions in existing agricultural systems taking into account costs and benefits, by

- creating a European platform to share and further develop IPM decision support systems, covering the various bio-geographical areas;
- establishing partnerships between actors developing cost effective IPM decision support systems which are ready for practice;
- increasing awareness of the available IPM toolbox;
- increasing on-farm use of IPM techniques;
- supporting relevant plant health policies, in particular the implementation of the SUD.

In the long run, results will contribute to more sustainable agriculture by reducing exposure to pesticides of humans and animals, terrestrial and aquatic ecosystems, drinking water and the food chain.

SFS-16-2018: Towards healthier and sustainable food

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Resource efficiency in the fishing sector and its improvement has many dimensions, including in particular extraction, Increasingly, consumers are paying attention to healthier food diets, "healthy" food attributes (such as "freshness", "naturalness" and "nutritional value") and overall sustainability of production and processing methods. To meet these demands food production and processing need to further evolve in terms of better preservation of the raw material and natural food properties while ensuring healthy, tasty and sustainable food. In parallel it is necessary to improve the understanding of the influence of consumers' practices in maintaining the healthy food attributes from purchasing to consumption. Other important trends include a growing demand for regional and locally produced/supplied and less processed food. This has resulted in the emergence of new SME-led business models and an increasing number of farmers engaging in food processing (either on farm or by sharing processing facilities) and local food value chains. Developing effective and sustainable logistics systems for these types of products is essential to fully capitalise on new business opportunities in local/regional food systems and meet consumer expectations.

Scope

Activities will assess and develop food processing methods (e.g. minimal, mild, careful processing) with the potential to optimise the preservation of the naturally occurring nutritional, structural and functional food properties, even once the food is processed. They will focus on innovative small-scale processing technologies tailored to the needs of SMEs, while ensuring links between food processing and primary production. Work will include, as appropriate, testing of solutions and assessment of their impacts on product characteristics (food structure, composition and stability, safety, nutritional and sensory quality), traceability and authenticity, sustainability (environmental, social, economic) and public health. When needed, proposals should address requirements from relevant EU regulatory frameworks including needs for pre-market approval. Activities will also look into the potential for the post-harvest preservation of naturally occurring nutritional food properties.

Furthermore, work will explore appropriate business models adapted to proposed methods / technologies, taking into account organisation and distribution concepts, consumer behaviour / acceptance and/or the potential for consumer engagement. Proposed work shall benefit both the conventional and organic sectors. Activities will fall under the concept of the 'multi-actor approach'44 and allow for adequate involvement of food SMEs, farmers and consumers.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 7 m would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Activities will enhance market orientation and capacity of small and medium scale food processors and its suppliers to meet consumer demand for healthier food diets.
In the short- to medium term work will

- increase the availability of food with "healthy" attributes, resulting in positive impacts on sustainability and public health;
- develop food processing methods/technologies adapted to the needs of the SMEs and with the potential to optimise the preservation of the naturally occurring nutritional, structural and functional food properties;
- develop flexible and optimised food processing units adapted to the seasonal character of raw material production and processing in small(er) batches;
- ensure food authenticity and prevent/reduce food losses through efficient use of raw material and optimised processes between primary production and processing;
- stimulate creation of new business models supporting job creation and job retention in rural areas.

In the longer term funded activities will contribute to increased competitiveness, sustainability, circularity and diversity of regional and local food systems.

LC-SFS-19-2018-2019: Climate-smart and resilient farming

RIA ☑	IA ☒	CSA ☒

Specific Challenge
Evidence on climate change is solid and reveals that it will affect the EU with European farming first in line through changes to rainfall regimes, rising temperatures, the variability and seasonality of the climate and the occurrence of more frequent extreme events (heatwaves, droughts, storms and floods). In addition to finding effective solutions for greenhouse gas (GHG) mitigation such as reducing GHG emissions and sequestering carbon below and above ground, farmers will need to adapt to climate change and develop farming systems resilient to fluctuating environmental and socio-economic conditions.

Scope
Proposals should address only one of the following sub-topics (A) or (B).

A. [2018] Microclimate management: from field to landscape (RIA)
Proposals shall improve the resilience of farming systems, including the livestock sector, to variable climatic conditions and more extreme weather events through risk management strategies and innovations in field and regional landscape design. Work will take into account the potential of traditional and innovative techniques and sensors and test their effectiveness in mitigating/buffering the effects of different weather events (such as drought, heat and cold waves, wind, heavy rain and flooding). Activities will maximise the time and space resolution of decision support systems to increase their effectiveness and reliability. Studies at landscape scale are required to understand leading ecological processes; therefore activities will include collaboration and coordination between farmers and between farmers and other stakeholders. Activities should look at the wider impacts of trade-offs and synergies between microclimate management and related policies (Water Framework Directive, Biodiversity Action Plans, Common Agricultural Policy, EU Adaptation Strategy) on agri-ecosystems and their surroundings. Proposals will use transdisciplinary research methods and should fall under the concept of the 'multi-actor approach'46. Proposals should establish a farm and landscape-level observatory and knowledge-exchange network on regional risks and microclimate management. They should build links with the European Innovation Partnership "Agricultural productivity and sustainability" and showcase good practices to be replicated.

B. [2019] Efficiency and resilience of mixed farming and agroforestry systems (RIA)
Activities will develop further mixed farming systems and show how the integration of crops, livestock and forestry

activities can improve the resilience of agriculture in combination with the related climate change mitigation potential (e.g. carbon sequestration, nutrient recycling). Proposals should enable the participative design of mixed farming and agroforestry systems not only focusing on technical and agronomic aspects but also taking on board socio-economic aspects of mixed farming modes, the related value chains and necessary infrastructures as well as the environmental and climate mitigation and adaptation potential. Proposals will contribute to increase synergies between crops and livestock by defining optimal combinations of production to increase income stability at farm level and sustainability of the relevant value chains. They shall develop models and tools adapted to real farm management to grasp the inherent complexity of mixed farming and agroforestry systems. Proposed work shall benefit both the conventional and organic sectors. Activities ill use transdisciplinary research methods and proposals should fall under the concept of the 'multi-actor approach'.

All sub-topics- The proposals funded under this topic (sub-topics A and B) will contribute to the development of a conceptual framework on resilience and mitigation at different levels (farm, community, region, national and EU) and its policy implications. Proposals should include a task to cluster with other projects financed under the same topic. The Commission considers that proposals requesting a contribution from the EU of up to EUR 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Funded activities will improve the climate and socio-economic resilience of the agricultural sector. In the short to medium term work will:

- Deliver effective solutions for ensuring the highest level of implementation on the farm and landscape scale regarding climate-smart and resilient systems and provide decision support systems adapted to mixed farming and agroforestry systems in heterogeneous landscapes;
- Unlock and improve viability and replicability of efficient and resilient farming systems and propose different transition scenarios leading to the development of modern land use systems, value chains and infrastructures;
- Reduce the environmental impact of farming and contribute towards mitigation and adaptation to climate change;
- Provide ecosystem services through integrated and small-scale land management.

In the longer term funded activities will help to foster the synergies between agricultural production, climate change mitigation and adaptation. They will allow the farming sector to continue fulfilling its multiple functions under predicted, more challenging abiotic conditions.

SFS-23-2019: Integrated water management in small agricultural catchments

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Tackling both quantity and quality of water in small agricultural catchments provides a number of advantages. The number of hydrological processes and interactions can be analysed in detail which is not the case for large scale hydrological analyses. Usually issues of natural/small water retention52 can be properly tackled at the smaller scale of an agricultural catchment. Equally, the local impact of climate change or/and changes in local micro-climate can also be analysed in an integrated way with other challenges of small scale catchments. At the level of the small agricultural catchment, water management supports not only sustainable agricultural production but also local ecosystems. A sufficient supply of water for sustainable crop production might become more important in the coming years. At the same time a number of underutilised techniques of water management (natural/small water retention, nutrients recovery from streams, etc.) could be re-introduced into agricultural management for the benefit of farmers, local communities and the environment.

Scope

Activities shall assess the use of small water retention approaches for managing excess and shortage of water and nutrient recovery from water streams. The link between agricultural land management and soil-water management for increased nutrient uptake and water retention should be assessed. Work should focus on affordable and easy-to-implement at the farm level solutions including an economic analysis of proposed measures as well as maintenance of the infrastructure. The analysis of proposed techniques for water management should consider the need for adaptation to climate change and its impact on ecosystem services. Work should allow assessing long-term benefits for the farm and the local ecosystem from the implementation of the natural/small water retention measures. Proposals should fall under the ‘multi-actor approach’53 ensuring cooperation between farmers and farmers associations, local water management organization, technology providers, research centres and public

administration. Preference will be given to proposals focusing on Continental, Pannonia and Boreal biogeographical regions of Europe as defined by the European Environment Agency.

The Commission considers that proposals requesting a contribution form the EU of up to EUR 7 million would allow this specific challenge to be addressed properly. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:
In the short to medium term:

- Improved understanding of how small water retention within different climatic zones can contribute to water-use efficiency at the farm level;
- Identification of tools and techniques for stream nutrients recovery and re-use of water at the scale of the agricultural catchment;
- Identification of economically sustainable technologies for dry and wet spell water management at the farm and catchment levels.

10. Secure, Clean and Efficient Energy

LC-SC3-EE-4-2019-2020: Upgrading smartness of existing buildings through innovations for legacy equipment

RIA ☒	IA ☑	CSA ☒

Specific Challenge

An essential part of Europe's clean energy transition is the changing role of buildings from energy consumers to actively controlling and optimising indoor environment while contributing to energy system flexibility by ensuring distributed energy generation from renewable energy sources, energy storage, facilitate smart charging of EVs, load reduction through energy efficiency and load shifting through demand response. Innovative technologies will enable smart buildings to interact with their occupants and the grid in real time and to manage themselves efficiently, so as to become an active element of the energy system. Intelligent and connected devices, sensors and controllers, supported by the development of new business models for new energy services, will create new opportunities for energy consumers.

Today in the EU, the existing building stock represents the main challenge for a more efficient energy use, in buildings as well as across the whole energy system. The smart readiness of buildings may evolve faster for devices and systems easily replaced and installed, than for other parts of the building's equipment such as HVAC and DHW systems etc. due to higher costs of replacement, longer lifecycles and difficulties related to the integration in buildings. This installed equipment remains highly relevant for buildings interactions with the energy system, making its upgrade to higher levels of smartness an essential step.

Scope

Proposals should develop and demonstrate cost-effective technological solutions to manage energy within existing buildings and interact with the grid providing energy efficiency, flexibility, generation and storage, based on user preferences and requests. These solutions should be aimed to upgrade existing buildings, either residential or tertiary, using automation and IT to offer new services and control to the building users, thereby improving their comfort and increasing their satisfaction.

Proposals should demonstrate how the smart systems, smart controls and smart appliances can be integrated seamlessly in existing buildings to interface and/or to control the major energy consuming domestic appliances that are already installed. These pilots should involve several types of domestic appliances and technical building systems with longer lifecycles (boilers, radiators, DHW preparation, motors for ventilation, windows opening and shading; lighting etc.) and with shorter lifecycles (dryers, washing machines, fridges, etc.), testing several types of control modes (ON/OFF, power modulation, etc.) possible for a given type of appliance. Recharging points for electric vehicles and other forms of energy storage should also be incorporated in the pilots. The proposed solutions should not adversely affect the original functionalities, product quality, lifetime, as well as warranties of the appliances.

Proposals are expected to include clear business model development and a clear path to finance and deployment. Key partners should have the capability and interest in making the developed solution a core part of their business/service model to their clients.
Besides the pilot demonstrations, proposals should outline business models and strategies for the broad uptake of the proposed smart systems into specific building typologies in Europe and their integration with evolving electricity markets, e.g. dynamic pricing or other services and information offered by energy suppliers and/or aggregators. Integrations with other energy networks (e.g. DHC) can also be considered.

The solutions should focus on cost-effectiveness, interoperability and user-friendliness: easy installation and maintenance, maximising consumer comfort (e.g. self-learning) and information on own consumption (e.g. recommendations to the user in order to maximise savings) as well as on gains from its contribution to grid operation.

A realistic estimate should be provided on the total energy savings/year and on the impact of the innovations demonstrated in the project on the total power available for cost effective demand response actions. The projects should involve technology providers (e.g. manufacturers of appliances, movable envelope components, smart control/ home systems providers), energy services providers (aggregators and/or suppliers and/or ESCO's), user representatives, electricity system operators and other actors as relevant.

The activities are expected to be implemented at TRL 6-8 (please see part G of the General Annexes).
The Commission considers the proposals requesting a contribution from the EU of between 3 to 4 million would allow this specific challenge to be addressed appropriately. Nonetheless this does not preclude submission and selection of proposals requesting other amounts.

This topic contributes to the roadmap of the Energy-efficient Buildings (EeB) cPPP.

Expected Impact
Proposals are expected to demonstrate the impacts listed below using quantified indicators and targets wherever possible:

- Primary Energy savings triggered by the project (in GWh/year);
- Investments in sustainable energy triggered by the project (in million Euro);
- Upgrade of existing buildings to higher smartness levels, including a significantly enlarged base of existing building equipment and appliances monitored by energy management systems and activated through demand response actions;
- Reduction in energy consumption and costs, exceeding the additional consumption from IT and its cost.

Additional positive effects can be quantified and reported when relevant and wherever possible:

- Reduction of the greenhouse gases emissions (in tCO2-eq/year) and/or air pollutants (in kg/year) triggered by the project.

LC-SC3-EE-5-2018-2019-2020: Next-generation of Energy Performance Assessment and Certification

RIA ☒	IA ☑	CSA ☑

Specific Challenge
Under the Energy Performance of Buildings Directive21, all EU countries have established independent energy performance certification systems supported by independent mechanisms of control and verification. However, current practices and tools of energy performance assessment and certification applied across Europe face a number of challenges.

Assessment processes and certificates have to become more reliable, user-friendly, cost-effective, have comparable good quality and be compliant with EU legislation in order to instil trust in the market and incite investments in energy efficient buildings. They have to increasingly reflect the smart dimension of buildings and at the same time, facilitate convergence of quality and reliability of Energy Performance Certificates (EPCs) across the EU. The building energy performance methodologies should also ensure a technology neutral approach, be transparently presented making use of International and European standards, in particular the ISO/CEN standards developed under Commission mandate M/480 aimed at enabling the presentation of national and regional choices on a comparable basis.

Next-generation energy performance assessment schemes will value buildings in a holistic and cost-effective manner across several complimentary dimensions: envelope performances, system performances and smart readiness (i.e. the ability of buildings to be smartly monitored and controlled and, to get involved in demand-side management strategies). The assessment should be based on an agreed list of parameters/indicators, such as e.g. calculated annual final energy use, share of renewable energy used, past (climate corrected) final energy consumptions and energy expenditure, comfort levels or the level of smartness. The assessment methods should increasingly take into account output measures of performance (actual measured data) making use of available and increasing number of building energy related data from sensors, smart meters, connected devices etc.. These new schemes should contribute to improving the effectiveness of certificates, by demonstrating how these could be strengthen, modernised and best linked to integrated national/regional certification schemes within a framework that aids compliance checking and effectiveness of financial support

Scope

2018 (Coordination and support action)

Proposals should involve relevant stakeholders (including national and regional certification bodies) to stimulate and enable the roll-out of next-generation of energy performance assessment and certification, with a view to achieve enhanced reliability, cost-effectiveness and compliance with relevant EU standards and the Energy Performance of Buildings Directive. Proposals should develop strategies to encourage convergence of EPC practices and tools across the EU so as to ensure a comparable level of high quality, independent control and verification. The applicability of assessment and the certification schemes should be assessed through a broad set of well-targeted and realistic cases, featuring various locations, building types, climatic conditions and field practices including existing national EPC schemes. The assessment will aim at demonstrating the potential of an EU-wide uptake of the proposed assessment and certification schemes, along well-defined criteria. Embedding the EPCs and their recommendations in broader concepts such as energy audits, wider-buildings related databases (e.g. national EPC databases, national housing surveys, EU Building Stock Observatory) and one-stop-shops including administrative, financial and supply side information and linking EPCs to related concepts such as buildings renovation passports, individual buildings renovation roadmaps or building logbooks should also be considered.

The Commission considers that proposals requesting a contribution from the EU of between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

2019 (Innovation action)

Proposals should address the definition and demonstration of innovative approaches for the assessment of building energy performance, focusing at first on the reliable assessment of building intrinsic performances (e.g. using inverse modelling) but working also towards output-based assessments using available building energy related data23. Proposals should involve relevant stakeholders (including national and regional certification bodies). The proposed approaches should be more reliable as well as cost-effective and compliant with relevant EU standards24, in order to allow for an EU-wide deployment. Such approaches should rely on the combination of existing and proven technology components (starting from TRL 6-7, please see part G of the General Annexes) with well-structured methodologies and protocols that can lead to the definition of new certification schemes. They could also consider implications when using EPCs in building passports and renovation roadmaps.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 2.5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

This topic contributes to the roadmap of the Energy-efficient Buildings (EeB) cPPP.

Expected Impact

2018 (Coordination and support action)

Proposals are expected to demonstrate, depending on the scope addressed, the impacts listed below using quantified indicators and targets wherever possible:

- Primary energy savings triggered by the project (in GWh/year);
- Investments in sustainable energy triggered by the project (in million Euro);
- Increased convergence of good quality and reliable energy performance assessment and certification and uptake and compliance with EU Directives and related standards;
- Increased rate of application and compliance of EPCs and independent control systems with the provisions of EU and national legislation, in a defined region;

- Increase of EPCs databases for compliance checking and verification, linking with financing schemes and building stock characteristics research etc.

2019 (Innovation action)
Proposals are expected to demonstrate, depending on the scope addressed, the impacts listed below using quantified indicators and targets wherever possible:

- Improved user-friendliness of EPCs in terms clarity and accuracy of the information provided;
- Enhanced user awareness of building energy efficiency;
- Primary energy savings triggered by the project (in GWh/year);
- Investments in sustainable energy triggered by the project (in million Euro).

Additional positive effects can be quantified and reported when relevant and wherever possible:

- Reduction of the greenhouse gases emissions (in tCO2-eq/year) and/or air pollutants (in kg/year) triggered by the project.

LC-SC3-RES-14-2019: Optimising manufacturing and system operation

RIA ☑ IA ☒ CSA ☒

Specific Challenge
Renewable electricity technologies still require optimisation in several key processes of the respective value chains in order to achieve a more efficient conversion of their primary energy source into electricity, as agreed with the sectorial stakeholders in the context of the SET-Plan and stated in the respective Declarations of Intent.

Scope
Proposals will address one of the following sub-topics:

- *Monitoring system for marine energy (ocean and offshore wind)*: New intelligent sensors, fault detection and communication systems for accurate condition and structural health monitoring will enable predictive and preventive Operation and preventive Maintenance processes, crucial for innovative wind farm control and the realization of virtual power plants. Sufficient knowledge of potential failures and the right tools to detect and locate failures are crucial.
- *Geothermal fluids*: Better understanding of the chemical and physical properties of these fluids (including super-hot and hot fluids) as transport media is necessary to optimize site development and operation.
- *Photovoltaics*: Development of innovative crystalline silicon wafer growth techniques to produce high-efficiency solar cells and modules.

Proposals are expected to bring the technologies from TRL 3-4 to TRL 4-5 (please see part G of the General Annexes). The Commission considers that proposals requesting a contribution from the EU of between EUR 3 to 5 million would allow this challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact
The improved performance of manufacturing processes and system operation is expected to lead to increased efficiency of the system and/or reduced operational costs of the renewable technologies.

LC-SC3-RES-15-2019: Increase the competitiveness of the EU PV manufacturing industry

RIA ☒ IA ☑ CSA ☑

Specific Challenge
The EU PV manufacturing industry has faced strong foreign competition in the last years, which has led to a dramatic reduction of its production capacity. The challenge is to develop innovative manufacturing solutions, spanning the entire production chain, that substantially improve competitiveness of the EU PV manufacturing industry and help regain a part of the potentially increasing worldwide PV market, while creating more secure and sustainable supply chains for the EU PV market. This challenge is in line with the priority identified in SET-Plan for an Initiative for Global Leadership in PV Scope: Demonstrating manufacturing innovation as well as product innovation for highly performing PV technologies (e.g. crystalline-silicon, thin-film and concentration PV). Innovative solutions will be demonstrated at pilot-line level, showing the potential to be scaled up to GW-size, high-yield-throughput and cost-effective industrial production of high-efficiency cells and modules. Possible examples range from the optimization of one or

more steps in the value chain (by e.g. increased automation, laser processing, etc.) to the tailored development of production equipment, to the enhanced durability and/or recyclability of the final product, to the demonstration of production routes for cells and modules based on innovative materials and/or architectures (e.g. perovskite/crystalline-silicon tandem cells).

Proposals are expected to bring the technology from TRL 5-6 to 6-7. The Commission considers that proposals requesting a contribution from the EU of between EUR 10 to 13 million would allow this challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Successful projects are expected to trigger new investments in the EU PV industry, via the establishment of pilot lines, which target innovative/optimised production processes and/or tailored development of equipment for mainstream power PV technologies. The proposed solutions are expected to show the potential for cost and performance competitiveness of the final product.

11. Smart, green and integrated transport

LC-MG-1-1-2018: InCo flagship on reduction of transport impact on air quality

RIA ☑ IA ☒ CSA ☒

Specific Challenge

The air quality situation in Europe has not sufficiently improved for some pollutants and significant exceedances are still found, for example, for particles, ozone and nitrogen oxides, particularly in areas affected by specific environmental or industrial conditions.. Similar situations occur in many cities around the world, and this is the reason for designing this international cooperation flagship.

High hopes are pinned on zero tailpipe emission technologies that might solve the problem in the longer term, particularly in the road sector. However, fleet renewal is too slow to just wait for all vehicles on the road to be replaced by electrified ones in order to solve the air quality issue. Also, emissions from other sectors, such as ships and aircraft in ports, internal waterways and airports, can contribute significantly to the problem, and zero emission technologies are not often available.

It is therefore urgent to address in as many ways as possible the reduction of the impact of the existing internal combustion transport fleets and support local authorities and other regulatory bodies with the provision of appropriate/advanced tools. Monitoring of the car fleet, for instance, can detect high emitters, allowing to provide information to authorities for possible cases of defeat devices, tampering, poor durability of depollution systems.
In the case of tampering, the legal situation varies among member states and needs to be clarified in view of facilitating enforcement.

The choices of customers buying new vehicles can be oriented towards cleaner vehicles by making visible which are those that have an overall better performance (i.e. as a consumer information measure, separate from EU certified type-approval testing, while users of existing polluting vehicles could be encouraged to use them in a more environmentally friendly way.

It is also important to verify the performance of On Board Detection (OBD) systems and of periodic inspections and improve them where appropriate.

On board measurement of pollutants could enable new implementation approaches to regulation showing on the one hand how much each driver pollutes (helping in the eco-driving effort) whilst on the other hand allowing a real "polluter pays" approach to certification, taxation and traffic regulation (the needed technology will be explored in LC-MG-1-4-2018, together with research on hardening de-pollution systems against tampering).

Apart from road vehicles, airports and ports can strongly contribute to poor air quality, it is therefore important to quantify their impact and monitor their evolution.

Finally, the health impact of extremely fine particles and of Volatile and Semi-Volatile Organic Compounds (VOCs and SVOCs free or absorbed in the particles), is still not well understood. Such ultra-fine particles have been proven to pass the alveoli, placental and brain barriers and they can reach other organs through the blood stream and generate serious health impacts which need further research.

Scope

Given the policy relevance of the topic, the selected consortia will regularly share their findings with relevant European Commission services. Proposals will have to address one of the following subtopics and clearly indicate which subtopic they are addressing:

A) Low-emission oriented driving, management and assistance. This area aims at exploring the impact of the user (including his driving behaviour and choices in maintaining the vehicle) on emission production:

- Driving behaviour exploration: PEMS7 driving measurement campaigns to assess driver behaviour variability and correlate it with real powertrain emission, and (if needed by lab measurement and modelling) brakes and road/tires emissions;

- Derivation of low polluting-emissions driving practices and dissemination through awareness campaigns. The collected data should be of adequate quality to be also usable as input for future implementation in driving assistance tools and automated driving, as well as traffic management;

- Assessment of the impact of other user behaviours such as poor maintenance or tampering. All aspects and causes should be studied, including an assessment of the real effectiveness of OBD and periodic inspections, of the legal situation of tampering in each member state (for both sales of devices and installation) and of the most effective ways to induce car owners not to tamper and to properly maintain their vehicles (considering both technical and economic reasons for their behaviour);

- Assessment of the potential impact of retrofits8, both for light and heavy duty road vehicles and NRMM9 (including the development of methodologies to verify a level of durability appropriate for the application) and promotion of their application in cities with pollution problems.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497) international cooperation is encouraged, in particular with China and other Asian and/or CELAC countries.

B) Starting from recently defined emissions indicators (RDE test results including NOx max and PN max values, WLTP CO2 emissions), development of a 12 to 18 month project to timely develop support to informed consumer choice by defining a holistic testing and scoring mechanism. This should be capable of assessing all vehicles (conventional and electrified) and lead to a single "GREEN VEHICLE index". Such index should encompass all of the relevant criteria, e.g. tailpipe CO2, and polluting emissions such as NOx/NO2, hydrocarbons and particles, noise, performance and operating cost. The developed methodology should be fine-tuned in a pilot phase on a sufficiently large number of vehicles to ensure that the results are comparable and provide a fair and reliable assessment. Such an index could result in a public awareness scheme (running after project end) capable of orienting eco-conscious consumer choice, and to create a virtuous circle (as achieved by EURONCAP for safety) creating competition on who brings to market the cleanest vehicles. The mechanism should complement (not overlap with) the results of regulatory real-driving emissions (RDE) tests with an aim to maximise the coverage of real-world driving situations and provide relevant information. Particular attention should be paid to the ways in which the variability of real-world emissions performance is communicated, and what usage patterns deliver the bestperformance (being therefore complementary to the study and awareness raising activities in Subtopic A).

C) Sensing and monitoring emission in urban road transportation system. This area intends to urgently provide a means to monitor fleet-wide on-road emissions, to detect and repress any emission-affecting modifications of individual vehicles (tampering) or bad maintenance/poor after-treatment system durability/OBD ineffectiveness, to support local air quality plans, and to help national and local enforcement authorities in identifying and prosecuting infringing vehicles.

- Remote sensing of road vehicle emissions (contactless measurements from the roadside, portals or from chasing vehicles); further technological development of available techniques is needed to improve performance, reduce costs, facilitate use by unskilled personnel and achieve a broader deployment potential;

- Establishment of a proper data infrastructure built around vehicle registration databases, traffic management measures and air quality monitoring systems;

- Demonstration of the system in several cities;

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged, in particular with China.

D) Cost effective enforcement of shipping related emissions legislation, both at the EU and global level, is essential for the expected environmental improvements to be achieved. To support the enforcement, assess their effectiveness and to identify potential future gaps it is necessary to develop, evaluate and demonstrate cost effective systems to measure the airborne emissions of pollutants from a vessel under real operational conditions (e.g using on board systems) and to target ships for inspection and the enforcement of emission limits.

For coastal, urban and port areas, develop measuring technologies and 'beyond state of the art' modelling tools to assess the contribution of air emissions from ships and their comparative impact on air quality and health building also on projects such as 'Interreg Clean North Sea Shipping (CNSS) and the LIFE project 'Clean Inland Shipping' (CLINSH).

In addition to characterising and quantifying particulate matter (in particular, the most harmful, including ultrafine), such systems should also be able to simultaneously measure other relevant pollutants including SOx and NOx.
In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged, in particular with the involvement of the largest ports and regulating authorities and other relevant bodies within the Asian region as well as in the frame of the activities of the International Maritime Organisation to which EU Member States and global maritime nations are parties.

E) Measurement of airborne pollutants emissions from aircraft under parking (with functioning APU), taxiing, take-off and climb-out conditions and under different climate conditions (In addition to characterising and quantifying particulate matter down to at least 10nm, systems should also be able to simultaneously measure other relevant pollutants including SOx and NOx). An assessment of pollutants' transport and impact on air quality in and around airports, in a form potentially suitable for regulation should be performed.

In line with the Union's strategy for international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged, in particular with Asia, CELAC and the US.

F) In-vitro and in-vivo assessment of health effects of ultrafine nanoparticles (VOCs and SVOCs) emitted from engines of the different transport modes particularly when using fuels with high aromatic content. Focus should be on understanding the biological processes leading to acute genotoxic and systemic effects in the lungs and, in particular, beyond.

The Commission considers that proposals requesting a contribution from the EU between EUR 2 and 5 million would allow the different specific challenges to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

All the above actions contribute to the UN's Sustainable Development Goals (SDG), in particular SDG 3 ("Ensure healthy lives and promote wellbeing for all at all ages") and 11 ("Make cities and human settlements inclusive, safe, resilient and sustainable") through:

- Reduction of emissions from the existing combustion-engined car fleet (A, C);
- Reduction of unnecessary driver-induced emissions though a better awareness by the public of their role in controlling polluting emissions (A) ;
- Increase of low emitting vehicle sales by providing more information to guide buyers towards the cleanest available vehicles (B);
- Reduction of transport-related emissions though the improvements of detection and enforcement against vehicles with tampering, defeat devices or durability issue, as well as of ships not complying with emissions regulations, i.e. not using clean low-sulphur fuels, suitable engine parameters for NOx reduction or properly activating de-pollution devices where appropriate (C, D) ;
- Better understanding of the impact of the different transport modes through monitoring detection and modelling of emissions in the existing road vehicle fleet as well as ships and aircraft (C, D, E) ;
- Improved and more comprehensive data for risk assessment from air pollutants from different transport modes and identification of cost effective reduction measures (F);
- Provide technical evidence to assess gaps in current regulation of vehicles and air quality (All).

LC-MG-1-9-2019: Upgrading transport infrastructure in order to monitor noise and emissions

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Noise and emissions from transport affect seriously people's health and environmental ecosystems requiring the implementation of mitigation measures to achieve a higher reduction in all transport modes. The fast development of technologies that facilitate connectivity of innovative sensors, -both on-board and on the side of the infrastructure- could allow real-time monitoring and control of transport noise and emissions. Current applications of different mobile systems and measurement methodologies make comparison of data rather difficult. The development of harmonized measurement methodologies will increase the reliability of collected data and the credibility of the consequent awareness/mitigation procedures. Systems embedded in the transport infrastructure can help in identifying vehicles not respecting prescribed limits and would either allow the operator to be informed swiftly of the environmental deficiencies of the vehicle, or would enable authorities to identify and prevent polluting vehicles from entering, hindering their access to specified low-emission zones, thus mitigating the effects of the non-respect of tolerance limits.

The integration in the infrastructure of absorbing materials and the utilization of negative-emissions solutions can also contribute to the reduction of the negative effects of emissions and noise.
Proposals should address all the following aspects:

- Development of equipment for integration into infrastructure that would be able to detect and identify (plate recognition) in real-time vehicles exceeding the limits of noise (Db(A)) and emissions (CO2, NOx, PM);
- Development of related I2V systems aimed at informing the transgressor of the emissions/noise limits being exceeded and preventing access to delimited low-emission zones;
- Development of automated tolling systems that take into account the level of emissions from individual vehicles;
- Development of new materials and negative-emissions solutions for infrastructure application, apt to mitigate noise and emissions.

Road and rail networks are primarily addressed, but research should not exclude solutions to reduce nuisance coming also from air and water transport.

Potential negative effects from fixed sensors on human health should be carefully considered and avoided.
The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

In line with the Union's strategy for international cooperation in research and innovation, international cooperation is encouraged. In particular, proposals should foresee twinning with entities participating in projects funded by US DOT to exchange knowledge and experience and exploit synergies.

Expected Impact

Development of measures aimed at reducing the negative effects of noise and emissions. Increased monitoring and detection of transport unacceptable levels of noise and emissions; identification of transgressing vehicles and possible invitation to appropriate revision; limiting access to sensitive zones (e.g. urban centres). Development of technologies to be applied for better calculation of externalities and consequent charging methods. The application of solutions should bring to a reduction of at least 30% in emissions and 20% in noise in targeted zones based on the measured level at the beginning of the project.

MG-2-7-2019: Safety in an evolving road mobility environment

RIA ☑ IA ☒ CSA ☒

Specific Challenge

The road mobility environment – the area which covers both road transport users and those affected by them – is

evolving. Vehicle types are beginning to change as a result of increasing levels of automation. New vehicle types and new types of road user will operate with conventional vehicles and road users as part of an evolving mixed traffic environment. Vulnerable road users are still a continued concern, and in the increasingly connected transport system "vulnerability" may in the future also be more related to the non-connected users and people unable to fully use the potential of the Information and Communications Technologies (ICT) services offered to mobility. Automated vehicles may enable occupants to be placed out of the traditional seating position (e.g. face to face or in lounge/office environments) while undertaking new activities, thus making them more vulnerable in normal traffic.
(Active and passive) safety systems will need to adapt to the future types of the potential collisions, occupant positioning taking into account possible differences between men and women and vulnerable road users of the future, and address the need to reduce minor and major injuries, as well as fatalities.
Scope: The scope is to assure the development of robust solutions in the context of the changing environment, leading to dramatic improvements in transport users' and road workers' safety. In order to be properly addressed, traffic safety needs to be articulated in terms that are relevant for the connected and automated transport system.
To respond to the challenges proposals should address the following:

- Define road safety characteristics and properties as conditions and constraints in a traffic system (including road workers) which is undergoing increasing automation and is highly dependent on software, positioning/navigation systems and connectivity. The concept of vulnerability should be given appropriate consideration and be viewed in the evolutionary context of the mobility system also addressing "automotive digital divides", e.g. between urban and rural areas. Future traffic changes and new traffic scenarios will need to be considered taking into account aspects such as severe weather conditions, poor road conditions. Updated ways to assess accident risks should be developed and also take into account injuries causing longer-term disability. A reduction of at least 10% (compared with 2016 figures) for road traffic casualties (fatalities, injuries and incidents -where known) should be demonstrated for the solutions developed within the chosen theme(s) below.

In addition at least one of the following themes should be addressed:

- Development of tools and models which simulate how traffic scenarios are expected to change over time with the introduction of new vehicle types and new safety technologies for all road users. Human Body Models may need to be further developed to represent future collision scenarios (including pre-crash and near-crash behaviour) taking into account all road users. (such as gender, percentile, age, obesity, etc). Open source approaches are encouraged.

- Design of (active/passive) protection systems for future collision scenarios as well as for occupants' variable body postures and different human body types in future interior concepts. These systems may require the further development of occupant monitoring functions and can make use of the sophisticated sensor systems which will be fitted to automated vehicles.

- Development of (physical and/or digital) infrastructure and on-vehicle safety solutions as well as education and training schemes for all road users which match the pace of the increased implementation of automated driving functions.

The cultural diversity of road users should be considered, as well as age, gender and IT-experience.
In line with the Union's strategy for international cooperation in research and innovation27 international cooperation is encouraged.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact
A reduction of at least a 10% (with respect to 2016 figures) in injuries and fatalities in road accidents, contributing to the ambitions of the Transport White Paper's goal to reach close to zero road fatalities by 2050. Contribution to the UN's Sustainable Development Goals (SDG), in particular goal 3.6 ("By 2020, halve the number of global deaths and injuries from road traffic accidents") and SDG 11 ("Make cities and human settlements inclusive, safe, resilient and sustainable").

Innovative optimum protection systems enabling the occupants of automated vehicles to assume new seating positions and leverage the perceived benefits of automation. Solutions will contribute to industry competitiveness and EU leadership in road safety.

Harmonised and relevant methods for the assessment of safety solutions in both real-world conditions and in future mobility scenarios, e.g. based on virtual simulations with validated models and/or based on experimental results.

Safer use of vehicles, effective education and training schemes and increased awareness of all road users in the evolving road mobility environment.

12. Climate action, environment, resource efficiency and raw materials

SC5-10-2019-2020: Raw materials innovation actions: exploration and Earth observation in support of sustainable mining

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Securing the sustainable access to raw materials, including metals, industrial minerals and construction raw materials, and particularly Critical Raw Materials (CRM), is of high importance for the EU economy.

The challenge for industry is to scale up promising raw materials production technologies, including for exploration, and to demonstrate that raw materials can be produced in an innovative and sustainable way in order to ensure that research and innovation end up on the market, to strengthen the competitiveness of the European raw materials industries, to meet the ambitious energy and climate targets for 2030, to minimise environmental impacts and risks and to gain the trust of EU citizens in the raw materials sector.

This specific challenge addresses the development of "innovative pilot actions"53 which is one of the major targets of the European Innovation Partnership (EIP) on Raw Materials.

Scope

Actions should develop innovative pilots demonstrating clean and sustainable production, including exploration, of non-energy non-agricultural raw materials in the EU from primary and/or secondary sources, finishing at Technology Readiness Levels (TRL) 6-7.

All actions should contribute to achieving the objectives and targets of the EIP on Raw Materials and to building the EU knowledge base of primary and secondary raw materials by feeding into the EC Raw Materials Information System – RMIS54. Actions should also contribute to improving the awareness of relevant external stakeholders and the general public across the EU about the importance of raw materials for society, the challenges related to their supply within the EU and about proposed solutions which could help to improve society's acceptance of and trust in sustainable raw materials production in the EU, duly taking into account the applicable EU environmental legislation. All actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain, and consider standardisation aspects when relevant. All proposals should justify the relevance of the selected pilot demonstrations in different locations within the EU (and also outside if there is a clear added value for the EU economy, industry and society).

All proposals should include an outline of the initial exploitation and business plans (with indicated CAPEX, OPEX, IRR and NPV55) with clarified management of intellectual property rights, and commitment to the first exploitation. Actions should include a task to cluster with other projects financed under this topic and – if possible – with other relevant projects in the field funded by Horizon 2020, in support of the EIP on Raw Materials.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged.
Actions should address only one of the following sub-topics:

a) **Integrated exploration solutions (2019)**: Actions should develop and demonstrate integrated exploration solutions focused on finding new deep land deposits. They could benefit from any of the advanced geological-geochemical-geophysical-remote sensing integrated (and multi-method) approaches, 3D and 4D modelling, automation and robotisation. Solutions should cover and be tested in both green and brown field mining sites.

b) Services and products for the extractive industries life cycle (2019): Actions should develop services and products based on Earth observation data and techniques and GNSS services for the extractive industries life cycle. The services and products should be built upon information and data made available by the Copernicus

Programme, and other relevant Earth observation and proximal sensing data. Use of data made available by EGNOS (and in the long term, Galileo) or other relevant Earth GNSS data should be considered where relevant. Services should be developed and tested for any of the different phases of the mining life cycle: exploration, extraction, closure or post closure. Particular attention should be given to services for environmental monitoring (including metals dispersion) and safety and security monitoring associated with open pits (slopes stability/landslides risk), underground mining (e.g. subsidence) and mining waste disposal (e.g. tailings dams and dumps). Services to be developed should include the design and testing of early warning systems and associated monitoring plans to prevent and mitigate risks associated with extraction and mining waste disposal.

The Commission considers that proposals requesting a contribution from the EU of between EUR 8 million and EUR 13 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

The project results are expected to contribute to:

- pushing the EU to the forefront in the area of sustainable raw materials production technologies and solutions through generated know how (planned patents, publications in high impact journals and joint public-private publications etc.);
- increasing the reserves of various primary raw materials within the EU;
- where relevant, reducing the exploration costs for the industry through new cost-effective exploration technologies, while safeguarding long- and short-term environmental sustainability;
- improving the resolution and interoperability of existing raw materials digital maps;
- in the longer term, improving the competitiveness of and creating added value and new jobs in raw materials producing, equipment manufacturing, information and communication technologies and/or downstream industries;
- additionally, only for b) 'Services and products for the extractive industries life cycle', improved validation of global Copernicus land use and land cover products, enhancing the market uptake of the Copernicus based services and products for mining lifecycle, as well as its synergetic use with GNSS.

SC5-14-2019: Visionary and integrated solutions to improve well-being and health in cities

RIA ☒	IA ☑	CSA ☒

Specific Challenge

It is estimated that by 2050 up to 70% of the world's population will be living in urban areas. Urbanisation affects human health and well-being through factors such as exposure to pollutants, including noise, disasters, stressors and diseases, urban density, lack of physical activity, degraded ecosystems and erosion of natural capital, which can be exacerbated by climate change. As acknowledge by the Habitat III New Urban Agenda, public spaces play a crucial role in urban interaction and systemic urban innovation and they need to be designed and managed sustainably and equitably to ensure that the way citizens produce, consume, commute and interact within the urban fabric has a positive impact on their health and quality of life, enhances resilience to disasters and climate change and reduces the environmental footprint of the cities. The systemic integration of social, cultural, digital and nature-based innovation in the design, development and governance of public space has a tremendous potential to transform these spaces into diverse, accessible, safe, inclusive and high quality green areas that increase well-being and health and deliver a fair and equitable distribution of the associated benefits.

Scope

Actions should deliver visionary and integrated solutions (e.g. therapy gardens, urban living rooms, creative streets, city farms) at the intersection of social, cultural, digital and nature-based innovation to increase citizens' health and well-being in cities67. These solutions should address social, cultural, economic and environmental determinants of health and well-being and support urban communities in reducing their exposure to climate-related risks, pollution (including noise), environmental stress and social tensions, including the negative effects of gentrification.

Actions should also demonstrate how the integration of these solutions into innovative land-use management, urban design and planning could reduce health-related environmental burdens in socially deprived neighbourhoods, foster equitable access for all to public spaces, enhance their quality and use and promote sustainable urban mobility patterns.

Actions should test new transition management approaches, governance models, legal frameworks and financing

mechanisms to re-design public spaces and urban commons and assess their contribution to improving health and well-being. They should promote multi-stakeholder initiatives, citizens' engagement, co-creation and co-ownership of public spaces. Optimal and cost-effective use of behavioural games, networks of sensors, GIS-mapping, big data, observational programmes such as Copernicus and GEOSS, and citizens' observatories should be made as appropriate to enable the integration and visualisation of data for more effective monitoring of the transition towards healthier and happier cities.

The involvement of social sciences and humanities disciplines such as psychology, behavioural science, economics, law, anthropology, sociology, architecture, or design studies, is considered essential to enhance social learning and promote the role of social and cultural innovation in transforming public spaces, with particular attention devoted to gender dynamics and diversity.

To enhance the impact and promote upscaling and replication of these solutions, projects should engage in substantial networking and training actions to disseminate their experience, knowledge and deployment practices to other cities beyond the consortium. To enhance impact cooperation and synergies with the activities undertaken within the Global Covenant of Mayors for Climate and Energy initiative and its regional components68 (supported by the EC) should be sought where appropriate.

Furthermore, actions should envisage resources for clustering with other ongoing and future projects on sustainable cities through nature-based solutions funded under the 'Smart and Sustainable Cities' call in part 17 of the 2016-2017 Work Programme as well as relevant projects to be funded under topics SC5-20-2019 and CE-SC5-03-2018 of this Work Programme. Cooperation with relevant actions funded under the Horizon 2020 Societal challenge 6 topic 'TRANSFORMATIONS-03-2018-2019: Innovative solutions for inclusive and sustainable urban environments' should also be sought as appropriate.

Funded projects are expected to establish long-term sustainable data platforms securing open, consistent data about the impacts of the deployed approaches and ensure interoperability with other relevant data infrastructures for effective communication, public consultation, exchange of practices, and sharing of experiences.
Proposals should pay attention to the special call conditions for this topic.

The Commission considers that proposals requesting a contribution from the EU in the range of EUR 10 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact
The project results are expected to contribute to:

- high quality, multifunctional, public spaces able to integrate digital, social, cultural and nature-based innovation to enhance health and well-being, while ensuring 'the right to the city' as specified in the Habitat III New Urban Agenda;
- European cities being world ambassadors of sustainable lifestyles, providing universal access to greener, safe, inclusive and accessible public spaces, also accounting for the gender dimension;
- participatory approaches in re-designing and transforming public spaces to increase health and well-being in cities through innovative public-private-people partnerships (PPPPs);
- more comprehensive assessment of the sustainability and resilience of cities through the development of health and well-being indicators;
- establishing innovative monitoring systems to measure benefits and capture the multiple co-benefits created by nature-based solutions in terms of health and well-being.

SC5-17-2018: Towards operational forecasting of earthquakes and early warning capacity for more resilient societies

RIA ☑	IA ☒	CSA ☒

Specific Challenge
To help mitigate the risks related to earthquakes, citizens need additional protection that goes beyond building codes and retrofitting actions. Early warning approaches and operational earthquake forecasting, which are under development, need to be seen in a Europe-wide perspective, building on improved, dense, robust and high quality seismic networks and new processing tools and activities. The practical applications and use of short-term forecasting, early warning methods, time dependent physical and systemic vulnerability estimates and rapid loss

assessment for earthquake risk reduction are still far from being operational. Strong European and international scientific collaboration is needed to make substantial progress in the domain.

Scope

Actions should enable an effective, real time seismic risk reduction capacity, and the improvement of current observational capabilities, present forecasting modelling and testing- validation capabilities, also accounting for their uncertainties. They should also enable the designing of clear procedures and improved decision making schemes to respond to stakeholders' needs. Actions should also suggest how to move from a single, probabilistic hazard forecasting model to complex, short-term risk forecasting models. Research should focus on better understanding which conditions may lead to an increased likelihood of earthquakes and/or which transient geophysical properties should be monitored as precursors before a large magnitude and damaging earthquake.
Building on multi-disciplinary research, actions should develop a new generation of early warning systems to mitigate the impact of earthquakes on societies and infrastructures, integrating innovative concepts and technologies, such as low-cost wireless seismic sensors and big data, for more accurate and reliable quantification of ground shaking (during or soon after the earthquake occurrence). These new early warning systems should also include decisional expert systems and should combine local and regional information, including social and economic data. They should have the capacity to trigger automatic safety actions or reach people before ground shaking occurs to mitigate the human and economic impact of earthquakes. They should also contribute to the development of future multi-hazard early warning systems.

Furthermore, actions should develop effective methods and communication systems and structures to improve dialogue between science and relevant users within the decision making chain. Actions should capitalise on knowledge acquired in previous and ongoing initiatives such as GEO Supersites/observational network, EPOS (European Plate Observing System), ARISTOTLE (All Risk Integrated System TOwards Trans-boundary hoListic Early-warning) and the Copernicus Emergency Management Service, and ensure compatibility and appropriate liaising with these initiatives.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged70.

The Commission considers that proposals requesting a contribution from the EU of between EUR 6 million and EUR 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

The project results are expected to contribute to:

- improved real time seismology and seismic risk reduction capacity;
- improved short-term forecasting, real-time operational forecasting and fast, reliable alerts and information;
- development of sound and rational risk reduction plans to manage low-probability/high-impact events;
- improved preparedness due to more effective two-way communication on forecasts, early warning and uncertainties for users and the public;
- improved capacity to tangibly reduce human and economic losses.

14. Secure societies – Protecting freedom and security of Europe and its citizens

SU-DRS02-2018-2019-2020: Technologies for first responders

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Resilience is critical to allow authorities to take proper measures in response to severe disasters, both natural (including climate-related extreme events) and man-made. Innovation for disaster-resilient societies may draw from novel technologies, provided that they are affordable, accepted by the citizens, and customized and implemented for the (cross-sectoral) needs of first responders.

Scope

Proposals are invited to propose novel solutions improving the protection of first responders against multiple and unexpected dangers, or enhancing their capacities by addressing related research and innovation issues, in particular:

- Sub-topic 1: [2018] Victim-detection technologies

The quick detection of victims potentially trapped in buildings as a result of all sorts of disasters of natural, accidental, or man-made or of terrorist origins is a major issue for first responders. Novel technologies should enable them to save the time taken to detect victims who are not visible, enabling more efficient and faster rescue operations leading to higher chances of saving lives and reducing injuries.

- Sub-topic 2: [2019] Innovation for rapid and accurate pathogens detection

Novel technologies are required by first responders for the rapid and accurate detection of pathogens, as well as tools for joint epidemiological and criminal risk and threat assessment and investigation.

- Sub-topic 3: [2020] Methods and guidelines for pre-hospital life support and triage

- Sub-topic: [2018-2019-2020] Open

Other technologies for use by first responders may be subject of proposals provided that they involve a large number of first responders' organisations (see eligibility and admissibility conditions.) For instance, but not exclusively: communicating and smart wearables for first responders and K9 units including light-weight energy sources; situational awareness and risk mitigation systems for first responders using UAV and robots, connected and swarms of drones; systems based on the Internet of Things; solutions based on augmented or virtual reality; systems communication solutions between first responders and victims; risk anticipation and early warning technologies; mitigation, physical response or counteracting technologies; etc.

Any novel technology or methodology under this topic should be tested and validated, not just in laboratories but also in training installations and through in-situ experimental deployment. They therefore need to be quick to deploy, bases on resilient and robust communication infrastructure. First responders, including through interdisciplinary teams (e.g. involving medical emergency services, public health authorities, law enforcement team, civil protection professionals, etc.) need to be involved in these activities. Proposals should address the participation of first responders in a systematic manner, and propose new methods on how to involve them and to organise their interaction with researchers when developing, testing, and validating technologies and methods.

Solutions are to be developed in compliance with European societal values, fundamental rights and applicable legislation, including in the area of privacy, personal data protection and free movement of persons. Societal aspects (e.g. perception of security, possible effects of technological solutions on societal resilience, gender diversity) have to be taken into account in a comprehensive and thorough manner.

In line with the objectives of the Union's strategy for international cooperation in research and innovation (COM(2012)497), international cooperation according to the current rules of participation is encouraged (but not mandatory), in particular with Japanese or Korean research centres. Co-funding opportunities from the Japan Science and Technology Agency exist for Japanese partners. For more information, please consult http://www.jst.go.jp/sicp/announce_eujoint_04_GeneralInfo.html. Co-funding opportunities from the Korean MSIP/NRF exist for Korean partners. For more information on Korea, please consult http://www.nrf.re.kr/eng/main andHttp://www.nrf.re.kr/biz/info/notice/view?nts_no=82388&biz_no=116&search_type=ALL&search_keyword=EU&page=.

The centre of gravity for technology development with actions funded under this topic is expected to be up to TRL 4 to 6. The Commission considers that proposals requesting a contribution from the EU of about EUR 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

As a result of this action, first responders should benefit from:

- Novel tools, technologies, guidelines and methods aimed at facilitating their operations
- New knowledge about field-validation of different tools, technologies and approaches involving first responders in (real-life) scenarios

SU-BES02-2018-2019-2020: Technologies to enhance border and external security

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Innovation for border and external security may draw, in particular, from novel technologies, provided that they are affordable, accepted by citizens and customized and implemented for the needs of security practitioners.

Scope

Proposals are invited to address related research and innovation issues, in particular:

- Sub-topic 1: [2018] Providing integrated situational awareness and applying augmented reality to border security

Currently, information is made available to border and coast guards in several formats and on different kinds of hardly interoperable displays. However, human cognitive is limited at managing information from several sources simultaneously and at handling too many separate pieces of equipment is a limit to their ability to act. Furthermore, border and coast guards often work in sparsely populated and remote areas where the availability of telecommunication networks may be an issue. Research and innovation should lead towards (cloud-based) integrated systems with simple but complete and highly-standardized interfaces showing real-time information in a user-friendly way that can assist border guards in decision-making, and in remaining in contact with their command and control centre in the actual context of operations. Water, land and air operating resources should be taken into account, to lead to enhanced concept of employment, integration and interoperability standards.

- Sub-topic 2: [2018] Detecting fraud, verifying document validity, and alternative technologies to identifying people

The use of counterfeit travel documents at borders is a reality, which entails the risk of not identifying known criminals, including terrorists. It is a cross-cutting priority according to the EU Serious and Organised Crime Threat Assessment 201728, since it enables or enhances all types of serious and organized crime and terrorism. New countermeasures are needed to address potential frauds, in particular for the detection of morphed face images. The use of biometrics "on the fly" techniques for identification in a non-intrusive manner and without interrupting the flow of people is an area for further development, testing and validation.

 Sub-topic 3: [2019] Security on-board passenger ships

Security on-board passenger ships is challenging, given the larger number of specific constraints that apply. To ensure security all along the "life cycle" of a voyage, new technologies can be implemented (together with methods for their deployment and possibly their integration into ship systems), as well as security novel procedures (including for embarkation and disembarkation, mooring at pier, etc.)

- Sub-topic 4: [2019] Detecting threats in the stream of commerce without disrupting business

The flow of goods crossing borders is increasing, whilst ways of concealing methods for dangerous materials and illegally trafficked goods are improving. The detection of such dangerous and illegal goods should be facilitated by novel technologies and sensing strategies characterized by risk-based protection and non-intrusive security checks that can be implemented without disrupting business.

Proposals should target the automation and integration of existing technologies for the purpose of identifying the largest possible amount of threat materials and ensuring the full supervision of the logistic flow of goods. This would require exploiting information obtained through the analysis of cargo flow data available from open source and documentary control, intelligence gathering, risk management, as well as through physical detection or inspection of cargo in means of transport, luggage, or carried by individuals. The fitness for purpose of novel solutions should be validated at the EU external border, in a context chosen on the basis of a sound and factual risk analysis.

Of particular relevance: the enhancement of detection capabilities of contraband (mainly cigarettes) hidden in high density cargo (coal, iron ore) in particular for rail cargo transport, and well as the fight against illicit trafficking of radioactive and nuclear (NR) materials (including through the establishment of trans-European network of detection facilities with its specific concept of operations.

- Sub-topic 5: [2020] Disruptive sensor technologies for border surveillance

- Sub-topic: [2018-2019-2020] Open

Proposals addressing other issues relevant to this challenge, based on a sound rationale and supported by a large number of relevant practitioners are invited to apply under this sub-topic (see eligibility and admissibility conditions.) Proposals should lead to solutions developed, tested, and validated in compliance with European societal values, fundamental rights and applicable legislation, including in the area of free movement of persons, privacy and protection of personal data. Societal aspects (e.g. perception of security, possible side effects of technological

solutions, societal resilience) have to be addressed in a comprehensive and thorough manner.

The centre of gravity for technology development with actions funded under this topic is expected to be up to TRL 5 to 6 – see General Annex G of the Horizon 2020 Work Programme..

The Commission considers that proposals requesting a contribution from the EU of about EUR 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Short term:

- Clear, realistic benchmarks against which to assess progress, so as to possibly stop the project if at mid-term review progress is not deemed sufficient.
- Plan to provide confidence in the take up of project results after the completion of the project.

Medium term:

- Evidence based knowledge, and developments performing beyond the current state of the art and leading quickly to innovation.
- Technical and operational guidelines, recommendations and best practices set in the EUROSUR handbook and in the future handbook for coast guards (as per Article 53 of the European Border and Coast Guard regulation.)

Long term:

- Implementation of solutions resulting from the legislative initiative in the "Smart Borders" package;
- Implementation of actions of civilian nature identified in the EU Maritime Security Strategy action plan;
- Implementation of the actions identified by the EU Strategy and Action Plan for customs risk management.

SU-BES03-2018-2019-2020: Demonstration of applied solutions to enhance border and external security

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Solutions at high Technological Readiness Levels (TRL; please see General Annex G) to enhance border and external security do exist, but if they are not to remain unused they need to be demonstrated in the context of actual operations or exercises for validation by practitioners.

Scope

Consortia are invited to propose demonstration of high (6-8) Technology Readiness Levels (TRL) systems applied in the context of border and external security. (TRL: please see General Annex G.)
Proposals should be submitted under only one of the following sub-topics:

- Sub-topic 1: [2018] Remotely piloted aircrafts and underwater autonomous platforms to be used from on-board offshore patrol vessels

Remotely piloted autonomous platforms of all kinds should demonstrate innovative capacities for land border and coast surveillance. Underwater autonomous platforms are also of interest for choke points surveillance (i.e. a port entrance.)

Research on artificial intelligence is likely to facilitate the transition from innovation to operation. Such platforms play an important role in facilitating long range and persistent surveillance in wide maritime areas, complementing operation from offshore patrol vessels. Improving the cost effectiveness, reliability and availability of such platforms, either by increasing the performance of existing technologies or by developing innovative concepts of operation, would notably contribute to better situational awareness at the tactical level beyond coastal waters (up to 200 nautical miles), while reducing risks during search and rescue missions, including launch and recovery phases, even in adverse sea and weather conditions. Proposals should aim at improved cost effectiveness, in particular through

the remote operation of sensors mounted on aerial platforms (including optionally and remotely piloted) and by improving the on-board processing of payload data, while minimizing the data transmission to the ground segment.

- Sub-topic 2: [2019] New concepts for decision support and information systems

Information systems to support border and external security may combine a broad variety of data from very different sources, including personal data. Innovative solutions are needed to ensure the interoperability of surveillance systems, and the availability of information for maritime border surveillance coming from the area of operations in standardized formats, when and where it is needed, thus at enhancing situation awareness at strategic level (in National Coordination Centres), but also at tactical level (with assets deployed under the frame of surveillance operations). This would allow faster reaction to incidents in the maritime domain, and a reduction in the death toll at sea. Proposals should aim at optimize the exploitation of data for their specific use in surveillance is currently embryonic, and needs to take better account of the specific characteristics of the domain, with a view to provide the needed information reducing redundancies.

- Sub-topic 3: [2020] Improved systems for the detection, identification and tracking of small boats

- Sub-topic: [2018-2019-2020] Open

Proposals addressing other issues relevant to this challenge, based on a sound rationale and with the active involvement of a large number of relevant practitioners are invited to apply under this sub-topic (see eligibility and admissibility conditions.)
Proposals submitted under this topic should be coordinated by a competent authority under civilian authority and command, nationally identified as specialised border or coast guard, or border police force.
They should clearly demonstrate how they complement and do not overlap with actions undertaken in the Preparatory Action on Defence Research under topic PADR-US-01-2017: Technological demonstrator for enhanced situational awareness in a naval environment.

Certain operational costs are excluded from eligible costs (see eligibility and admissibility conditions.)

Proposals should lead to solutions developed in compliance with European societal values, fundamental rights and applicable legislation, including in the area of privacy and personal data protection.
Proposals should lead to solutions developed in compliance with European societal values, fundamental rights and applicable legislation, including in the area of free movement of persons, privacy and protection of personal data.

The Commission considers that proposals requesting a contribution from the EU of about EUR 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Medium term

- Innovative solutions validated and qualified in the real, operational environment of civilian missions, defined in detail according to specifications set by the practitioners (authorities in charge of border surveillance and coast guard functions) and tailored to effectively meet their requirements within civilian missions.
- Plans for the quick take up of qualified systems at EU level.
- Plans for transnational procurement strategies.

Long term

- Improved cost-effectiveness and efficiency of systems for the prevention of cross border crime and for border surveillance for civilian purposes.
- European standards for interoperable systems.
- Substantial and tangible improvement of (maritime) situational awareness and reaction capability, as appropriate in surveillance for civilian purposes, fight against crime, and search and rescue missions by the National and European Border and Coast Guards.
- Contribution to the concept of Common Application of Surveillance Tools, as for the European Border Surveillance System (EUROSUR) and to its interoperability with other systems.

17. European Innovation Council (EIC) pilot 2018-20

SME INSTRUMENT: EIC-SMEInst-2018-2020

SME-1 SME instrument phase 1	SME-2 SME instrument phase 2	IA
☑	☑	☑

Specific Challenge

Are you an innovative, high-flying small or medium-sized business with European and global ambitions?

Have you got an idea for an innovation that targets new markets and could boost the growth of your company?

Are you looking for substantial funding to develop and scale up your idea?

And could you make use of business development resources and coaching to take your company forward? Then the SME Instrument is for you.

The SME Instrument supports high-risk, high-potential small and medium-sized enterprises to develop and bring to market new products, services and business models that could drive economic growth.

The SME Instrument is for innovators with ground-breaking concepts that could shape new markets or disrupt existing ones in Europe and worldwide.

Competition for SME Instrument support is tough.

The SME Instrument is very selective.

Only the most convincing and excellent proposals can be funded after a thorough evaluation by multinational panels of technology, business and finance experts.

Selected companies receive funding and are offered business coaching to scale up their innovation idea, and can also receive mentoring. They are helped in networking with other SME Instrument clients, with other companies of all sizes, and with potential co-investors and follow-up investors across Europe. As an SME Instrument client, you will gain visibility and boost your chances of success in European and international markets.

Europe needs more radical, market-creating innovations to improve productivity and international competitiveness and generate new jobs and higher standards of living.

These innovations must meet user and customer needs and tackle societal, technological and business challenges in a sustainable way.

Have you got what it takes? Then apply now!

Scope

Who can apply?

For-profit SMEs, including young companies and start-ups, from any sector. You must be established in an EU Member State or a Horizon 2020 associated country.

What topics are covered?

There are no set topics. Negative impacts on climate and the environment should be avoided.

How does it work?

The SME Instrument provides full-cycle business innovation support. It has three phases, including a coaching and mentoring service.

> Feasibility study: Phase 1

Phase 1 helps you get a grip on the R&D, technical feasibility and commercial potential of a ground-breaking, innovative idea and develop it into a credible business plan for scaling it up.

Activities can include, for example, risk assessment, market research, user involvement, analysis of regulatory constraints or standards regimes, intellectual property management, partner search, or feasibility assessment.

Your goal in Phase 1 is to formulate a solid, high-potential innovation project with a European or global growth-oriented strategy

Your proposal must be based on an initial business plan and outline the specifications of a more elaborate one, which will be the outcome of the project.

Phase 1 funding is a lump sum of €50 000. Projects should last around 6 months

> From concept to market: Phase 2

Phase 2 helps you develop your business concept further into a market-ready product, service or process aligned with your company's growth strategy. Activities could, for example, include trials, prototyping, validation, demonstration and testing in real-world conditions, and market replication. If the activity concerns a primarily technological innovation, a Technology Readiness Level (TRL) of 6 or above is envisaged. You can subcontract work essential for your innovation project.

You can apply to Phase 1 as a means of preparing for Phase 2, or you can apply directly to Phase 2.

Your proposal must be based on a strategic business plan that was either developed in Phase 1 or by another means. Your proposal must specify the expected outcome of the project and criteria for success, as well as the expected impacts on your company in both qualitative and quantitative terms (e.g. on turnover, employment, market size, IP management, sales, return on investment, or profitability).

You must pay particular attention to IP protection and ownership, and present convincing evidence or measures to ensure the possibility of commercial exploitation (often known as 'freedom to operate'). You should also address regulatory and standardisation issues.

Grant funding is provided (funding rate 70%) of between €0.5 million and €2.5 million. You can request a higher or lower amount, duly justified, when applying. Your project should normally take 12 to 24 months to complete, but could be longer in exceptional and well-justified cases.

> Commercialisation: Phase 3

Phase 3 helps you take advantage of additional EU support extended via a range of business support services offered on the EIC Community Platform, open to SMEs benefiting from the different EIC calls for proposals. This support can take the form of training, links to investors, partnering and networking with other EIC SME clients and larger firms and services to help you access international markets, e.g. via participation in overseas trade fairs. Phase 3 is not necessarily subsequent to Phase 1 or Phase 2; it provides specific support to EIC SME clients, mainly to help them access new markets or customers and link with investors. It does not provide direct funding. In the 2018-2020 period, Phase 3 is open to SMEs receiving grants under the FTI and FET-Open schemes, in addition to SMEs receiving grants from the SME Instrument budget.

All Phase 3 support services are accessible through a single, dedicated entry point, which serves as an information portal and networking space. *[See 'EIC Support Actions']*

Coaching

If you are an SME benefiting from grant funding from the SME Instrument, FTI or FET-Open, we offer business coaching to help your business scale up and grow.

Coaching covers business development, organisational development, cooperation, and financing.

For SME Instrument clients, up to 3 coaching-days are available in Phase 1, and up to 12 coaching-days in Phase 2. SMEs taking part in FTI or FET-Open are offered up to 12 coaching-days.

The free-of-charge coaching service is facilitated by the Enterprise Europe Network (EEN). Coaching is delivered by one or more qualified, experienced business coaches recruited from a database managed by the European Commission. All coaches meet stringent criteria regarding business experience and coaching skills. Throughout your project, the EEN will complement the coaching support. EEN offers a service package covering an assessment of your firm's innovation management capacities and the identification of a suitable coach or consulting package to address the gaps, EEN also provides access to its innovation and internationalisation services.

Mentoring

If you are an SME benefiting from grant funding from the SME Instrument, FTI or FET-Open, we will offer mentoring to individual founders, CEOs and leaders.

Mentoring aims to develop leadership skills such as resilience, tenacity and strategic insight.

The mentoring scheme will involve one-to-one meetings with an experienced entrepreneur, who will share expertise and provide impartial guidance and support.

Mentors will be CEOs of firms that have moved beyond the start-up stage. To begin with, mentors will be drawn from a pool of SME Instrument Phase 2 current and former clients willing to act as mentors on a *pro bono* basis.

Mentors and mentees will be matched up via the EIC Community Platform and during EIC Events and other suitable events.

We will introduce the mentoring scheme during 2018, and announce more details nearer the launch-date.

Fast Track to Innovatio: H2020-EIC-FTI-2018-2020

RIA ☒ **IA** ☑ **CSA** ☒

Specific Challenge

Who should apply to FTI, the Fast Track to Innovation?

Are you looking for partners that can help you with a fast go-to-market of an industry-driven, innovative concept that has strong potential to make your company grow and scale-up?

Do you see co-creation or open innovation as ways to advance your innovation cycle and enter the market within three years?

Are you looking for substantial funding to test, demonstrate and validate your innovation with users before full commercial roll-out, potentially via a spin-off company or a joint venture?

Then FTI is the scheme for you.

Innovation is fostered when new ideas can emerge and easily translate into socio-economic value, shaping new markets and laying the foundations of a stronger, high-tech industrial base for Europe.

Working together, partners with complementary backgrounds, knowledge and skills, in both new and established value-chains, can turn ideas into world-beating products, processes and services that tackle societal challenges.

FTI accelerates the market uptake of ground-breaking innovations by providing funding in an open, accessible scheme that nurtures ideas from consortia of innovators of all types and sizes from across Europe.

Participation by industry — defined as private-for-profit organisations — is mandatory; industry is best-placed to ensure the due commercial exploitation of the innovation developed; in addition, company growth and development in order to strengthen Europe's industrial leadership are explicitly pursued with FTI support.

Scope

Principles and funding of FTI

FTI supports actions undertaking innovation from the demonstration stage through to market uptake, including activities such as piloting, test-beds, systems validation in real-world working conditions, validation of business models, pre-normative research, and standard-setting.

The maximum EU contribution per action is €3 million (funding rate: 70% for for-profit entities; 100% for not-for-profit entities).

FTI targets relatively mature, ground-breaking new technologies, concepts, processes and business models that need final development to be able to shape a new market and achieve wider deployment.

If your proposal involves technological innovation, your consortium should declare that the technology or the technologies concerned are at least at Technology Readiness Level (TRL) 6. The intention will be to bring the TRL up to 8 for technological innovations and to an analogous level of maturity for non-technological innovations during the lifetime of the FTI action. TRLs are described in General Annex G of the work programme.

FTI actions are encouraged to be interdisciplinary, cutting across different sector and technologies. Actions supporting innovative concepts that have the potential to disrupt or to create new markets are particularly welcome.

In your proposal, you should:

- Specify the intended outcome and describe key performance indicators and success criteria.
- Make reference to and incorporate a business plan clearly describing the market potential, business opportunities for participants, measures to enhance the probability of eventual commercial take-up, and a credible commercialisation strategy that identifies next steps and specifies other actors to be involved.
- Pay particular attention to IP protection and ownership and to the possibility of commercial exploitation (often known as 'freedom to operate').
- Specify the expected impact in terms of competitiveness and growth of the business partners in the consortium, measured in terms of turnover and job creation.
- Clearly describe the expected impact in both qualitative and quantitative terms, with factors such as time sensitivity and international competitiveness considered in the light of the technology field, innovation area and industry sectors concerned.

The time to initial market take-up should be no more than 3 years from the start of your FTI action.

In very well-justified cases linked to the specific characteristics of a particular innovation field or industry sector, the time to initial market take-up could be longer.

Possible impacts on sustainability or climate change, in particular, or on other cross-cutting objectives of Horizon 2020, must be highlighted.

Participation from industry in your consortium is mandatory. Universities and research and technology organisations can also participate. Actors with an important role in commercialisation are encouraged to take part, such as cluster organisations, end-users, industry associations, incubators, investors, and the public sector. Including start-ups with ground-breaking ideas that could create new markets is encouraged.

FETOPEN-01-2018-2019-2020

RIA ☑ IA ☒ CSA ☒

FET Open aims to establish European leadership in the early exploration of future technologies. It looks for opportunities of long-term benefit for citizens, the economy and society. It aims to mobilise Europe's most creative and forward thinking researchers from all disciplines to work together and explore what may become the leading technology paradigms of the future.

FET Open supports early stage science and technology research exploring new foundations for radically new future technologies by challenging current paradigms and venturing into unknown areas. A bottom-up selection process widely open to any research idea builds up a diverse portfolio of new research directions. Early detection of promising new areas, developments and trends, along with attracting new and high-potential research and innovation players, are key factors.

FET Open combines high scientific ambition with concrete technological implications. It aims to attract interdisciplinary consortia that do not shy away from exploring connections between remote disciplines in order to open-up new and potentially game changing technological directions that FET as a whole aims to develop into the leading technology paradigms of the future, including through FET-Proactive projects and FET-Flagship initiatives. In spite of the high initial risk, the long-term impact can be enormous: these new technologies can become the core for new high-growth companies, for new industries or for radically new ways of tackling societal challenges.

The FET-Open call is a part of the European Innovation Council (EIC) pilot. It provides the EIC with a bold exploratory engine that shatters the frontiers of current thinking. All FET-Open projects, even if far from today's markets, are full of great ideas to inspire the entrepreneurial minds that the EIC attracts. While keeping its own identity of excellence in science and technology research, the exposure of FET Open within the EIC allows new and sometimes unexpected opportunities to be detected and picked up early on. For those cases, the FET Innovation Launchpad is designed to assist in the first steps to accelerate the real-world impact of a result from FET research – a win-win for both research and innovation. Other parts of the EIC provide further tools for achieving high impact on society and/or the economy. Furthermore, by being part of the EIC pilot, FET-Open participants have access to the assistance, networking and financing possibilities offered by the EIC thus further increasing the leverage and increased impact from the initial high-risk investment in FET projects.

Specific Challenge

To lay the foundations for **radically new future technologies** of any kind from visionary interdisciplinary collaborations that dissolve the traditional boundaries between sciences and disciplines, including the social sciences and humanities. This topic also encourages the driving role of new actors in research and innovation, including excellent young researchers, ambitious high-tech SMEs and first-time participants to FET under Horizon 2020 from across Europe.

Scope

Proposals are sought for cutting-edge **high-risk / high-impact interdisciplinary research with all of the following essential characteristics** ("FET gatekeepers"):

- **Radical vision**: the project must address a clear and radical vision, enabled by a new technology concept that challenges current paradigms. In particular, research to advance on the roadmap of a well-established technological paradigm, even if high-risk, will not be funded.
- **Breakthrough technological target**: the project must target a novel and ambitious science-to-technology breakthrough as a first proof of concept for its vision. In particular, blue-sky exploratory research without a clear technological objective will not be funded.
- **Ambitious interdisciplinary research** for achieving the technological breakthrough and that opens up new areas of investigation. In particular, projects with only low-risk incremental research, even if interdisciplinary, will not be funded.

The inherently high risks of the research proposed shall be mitigated by a flexible methodology to deal with the considerable science-and-technology uncertainties and for choosing alternative directions and options.

The Commission considers that proposals requesting a contribution from the EU of up to €3 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected impact

- Scientific and technological contributions to the foundation of a new future technology.
- Potential for future social or economic impact or market creation.
- Building leading research and innovation capacity across Europe by involvement of key actors that can make a difference in the future, for example excellent young researchers, ambitious high-tech SMEs or first-time participants to FET under Horizon 2020.

Annex 1. List and link to Work Programmes H2020, 2018-20

Work Programmes 2018-20

http://ec.europa.eu/research/participants/portal/desktop/en/funding/reference_docs.html#h2020-work-programmes-2018-20

1. Introduction 2018-20
2. Future and Emerging Technologies (FETs) 2018-20
3. Marie Sklodowska-Curie actions (MSCA) 2018-20
4. Research infrastructures (including e-Infrastructures) 2018-20
5. Introduction to Leadership in enabling and industrial technologies (LEITs) 2018-20
5i. Information and communication technologies (ICT) 2018-20
5ii. Nanotechnologies, advanced materials, advanced manufacturing and processing, biotechnology 2018-20
5iii. Space 2018-20
6. Access to risk finance 2018-20
7. Innovation in SMEs 2018-20
8. Health, demographic change and well-being 2018-20
9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy 2018-20
10. Secure, clean and efficient energy 2018-20
11. Smart, green and integrated transport 2018-20
12. Climate action, environment, resource efficiency and raw materials 2018-20
13. Europe in a changing world - inclusive, innovative and reflective societies 2018-20
14. Secure societies – protecting freedom and security of Europe and its citizens 2018-20
15. Spreading excellence and widening participation 2018-20
16. Science with and for society 2018-20
17. European Innovation Council (EIC) 2018-20
18. Dissemination, Exploitation and Evaluation 2018-20

Annex 2. Summary of selected topics (instrument, budget, deadlines)

		TYPE OF ACTION	BUDGET 2018 (M EUR)	BUDGET SHARED WITH CALLS:	BUDGET 2019 (M EUR)	BUDGET SHARED WITH CALLS:	DEADLINE single step	DEADLINE 1st step	DEADLINE 2nd step
2. Future and Emerging Technologies (FETs) 2018-20									
FETPROACT-01-2018	FET Proactive: emerging paradigms and communities	RIA	88.00				22/03/2018		
FETFLAG-01-2018	Preparatory Actions for new FET Flagships	CSA	6.00					20/02/2018	18/09/2018
FETFLAG-03-2018	FET Flagship on Quantum Technologies	CSA	2.00				20/02/2018		
FETFLAG-03-2018	FET Flagship on Quantum Technologies	RIA	130.00				20/02/2018		
4. Research infrastructures (including e-Infrastructures) 2018-20									
INFRADEV-01-2019-20	Design Studies	RIA	15.00		85.00		12/11/2019		
INFRADEV-02-2019-20	Preparatory Phase of ESFRI projects	CSA			20.00		29/01/2019		
INFRADEV-03-2018-19	Individual support to ESFRI and other world-class research infrastructures	RIA	15		45		22/03/2018 20/03/2019		
INFRAIA-01-2018-2019	Integrating Activities for Advanced Communities	RIA	101.50		101.50		22/03/2018 20/03/2019		
5i. Information and communication technologies (ICT) 2018-20									
ICT-03-2018-19	Photonics Manufacturing Pilot Lines for Photonic Components and Devices	IA	30,00		30,00		17/04/2018 28/03/2019		
ICT-04-2018	Photonics based manufacturing, access to photonics, datacom photonics & connected lighting	IA	25,00				17/04/2018		
ICT-04-2018		RIA	30,00				17/04/2018		
ICT-05-2019	Application driven photonics components	IA			45,00		28/03/2019		
ICT-05-2019	Application driven photonics components	RIA			30,00		28/03/2019		
ICT-05-2019	Application driven photonics components	CSA			1,50		28/03/2019		
5ii. Nanotechnologies, advanced materials, advanced manufacturing and processing, biotechnology 2018-20									
DT-NMBP-01-2018	Open Innovation Test Beds for Lightweight, nano-enabled multifunctional composite materials and components	IA	75.00	DT-NMBP-02-2018				23/01/2018	28/06/2018
DT-NMBP-02-2018	Open Innovation Test Beds for Safety Testing of Medical Technologies for Health	IA	75.00	DT-NMBP-01-2018				23/01/2018	28/06/2018
DT-NMBP-03-2019	Open Innovation Test Beds for nano-enabled surfaces and membranes	IA			50.00			22/01/2019	03/09/2019
DT-NMBP-07-2018	Open Innovation Test Beds for Characterisation	IA	44.00	DT-NMBP-09-2018				23/01/2018	28/06/2018
DT-NMBP-08-2019	Real-time nano-characterisation technologies	RIA			37.80	DT-NMBP-10-2019		22/01/2019	03/09/2019
DT-FOF-01-2018	Skills needed for new Manufacturing jobs	CSA	2.00				22/2/2018		
DT-FOF-03-2018	Innovative manufacturing of opto-electrical parts	RIA	79.00	DT-FOF-02-2018 DT-FOF-04-2018			22/2/2018		

		TYPE OF ACTION	BUDGET 2018 (M EUR)	BUDGET SHARED WITH CALLS:	BUDGET 2019 (M EUR)	BUDGET SHARED WITH CALLS:	DEADLINE single step	DEADLINE 1st step	DEADLINE 2nd step
5ii. Nanotechnologies, advanced materials, advanced manufacturing and processing, biotechnology 2018-20									
DT-FOF-04-2018	Pilot lines for metal Additive Manufacturing (50%)	IA	79.00	DT-FOF-02-2018 DT-FOF-03-2018			22/2/2018		
DT-FOF-08-2019	Pilot lines for modular factories (IA 50%)	IA		DT-FOF-05/06/12	106.60		21/2/2019		
DT-NMBP-19-2019	Advanced materials for additive manufacturing	IA			20.40			22/01/2019	03/09/2019
5iii. Space 2018-20									
SPACE-10-TEC-2018-20	Technologies for European non-dependence and competitiveness	RIA	12.00				06/03/2018		
LC-SPACE-14-TEC-2018-2019	Earth observation technologies	RIA	8.00		8.00		06/03/2018 12/03/2019		
SPACE-15-TEC-2018	Satellite communication technologies	RIA	9.00				06/03/2018		
SU-SPACE-22-SEC-2019	Space Weather	RIA			9.00		12/03/2019		
7. Innovation in SMEs 2018-20									
INNOSUP-01-2018-2020	Cluster facilitated projects for new industrial value chains	IA	19.97		22.85			12/04/2018 03/04/2019	13/09/2018 12/09/2019
INNOSUP-02-2019-2020	European SME innovation Associate - pilot	CSA			4.00		17/01/2019		
8. Health, demographic change and well-being 2018-20									
SC1-BHC-03-2018	Exploiting research outcomes and application potential of the human microbiome for personalised prediction, prevention and treatment of disease	RIA	50.00				18/04/2018		
SC1-BHC-28-2019	The Human Exposome Project: a toolbox for assessing and addressing the impact of environment on health	RIA			50.00		16/04/2019		
DT-TDS-01-2019	Smart and healthy living at home	IA			60.00 (25.00 from ICT)		14/11/2018		
9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy 2018-20									
SFS-05-2018-2019-2020	New and emerging risks to plant health	RIA	7.00					13/02/2018	11/09/2018
SFS-06-2018-2020	Stepping up integrated pest management	RIA	5.00					13/02/2018	11/09/2018
SFS-16-2018	Towards healthier and sustainable food	RIA	14.00					13/02/2018	11/09/2018
LC-SFS-19-2018-2019	Climate-smart and resilient farming	RIA	7.00		14.00			13/02/2018 23/01/2019	11/09/2018 04/09/2019
SFS-23-2019	Integrated water management in small agricultural catchments	RIA			14.00			23/01/2019	04/09/2019

		TYPE OF ACTION	BUDGET 2018 (M EUR)	BUDGET SHARED WITH CALLS:	BUDGET 2019 (M EUR)	BUDGET SHARED WITH CALLS:	DEADLINE single step	DEADLINE 1st step	DEADLINE 2nd step
10. Secure, clean and efficient energy 2018-20									
LC-SC3-EE-4-2019-2020	Upgrading smartness of existing buildings through innovations for legacy equipment	IA			10.00		03/09/2019		
LC-SC3-EE-5-2018-2019-2020	Next-generation of Energy Performance Assessment and Certification	CSA	5.00				04/09/2018		
LC-SC3-EE-5-2018-2019-2020	Next-generation of Energy Performance Assessment and Certification	IA			10.00		03/09/2019		
LC-SC3-RES-14-2019	Optimising manufacturing and system operation	RIA			20.00			16/10/2018	25/04/2019
LC-SC3-RES-15-2019	Increase the competitiveness of the EU PV manufacturing industry	IA			25.00		11/12/2018		
11. Smart, green and integrated transport 2018-20									
LC-MG-1-1-2018	InCo flagship on reduction of transport impact on air quality	RIA	30.00					30/01/2018	19/09/2018
LC-MG-1-9-2019	Upgrading transport infrastructure in order to monitor noise and emissions	RIA			7.00			16/01/2019	12/09/2019
MG-2-7-2019	Safety in an evolving road mobility environment	RIA			8.00			16/01/2019	12/09/2019
12. Climate action, environment, resource efficiency and raw materials 2018-20									
SC5-10-2019-2020	Raw materials innovation actions: exploration and Earth observation in support of sustainable mining	IA			20.00			19/02/2019	04/09/2019
SC5-14-2019	Visionary and integrated solutions to improve well-being and health in cities	IA			43.00			19/02/2019	04/09/2019
SC5-17-2018	Towards operational forecasting of earthquakes and early warning capacity for more resilient societies	RIA	18.00					27/02/2018	04/09/2018
14. Secure societies – protecting freedom and security of Europe and its citizens 2018-20									
SU-DRS02-2018-2019-2020	Technologies for first responders	RIA	28.00		21.00		23/08/2018 22/08/2019		
SU-BES02-2018-2019-2020	Technologies to enhance border and external security	RIA	21.00		21.00		23/08/2018 22/08/2019		
SU-BES03-2018-2019-2020	Demonstration of applied solutions to enhance border and external security	IA	10.00		10.00		23/08/2018 22/08/2019		

		TYPE OF ACTION	BUDGET 2018 (M EUR)	BUDGET SHARED WITH CALLS:	BUDGET 2019 (M EUR)	BUDGET SHARED WITH CALLS:	DEADLINE of cut-offs	DEADLINE 1st step	DEADLINE 2nd step
17. European Innovation Council (EIC) 2018-20									
EIC-SMEInst-2018-2020	SME instrument (phase 1 & phase 2)	**IA**	479.74		552.26				
EIC-SMEInst-2018-2020	SME-1: SME instrument phase 1	**IA**	[10% of total– see above]	divided equally between cut-off dates in each year	10%	divided equally between cut-off dates in each year	08/02/2018 03/05/2018 05/09/2018 07/11/2018 13/02/2019 07/05/2019 05/09/2019 06/11/2019		
EIC-SMEInst-2018-2020: SME instrument	SME-2: SME instrument phase 2	**IA**	[87% of total – see above]	divided equally between cut-off dates in each year	87%	divided equally between cut-off dates in each year	10/01/2018 14/03/2018 23/05/2018 10/10/2018 09/01/2019 03/04/2019 05/06/2019 09/10/2019		
EIC-FTI-2018-2020	Fast Track to Innovation (FTI)	**IA**	100.00	divided equally between cut-off dates in each year	100.00	divided equally between cut-off dates in each year	21/02/2018 31/05/2018 23/10/2018 21/02/2019 23/05/2019 22/10/2019		
FETOPEN-01-2018-2019-2020	EIC - FET-Open – Novel ideas for radically new technologies	**RIA**	181.20		162.80		16/05/2018 24/01/2019 18/09/2019		