Selection of calls
FUNDING OPPORTUNITIES FOR PHOTONICS
H2020, Work Programme 2016 - 2017

Information obtained from the Work Programme
published calls for 2017

The parts of the Work Programme that relate to 2017 are provided at this stage on an indicative basis. Such Work Programme parts will be decided during 2016.

The conditions related to each topic are provided at the end of the correspondent call and in the General Annexes.

Infrastructures, ICT, NMBP, Space, Innovation in SMEs, Societal Challenges, Fast Track to Innovation Pilots: European Commission Decision C (2015)6776 of 13 October 2015

Euratom: European Commission Decision C (2015)6744 of 13 October 2015

This document includes a selection of calls for 2017 obtained from the whole collection of calls published under H2020, 2016-17 Work Programmes. The criteria used for the selection is the relationship with Photonics Technologies, 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 (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.

http://ec.europa.eu/research/participants/portal/desktop/en/funding/reference_docs.html#h2020-work-programmes-2016-17

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4. European Research Infrastructures (including e-Infrastructures)

INFRADEV-01-2017: 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 address all 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). Design studies lead to a 'conceptual design report' 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 European interest. All fields of science are considered.

The activities to be performed in a Design Study proposal 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 impacts, as well as, when relevant, the creation of prototypes; (2) scientific and technical work to ensure that the scientific user communities exploit the new facility from the start with the highest efficiency.
- 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; (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 main output of a design study will be the conceptual design reports for a new or upgraded research infrastructure of strategic importance for Europe.

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

- 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 and roadmaps 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.

INFRADEV-03-2016-2017: Individual support to ESFRI and other world-class research infrastructures

RIA ☒ IA ☒ CSA ☑

Specific Challenge:

The new research infrastructures under development at European level, such as those identified in the ESFRI roadmap, are advancing in their implementation phase and/or starting their operation. The initial phase is, however, the most delicate and difficult one for new pan-European infrastructures in the process to become fully operational as financial sustainability must be proved and the trust and awareness of users must be earned.

Scope: Under the Work Programme 2016-2017 this topic will target the long-term sustainability of new research infrastructures, ESFRI and other world-class research infrastructures in Europe, with established governance and legal structure, notably on the basis of the European Research Infrastructure Consortium (ERIC) or any other suitable structure. Support will be provided to activities aimed at ensuring long-term sustainability, including enlargement of the membership, European coverage, international cooperation[1], 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 complementarities with previous or current EU grants.

Specific attention will be given to the interaction with industry and SMEs. Activities may also foster the development of Regional Partner Facilities. 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:

This activity will:

- 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-01-2016-2017: Integrating Activities for Advanced Communities

RIA ☑ IA ☒ CSA ☒

Specific Challenge:

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[2] in a given field as well as other stakeholders (e.g. public authorities, technological partners, research institutions) from

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

2 Exceptionally, the consortium may include only one research infrastructure providing access, if this facility is of a truly unique nature

different Member States, Associated Countries and other third countries[3] 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 conditions), 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.

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. 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 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, working in cooperation with e-infrastructure service providers.

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 that rationally designed, comprehensive and coherent overall concepts for European Infrastructures are being pursued.

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, at most one proposal per area is expected to be submitted.

Further conditions and requirements that applicants should fulfil when drafting a proposal are given in part C 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.

3 Legal entities established in Australia, Brazil, Canada, China, India, Japan, Russia, Mexico and USA, which provide, under the grant, access to their research infrastructures to researchers from Members States and Associated countries, are eligible for funding from the Union

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.

Biological and Medical Sciences

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. Adequate consideration should be taken of the produced data and its availability for research. In this respect, synergies with other relevant ESFRI Infrastructures, in particular ELIXIR, should be duly exploited.

Vaccine infrastructures. This activity aims at bridging the 'translational gap' in biomedical research by providing academia- and SME- driven vaccine R&D with high quality services to support vaccine formulation, access to GMP (Good Manufacturing Practices), preclinical studies including relevant animal models, vaccine trials, compilation of regulatory dossiers and advice on production issues like upscale and quality control. Both human and veterinary vaccines, for prophylactic and therapeutic applications, should be addressed. Furthermore, work shall be carried out towards integration with the ESFRI Infrastructures EATRIS and INSTRUCT to ensure sustainability of the trans-national access services. Synergies with other relevant ESFRI Infrastructures, such as ECRIN, should be duly exploited.

Experimental facilities for animal disease and infectiology (including zoonoses). A project under this topic must provide and facilitate access to the key experimental facilities under BSL3 conditions in Europe for animal and zoonotic infectious diseases. It will also include key collections of samples necessary for research on animal and zoonotic infectious diseases. The project should aim to integrate these facilities and resources with a long term perspective. It should also develop the necessary collaborations outside Europe, towards a global sharing of available resources.

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 experiments, as framed by the directive 86/609/EEC, and by the Commission proposal for its revision, COM(2008)543. The proposal should also develop the necessary collaborations outside Europe.

Facilities and resources for plant phenotyping. This activity aims at providing and facilitating access to the key research infrastructures in Europe for high throughput plant phenotyping. It should aim to integrate these facilities and resources with a long term perspective, improving coordination, as regards standards, protocols, access modalities, etc. The project should also develop the necessary collaborations outside Europe, towards a coordinated development of such facilities and resources. The facilities should enable more efficient European research to be conducted in plant genetics, plant physiology and bio-ecology, under controlled conditions.

Marine biological stations. This activity aims at improving and further integrating access to a wide range of marine biology and ecology resources for research, including: marine biodiversity and associated historical time-series data; culture collections of marine biological resources; marine model organisms, including specific genetic resources; up-to-date equipment for biological research (“omics”); and rare and unique facilities for experimental biology and ecology. It should also stimulate knowledge and technology transfer to industry and to public policy-makers. Synergies with relevant ESFRI Infrastructures, in particular EMBRC, should be duly exploited.

Research Infrastructures for the control of vector-borne diseases. This activity aims at integrating specialised facilities in Europe for the study of insect-transmitted disease with the objective to validate and roll out new control measures targeting insect vectors that pose the greatest threats to human health and animal industries. These facilities, supporting research and product development, include P3 secure insectaries for research on vectors and pathogens, large scale production of mosquitoes, facilities for the testing and evaluation of insecticides, and facilities for high-throughput genetic analysis of insect vectors and pathogens. The facilities of this activity and associated networking and research activities will play a critical role in consolidating European leadership in the field of insect vector biology and disease control. Synergies with relevant ESFRI Infrastructures such as ELIXIR should be duly exploited.

Energy

Research Infrastructures for research on biomass conversion and biorefinery. This activity aims at integrating the key research infrastructures in Europe for the advanced conversion technologies of biogenic feedstock. Research Infrastructures to be integrated would be laboratory and pilot-scale installations as well as demonstration plants (facilities like furnaces, gasifiers, fermenters, biorefineries, etc.) for carrying out research in the fields of: combustion and thermal gasification of solid fuels, modelling, gas cleaning, second and third generation biofuels

with emphasis on marine biomass, anaerobic digestion, biomethane production from organic waste and green biorefinery (sustainable processing of biomass into a marketable spectrum of products). The issue of the use of new feedstock is an integral part of the activity. This activity will support the European Strategic Energy Technology Plan (SET-Plan, COM (2007)723).

Research Infrastructures for offshore renewable energy. This activity aims at integrating the key research infrastructures in Europe for research, development and testing of offshore wind and ocean energy systems including electrical sub systems and grid integration through a range of TRLs (from laboratory scale TRL 1/2 through to open ocean at TRL 6/7). Trans-national access should open existing pilot and demonstration plants as well as laboratory scale installations from wave basins to large scale open sea test sites. This activity will support the European Strategic Energy Technology Plan (SET-Plan, COM (2007)723) including emerging concepts of multi-purpose platforms.

Environmental and Earth Sciences

Research infrastructures for terrestrial research in the Arctic. This activity should integrate, as an international network for terrestrial research and monitoring in the Arctic, key research stations and large research field sites throughout the circumpolar Arctic and adjacent northern countries, aiming at implementing capacity for research, monitoring and education. The project should include work on best practises for managing stations, and (international) logistics. The network should link with marine and atmospheric networks, aiming at close cooperation.

Research Infrastructures for earthquake hazard. This activity aims at integrating the key research infrastructures in Europe for natural and anthropogenic earthquake risk assessment and mitigation. More integrated services from seismic and engineering infrastructures would contribute to supporting the reduction of vulnerability of European citizens and constructions to earthquakes. International collaboration activities and the further integration of the research field are encouraged. Synergies with relevant ESFRI Infrastructures, in particular EPOS, should be duly exploited.

Mesocosms facilities for research on marine and freshwater ecosystems. This activity aims at integrating leading mesocosm infrastructures in Europe enabling in particular research on impact of climate change, pollution and other disturbance on ecosystems, from Mediterranean to Arctic.

Atmospheric simulation chambers. This activity should further integrate key instrumented environmental chambers and improve access to them for atmospheric research, including model development, while expanding to larger scientific communities and interdisciplinary research fields. It is expected that this community work towards close cooperation with relevant ESFRI Infrastructures. By developing their complementary nature, the different research infrastructures should answer broad scientific needs such as studies of the impact of atmospheric processes e.g. on regional photochemistry, global change, as well as cultural heritage and human health effects. Building on the former integrating initiatives, the development of a strategic integrating structure should also be considered.

Research infrastructures for forest ecosystem and resources research. This activity aims at integrating and facilitating broad access to forest research facilities and methodologies with a view to enabling, coordinating and harmonising research and monitoring including investigation of the biological effects of air pollution and mitigation and adaptation to climate change. Access should be provided to data on genetic and species diversity in forest ecosystems. Support for development of forest management approaches should be part of the project, taking into account environmental and land use changes and the bio-economy.

Sites, experimental platforms and data collections of anthropogenic impacts for ecosystem functioning and biodiversity research. This activity aims at bringing together highly instrumented experimental, analytical and modelling facilities, looking at all major European ecosystem types and all major pressures on them. It will optimise the collaborative use of these sites by a large scientific community. Efficient methods and techniques will be implemented for rapid data sharing and processing at the European level. Synergies with relevant ESFRI Infrastructures such as ANAEE should be duly exploited.

Multidisciplinary Marine Data Centres for ocean and marine data management. This activity aims at providing and facilitating access to the key data centres in Europe for in-situ and remote sensing data for marine research (including coastal research). It must present a long-term sustainable perspective on the integration of these facilities and related resources. It should enhance and innovate the services offered to an expanded multidisciplinary community and promote the adoption of the developed protocols and standards for interoperability to other key downstream initiatives in the field. Synergies with relevant ESFRI Infrastructures should be duly exploited.

Mathematics and ICT

Integrating activity for facilitating access to HPC (High Performance Computing) centers. This activity aims at furthering the services harmonisation and enhancement of national and regional High Performance Computing

Centres of pan-European interest and at enlarging the European HPC user base preparing it to the use of the top end HPC resources such as PRACE (Partnership for Advanced Computing in Europe). It will widen trans-national access to HPC resources across different disciplines and for a wide range of applications including advanced simulation and modelling.

Material Sciences and Analytical facilities

Research Infrastructures for advanced spectroscopy, scattering/ diffraction and imaging of materials. This activity aims at integrating the key research infrastructures in Europe to offer electronic, X-ray, optic and magnetic inspection techniques, and their combinations, for the analysis and engineering of novel materials ranging from hard to soft matter. Such infrastructures would allow the detailed understanding and optimisation of the physical, chemical and biological properties of the materials.

Synchrotron radiation sources and Free Electron Lasers. This activity should provide and facilitate access of a wide range of user communities to the key research infrastructures in Europe based on Synchrotron and Free Electron Laser light sources. It aims to further integrate these facilities and resources with a long term perspective. It should also stimulate new scientific activities taking full advantage of new experimental possibilities offered by new light sources such as the European X-Ray Laser ("XFEL").

Facilities for research on materials under extreme magnetic conditions. This activity aims at integrating key research facilities for high magnetic fields. The activity should enable a wider research community to perform experiments in physics and materials science.

Infrastructures for Neutron Scattering and Muon Spectroscopy. This activity should provide and facilitate wider access to the key research infrastructures in Europe for Neutron scattering and Muon Spectroscopy. It must present a long-term sustainable perspective on the integration of these facilities and related resources. The activity should also stimulate new scientific activities taking full advantage of new experimental possibilities offered by the future European Spallation Source ("ESS").

Physical Sciences

Research Infrastructures for advanced radio astronomy. This activity should provide and facilitate access to the key research infrastructures in Europe for advanced radio astronomy, including Very Long Baseline Interferometry. It must present a long-term sustainable perspective on the integration of these facilities and related resources. A project under this topic should also stimulate new scientific activities aimed at taking full advantage of new possibilities which will be offered by relevant initiatives on the ESFRI Roadmap.

Research Infrastructures for optical/IR astronomy. This activity should provide and facilitate access to the key research infrastructures in Europe for optical and infrared astronomy. It must present a long-term sustainable perspective on the integration of these facilities and related resources. Furthermore, it should also stimulate new scientific activities aimed at taking full advantage of new possibilities which will be offered by relevant initiatives on the ESFRI Roadmap.

Research Infrastructures for hadron physics. This activity must 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 must present a long-term sustainable perspective on the integration of relevant facilities and related resources. Furthermore, it should also target new users and stimulate new scientific activities aimed at taking full advantage of new possibilities which will be offered by relevant initiatives on the ESFRI Roadmap, in particular FAIR.

Particle Accelerators. A project under this topic should facilitate access to state-of-the-art facilities to develop new techniques for improving the performance of existing and future accelerators. It should include accelerators for nuclear and particle physics and accelerator-based photon sources. It must present a long-term sustainable perspective on the integration of relevant facilities and related resources. A project under this topic should complement and further new scientific activities aimed at taking full advantage of new possibilities which will be offered by relevant initiatives on the ESFRI Roadmap.

Social Sciences and Humanities

Access to European Social Science Data Archives and Official Statistics. A project under this topic should aim at a further improvement of the researcher's access to official statistics. Work should address technologies for secured trans-national access to sensitive data. Synergies with relevant ESFRI Infrastructures, in particular CESSDA, should be duly exploited.

Research infrastructures for the study of poverty, working life and living conditions. The aim of this activity is to bring together research infrastructures serving European and international research in the fields of poverty, working life, and living conditions. It will compile historical data, and provide instruments for the analysis of the effects of employers' behaviour and the evaluation of labour market and social policies targeted to vulnerable groups as well as offer training to researchers interested in the use of these instruments.

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.
- 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.

INFRAIA-02-2017: Integrating Activities for Starting Communities

RIA ☑ IA ☒ CSA ☒

Specific Challenge

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: A 'Starting Community' has never been supported for the integration of its infrastructures under FP7 or Horizon 2020 calls, in particular within an integrating activity.

An Integrating Activity will mobilise a comprehensive consortium of several key research infrastructures[4] 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 countries[5] 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 conditions), the cooperation between research infrastructures, scientific communities, industries and other stakeholders, the improvement of the services the infrastructures provide, the harmonisation, optimisation and improvement of access procedures and interfaces.

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.

[4] Exceptionally, the consortium may include only one research infrastructure providing access, if this facility is of a truly unique nature

[5] Legal entities established in Australia, Brazil, Canada, China, India, Japan, Russia, Mexico and USA, which provide, under the grant, access to their research infrastructures to researchers from Members States and Associated countries, are eligible for funding from the Union.

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 the project, in particular in the networking activities for the exchange of best practises, without necessarily be beneficiaries of the action.

The research infrastructures of a 'Starting Community' usually show a limited degree of coordination and networking at present. The strongest impact of an integrating activity is expected typically to arise from a focus on networking, standardisation and establishing a common access procedure for trans-national and/or virtual access provision.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), Integrating Activities should, whenever appropriate, give due attention to any related initiatives internationally (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 Pilot on Open Research Data. Data management, interoperability (definition of metadata and ontologies) 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, working in cooperation with e-infrastructure service providers.

Integrating Activities in particular should 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, knowledge sharing through co-creation, 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 that rationally designed, comprehensive and coherent overall concepts for European Infrastructures are being pursued.

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, at most one proposal per area is expected to be submitted.

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

Integrating activities for starting communities range across all areas of science and technology. Proposals should not restrict their services to too narrow research fields and should address the wider scientific communities, even multidisciplinary ones, which can be served by the involved sets of research infrastructures.

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

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.
- 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.
- 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.

INFRAINNOV-01-2017: Fostering co-innovation for future detection and imaging technologies

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Research infrastructures, as providers of advanced services and as procurers of leading-edge technologies, have an innovation potential that has not always been sufficiently exploited. Opportunities provided by the development of components, instruments, services and knowledge for the implementation and upgrade of research infrastructures, could be better exploited to push the limits of existing technologies. There is a clear innovation potential associated with procurement from industry during the construction and upgrade of research infrastructures.

A co-innovation approach to continuously generate, scale and deploy breakthrough technologies with market and social value needs to be adopted by research infrastructures.

Scope: The aim is the establishment of an open initiative oriented towards a novel research and innovation collaborative framework engaging both the research communities in Europe using Research Infrastructures and the industry (including SMEs), for the mutual benefit of these stakeholders and the European society at large.

This initiative should address:

- The identification of a wide spectrum of technology opportunities with breakthrough potential across Europe; the assessment of the feasibility and scalability of the identified opportunities; the selection and clustering of those opportunities with a clear potential for industrial implementation; and the support of those opportunities towards industrial applications having societal value;
- The support of technology and innovation transfer and joint development measures of high-tech components;
- The enabling of the best conditions for full exploitation by industrial partners of the innovation potential of Research Infrastructures (e.g. in the field of instrumentation and detectors);

As a pilot initiative, the proposals should mainly address the development of future detection and imaging technologies, which have applications in the fields of medicine, manufacturing industry, aerospace, ICT, engineering, environmental sciences and beyond, and should constitute a driver enabling the transfer of fundamental research towards industrial application.

This action allows for the provision of financial support to third parties in line with the conditions set out in Part K of the General Annexes. The financial support to third parties is the primary aim of the action.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 20 million would allow this topic to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

This activity will:

- establish a co-innovation platform in the field of detection and imaging technologies
- provide financial support and guidance towards industrial applicability to the identified co-innovation opportunities
- increase the capacity to generate, absorb and use new technologies in Europe;
- enhance the innovation capability of European Research Infrastructures;
- increase the involvement of industry (including SMEs) in the development of research infrastructures, raising the technological level and competitiveness of European companies and generating market opportunities for them;
- raise the awareness of industry (including SMEs) regarding opportunities offered by research infrastructure to improve their products, e.g. as experimental test facilities, innovation hubs, knowledge-based centres;
- support the integration of research infrastructures into local, regional and global innovation systems;
- 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-07-2017: 5G PPP Research and Validation of critical technologies and systems

RIA ☑ IA ☒ CSA ☑

Specific Challenge

This challenge frames the 5G PPP initiative, whose phase 2 will be implemented under this LEIT-ICT Work Programme. The challenge is to eliminate the current and anticipated limitations of network infrastructures, by making them capable of supporting a much wider array of requirement than is the case today and with capability of flexibly adapting to different "vertical" application requirements. The vision is that in ten years from now, telecom and IT will be integrated in a common very high capacity and flexible 5G ubiquitous infrastructure, with seamless integration of heterogeneous wired and wireless capabilities. 5G Networks have to cover a wide range of services from different use case and application areas/verticals, for increasingly capable user terminals, and for an extremely diverse set of connected machines and things; to cope with an increasingly cloud-based service access (>90% of the internet traffic will go through data centres); to support a shift from the “Client-Server” model to “Anything” as a Service (XaaS), without needs of owning hardware, software or the cognitive objects themselves. Network elements will become "computing equivalent" elements that gather programmable resources, interfaces and functions based on virtualisation technologies, to implement control functionalities ad-how as a function of the use case.

This challenge includes optimisation of cost functions (capex/opex) and of scarce resources (e.g. energy, spectrum), as well as migration towards new network architectures.

A particular issue is to leverage work and results of phase 1 (WP 2014-15)[6] and to accelerate on proof of concepts and demonstrators. Where technological maturity permits, validation of research results, of the most demanding KPI's and of the most promising 5G technology options will be supported by experimental testing conducted in the context of use case in active cooperation with the various potential "vertical" sectors driving the innovative requirements. This validation activity is also expected to be boldly leveraged in the context of the important standardisation (3G PP) and spectrum (WRC 19) milestones that will appear over this WP implementation period.

Scope

a. Research and Innovation Actions covers three strands that complement each other. Proposal may address parts of a strand or parts that cut across several strands.

Strand 1 covers wireless access and radio network architecture/technologies:

- Novel air interface technologies i) supporting efficiently a heterogeneous set of requirements from low rate sensors including mission critical M2M communications to very high rate HD/3D TV and immersive services; ii) supporting local and wide area systems, heterogeneous multi-layer deployments, assuring uniform performance coverage, capacity, e.g. through advanced Multi Antenna Transceiver Techniques, including 3D and massive MIMO beam-forming; iii) enabling usage of frequency bands above 6GHz, for ultra-high speed access, backhaul and fronthaul, based on fully characterised channel models.
- Hardware architectures technologies and building blocks for 5G low cost low-within relevant spectrum range;
- (Radio) Network functional architectures and interfaces leading to a stable vision / reference architecture for 5G in support of the standardisation work expected to culminate under the 2017-2020 period. It provides a platform for technical coordination with other 5G initiatives. This architecture efficiently supports different deployment topologies ranging from fully distributed to fully centralised, with reduced management complexity and minimised signalling overhead. It also covers technologies like WiFi. It supports the “5G services and verticals” framework embracing the machine-type of communication services, the Internet of Things. It covers solutions that unify connection, security, mobility, multicast/broadcast and routing/forwarding management capable of instantiating any type of virtual network architecture;
- Co-operative operation of heterogeneous access networks integrating virtual radio functions into service delivery networks, including broadcast/multicast technologies (terrestrial and satellite based) and supporting Software Defined Networking (SDN) and virtualisation techniques of RAN functions, providing the environment for multi-base station attachment;
- Support of numerous devices with different capabilities, with unified connectivity management capabilities, in terms of security, mobility and routing. It includes cloud and edge computing for low latency requirements

[6] This is not limited to results worked out under the H2020 context, but may include results from other R&I initiatives, e.g. in Member States

and carrier grade communications for Machine Type Communications (MTC) with resource-constrained sensor and actuator nodes with multi-year battery life operation;

- Coordination and optimization of user access to heterogeneous radio accesses including ultra-dense networks, supported by intelligent radio resource management framework. This covers the joint management of the resources in the wireless access and the backhaul/fronthaul as well as their integration with optical or legacy copper networks;
- Multi-tenancy for Radio Access Network (RAN) sharing, covering ultra-dense network deployments with the ability to allocate traffic to shared MNOs infrastructure while satisfying their SLAs. Load and deployment are key aspects. Impacts in other segments of the network (e.g., backhaul), is taken into account for joint management;
- Integration of Satellite Networks to support ubiquitous coverage, resilience, specific markets, and where appropriate further complement terrestrial technologies (e.g. in traffic off loading, backhaul, or content delivery).

Strand 2: High capacity elastic - optical networks

The objective is to support very high traffic and capacity increase originating from an (5G) heterogeneous access networks with matching capabilities from the core and metro environments, at ever increasing speeds and in more flexible and adaptive form. It covers new spectrally efficient, adaptive transmission, networking, control and management approaches to increase network capacity by a factor of >100 while at the same time providing high service granularity, guarantees for end-to-end optimization and QoS - reducing power consumption, footprint and cost per bit and maintaining reach. The integration of such new optical transport and transmission designs with novel network control and management paradigms (e.g., SDN) are expected to enable programmability.

Disruptive approaches for a massive capacity scaling may impact network infrastructure, and system architectures which need to be assessed for integration and migration aspects.

Strand 3 covers the "Software Network", including work on:

- Software network architecture to support an access agnostic converged core network and control framework enabling next generation services (including services for vertical sectors) and integrating next generation access and devices. The architecture leverages the SDN/NFV paradigm and is able to integrate/manage next generation transport and optical technologies, both for backhaul and fronthaul, to flexibly meet increasing system capacity requirements;
- A unified management of connectivity, with end to end security mobility and routing (including multicast/broadcast) beyond current concepts (e.g. tunnelling) for flexible introduction of new services. This aims at a unified physical infrastructure and includes corresponding abstractions – (virtual) resources, functions, hardware etc. – for control and orchestration. Solutions to provision SDN networks across administrative boundaries (e.g. multiple operators, customer networks, datacentres) and interoperability issues between multiple SDN control domains are in scope;
- Solutions (e.g API's and corresponding abstractions) that allow re-location or anycast search of services and their components, as a function of the context. This includes problems involved in portability of virtual network functions and naming of deployed functions and services. It supports co-existence of multiple network domains and easy migration;
- Scalability and efficiency related to increasing deployment of software-based network equipment and functions as well as corresponding more diverse services and usages. These include ease of deployment of multitenant networks, cost and energy efficiency, "five 9" reliability, flexibility and perceived "zero latency" where relevant;
- Realisation of the "plug and play vision" for computing, storage and network resources through appropriate abstraction, interfaces, and layering. It covers the full network infrastructure from core network to heterogeneous access, also with integration of the 5G architecture with legacy infrastructure. The target is for a Network Operating System (NOS) with hardware and user interfaces to manage and orchestrate unified access to computing, storage, memory and networking resources. The approach towards a NOS may also be considered in the context of experimental facilities, in view of integrating multiple heterogeneous European experimental facilities. The goal is to allow proper testing and comparison of the different 5G technological components. OSS solutions are preferred;
- Management and security for virtualised networks and services to support service deployment decisions related with location and lifecycle management of network functions, and flexible configuration of network nodes. Network analytics tools, knowledge reasoning and cognition, may be extended towards network operations to cope with complex, heterogeneous, and dynamic networks featuring large numbers of nodes, and to correlate all monitoring sources in order to create a real-time supervision of Quality of Service and

Quality of Experience. Management of security (privacy where appropriate) across multiple virtualised domains is a key aspect to be cobered by this call.

For the 3 strands above, projects will be implemented as a programme and be expected to actively contribute key horizontal results to the integration process led by the programme level CSA. Therefore all grants awarded under this topic will be complementary to each other and to the grant agreement(s) under the topic ICT-08-2017 a). The respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement will be applied[7]. International cooperation with clear EU industrial benefits may be considered, preferably with nations having launched strategic 5G initiatives (e.g. China, Japan, South Korea, Taiwan, USA).

The Commission considers that proposals requesting a contribution from the EU of between EUR 5 and 8 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts, in particular for proposals targeting significant experiment/demonstrations activities in relation to well identified use cases justifying higher amounts.

b. Coordination and Support Actions

5G PPP projects will be implemented as a programme through the use of complementary grants and the respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement[8] will be applied. This calls for activities to ensure a sound programmatic view of the implemented 5G Research and Innovation Actions (RIA) and Innovation Actions (IA) results. The proposed support actions shall liaise with the 5G RIA and IA actions to exploit synergies in the implementation of the activities that include:

- Programme level integration through management and orchestration of 5G PPP project cooperation for horizontal issues of common interests (security, energy efficiency, spectrum, standardisation, societal impact of 5G…) in support of the commitments of the 5G PPP contractual arrangement and mapping the strategic programme of the 5G industrial Association;
- Portfolio analysis, coverage, mapping and gap analysis, roadmaps for key PPP technologies and for experimental requirements and facilities, also taking into account national developments;
- Proactive support to the emergence of a 5G PPP "5G vision", to key international co-operation activities. A clear proactive strategy is expected to channel relevant 5G PPP project outcomes towards key SDO's like 3G PP (standardisation work expected to start in 2016) and to valorise relevant spectrum work in the context of future WRC's;
- Organisation of stakeholder events, including reaching out to users and key verticals;
- Monitoring of the openness, fairness and transparency of the PPP process, including sector commitments and leveraging factor;
- Maintenance of the "5G web site".

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

Expected Impact

a. Research and Innovation Actions

- Overarching impact: 40% of the world communication infrastructure market for EU headquartered companies;
- Demonstrated progress towards core 5G PPP KPI's: 1000x capacity, 1ms latency, 90% energy savings, 10x battery lifetime, service creation in minutes, better/increased/ubiquitous coverage, 10 times to 100 times higher typical user data rate, 10 times lower energy consumption for low power Machine type communication, Lowered EMF levels compared to LTE solutions;
- Novel business models through innovative sharing of network resources across multiple actors;
- Finer grained management of optical metro and core capacity and capacity increase by a factor of 100 (only for Strand 2);
- Optimised optical backhaul architectures and technologies (only for Strand 2);
- Ubiquitous 5G access including in low density areas (only for Strand 1 and 2);
- Definition of 5G network architecture and of core technological components (only for Strand 1 and 3);
- Proactive contribution to the 3G PP standardisation activity on 5G, and to other standardisation activities, e.g.

[7] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf
[8] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

ONF, ETSI-NFV, IEEE; proactive contribution to the WRC 19 preparation for 5G spectrum.

- Proof-of-concept and demonstrators beyond phase one and validating core functionalities and KPI's in the context of specific use cases with verticals closely associated to the demonstrations and validation. Indicative sectors include: automotive, connected cars; eHealth; video/TV broadcast; Energy management; very high density locations and events (only for Strand 1 and 3);
- Novel connectivity paradigms, beyond the Client server model and enabling massive edge network deployments (only for Strand 1 and 3);
- Network function implementation through generic IT servers (target) rather than on non-programmable specific firmware (today) (only for Strand 3);
- OS like capabilities to orchestrate network resources (only for Strand 3);
- Trustworthy interoperability across multiple virtualised operational domains, networks and data centres;
- Solutions for the management of multi domain virtualised networks with coverage of security architectures based on industry characterised threat models.

b. Coordination and Support Actions

- Maximised output and exploitation of 5G PPP project results in key domains (standardisation, spectrum) through managed projects cooperation on horizontal issues;
- Constituency building, stakeholder support, support to key international cooperation events; dissemination, support to core international cooperation activities, to relevant stakeholder events;
- Definition of future R&I actions through roadmapping.

ICT-08-2017: 5G PPP Convergent Technologies

RIA ☑	IA ☑	CSA ☒

Specific Challenge

Network and service providers are faced with increasing challenges to manage convergence technologies. On the one hand, technological versatility increases service provision capabilities, with ever raising possibilities to dimension service offer to context and user specific SLA's. On the other hand, convergence technologies are getting increasingly complex, with ever larger integration of multiple technological heterogeneous hardware and software components, and more difficult properties to characterise at scale. The challenge thus tackles scalability and usability of mixed network technological approaches that can benefit from previous research, towards validation of deployment at scale.

Scope

a. Innovation actions

Strand 1: Ubiquitous 5G access leveraging optical technologies

5G access networks have to dramatically grow in user capacity, quality of service, responsiveness, energy efficiency and number of connected devices while keeping a sustainable cost.

The objective is to develop and assess new optical access network solutions based on integrated optical device prototypes. Novel integrated devices and subsystems may cover new optical transmission, switching and information processing techniques to support key access functionalities such as beam forming, high accuracy cm/mmWave generation and massive MIMO deployments. They may also be based on new network concepts and control architectures. Co-operative radio-optical approaches are seen as very promising, also to cover

intelligent interference cancellation. Techniques to map 5G channels to optical transport and a co-design of the optical and wireless interfaces and protocols are also targeted, to increase capacity and reduce latency, especially in highly dense 5G scenarios. The work draws on existing scientific and research results in the field and includes scalable demonstrators validated through typical usage scenario.

Strand 2: Flexible network applications

The work leverages the current intense research activities in relation to Virtualised Network Functions (VNF) and targets development of a multiplicity of VNF's useful to operators, service providers and users. Service providers or third party providers should be able to assemble these virtualised 5G functions as "network apps" from an NFV hosting infrastructure, to deploy them in the relevant network nodes, to orchestrate and customise resources to provision user services. The target is for a cloud like 5G infrastructures, supporting network services, resource and service orchestration. This environment also provides an open source development framework for control functionalities and application developments. It also provides the link between the network –terminal functions

and the app/content providers towards standards developments. The platform will be opened to third party developers to demonstrate network "apps".

For the strands above, projects will be implemented as a programme and will be expected to actively contribute key horizontal results to the integration process led by the programme level CSA. Therefore all grants awarded under part a) of this topic will be complementary to each other and to the grant agreement(s) under the topic ICT-07-2017. The respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement will be applied[9]. International cooperation with clear EU industrial benefits may be considered, preferably with nations having launched strategic 5G initiatives (e.g. China, Japan, South Korea, Taiwan, USA).

The Commission considers that proposals requesting a contribution from the EU of between EUR 5 and 8 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Minimum one action per strand will be selected.

b. Research and Innovation Actions – Cooperation in access convergence

This activity takes advantage of the supporting 5G research and demonstration facilities offered by Taiwan towards collaborative 5G research with the EU, and aims at developing and demonstrating an integrated convergent access across different air interface technologies and the fronthaul/backhaul/core network. Test beds making use of facilities offered by Taiwanese partners are targeted. It demonstrates the capabilities of new spectrum access schemes, including for co-working with the network. A system demonstrator showing applications potential is thus favoured, e.g. for high speed moving vehicles.

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

Expected Impact

a. Innovation Actions

- Validated access network architecture with integrated optical technologies for the realisation of critical access and transport control function (only for Strand 1);
- Demonstration of technological applicability to dense access scenarios supporting the 1000 capacity increase objective (only for Strand 1);
- Demonstrated scalability, close to operational context, of the proposed technological approach (only for Strand 1);
- Contribution to standards, notably 5G and optical access (only for Strand 1);
- Optical access interface with 10 times lower energy consumption (only for Strand 1);
- Open environments for creation of network apps (only for Strand 2);
- Open repository of network apps that may be validated and leveraged by third party developers (only for Strand 2);
- Validation at scale of the VNF aggregation capability of the proposed environment (only for Strand 2).

b. Research and Innovation Actions – Cooperation in access convergence

- Contribution to the ITU-R objectives for the next generation mobile network including requirements on data rates, mobility, connection density, latency, energy efficiency, spectrum efficiency, and traffic volume density
- Contribution to the 1000 fold mobile traffic increase per area, in the context of the target application
- Contribution to the 1ms latency objective in the context of the target application
- Results exploitation in the context of standardization and spectrum requirements

ICT-09-2017: Networking research beyond 5G

RIA ☑	IA ☒	CSA ☒

Specific Challenge

While 5G networks has an established roadmap towards technology validation, specifications and tests by industry, outstanding new scientific opportunities are blooming in the field of networking research, with the objective of bringing little explored technologies and system concepts closer to exploitation. The challenge is to support European scientific excellence notably in the DSP domain, and to bring the most promising long term research coming from the labs closer to fruition. This includes perspectives for the full exploitation of the spectrum

[9] http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/amga/h2020-amga_en.pdf

potential, notably above 90Ghz, with new waves of technologies and knowledge, bringing wireless systems to the speed of optical technologies, and for new applications. It includes interaction with photonic systems as well as new cooperation networking and protocols, notably in the mobility context.

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

Scope

Research and Innovation Actions

Proposals may cover one or more of the themes identified below.

- **Scientific and technology advances** for novel use of the spectrum potential, de-risking technological building blocks at frequencies above 90 Ghz up to Thz communications backed by innovative usage scenarios, address visible light communications and develop radically new approaches for spectrum efficiency.
- **Advanced signal processing**, antenna processing, information theory and coding to optimize and reach Tbit/s in wireless communications.
- **Demand-attentive and cooperation networking** alternative to 5G architectures, including HetNets, opportunistic networks novel architectures and protocols for routing, latency and caching in complex networks notably for mobility.

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

Expected Impact

- Validation of disruptive communication concepts, technologies and architectures;
- Proof of applicability of challenging spectrum regions towards innovative and cost efficient applications;
- Advances in signal processing and information theory and scientific publication in world class journals;
- Industry competitiveness with exploitation of academic research through transfer and innovation towards industry, in particular SMEs or start ups.

ICT-30-2017: Photonics KET 2017

RIA ☑	IA ☑	CSA ☑

Specific Challenge

Investments in R&D&I are essential for reinforcing Europe's industrial competitiveness and leadership in photonic market sectors where Europe is strong (e.g. in communications, medical photonics, sensing) and to seize new opportunities. Europe also needs to strengthen its manufacturing base in photonics to safeguard the further potential for innovation and value creation and for job creation. We must better exploit the large enabling potential of photonics in many industrial sectors and in solutions addressing major societal challenges such as health and well-being, energy efficiency or safety. Finally, Europe needs to better exploit the innovation capacity of the photonics SMEs and the innovation leverage potential of the innovation clusters and national platforms.

Scope

a. Research and Innovation Actions

All R&I actions should demonstrate strong industrial commitment, be driven by user needs and concrete exploitation strategies, and they should cover the value/supply chain as appropriate. They should address manufacturability and include standardisation activities as appropriate. Focus is on one of the following themes:

i. **Application driven core photonic technology developments** for a new generation of photonic devices (including components, modules and sub-systems) **for agile Petabit/s Optical Core and Metro Networks.** The objective is to develop new photonic technologies for metro and core networks allowing capacities of Pb/s per node, and Tb/s per channel and 100 Tb/s per link over increased transport distances, while supporting network programmability features and fitting network operator requirements and roadmaps. Actions should include all new device developments for the envisaged network architecture. The action should also lead to network solutions with an energy consumption and equipment footprint reduction by more than 10 and a significant reduction in network cost. Actions may include system, network, control and security level aspects to the extent necessary for the action.

ii. **Photonic integrated circuit (PIC) technology:** The objective is to achieve major advances in chip integration technology, enabling a cost effective volume manufacturing of PICs with significantly enhanced performances (e.g. integration complexity, footprint, energy efficiency, speed, …) or new functions. Potential for such technology advances exists e.g. in selective area growth for multi-function integration, wider band-gap engineering,

heterogeneous integration, wafer-scale electronic-photonic integration, the use of new materials, and in new approaches to small and efficient laser sources. Actions may address also the related design methodology and tools and the optimisation of materials, and should include a validation of results with fabricated PIC prototypes.

iii. **Disruptive approaches to optical manufacturing by 2 and 3 D opto-structuring:** The objective is to develop new optical manufacturing approaches for photonic components with unprecedented resolution (down to the submicron and nano-scale) or for functionalization of the surface of the materials to tailor and optimise their characteristics for a specific application. Actions may also address the related material. Novelty may be related for example to the laser source, to the optical system for light manipulation, to light-matter interaction or to the exploitation of quantum effects. Actions should include the validation of the manufacturing approach through a functional prototype of an application relevant device that goes clearly beyond the state of the art.

The Commission considers that proposals requesting a contribution from the EU of between EUR 6 and 8 million (for theme a.i), between EUR 3 and 4 million (for theme a.ii and a.iii) would allow these themes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Minimum one action per theme will be selected.

b. Innovation Actions

Focus is on one of the following themes:

i. Innovation Incubator for SMEs[10]

The objective is to reinforce the competitiveness of photonics and end-user industries, in particular SMEs, by providing them one-stop-shop access, supported through competence centres, to services and capabilities such as expertise, training, prototyping, design, engineering or pilot manufacturing services for first users and early adopters enabling the wider adoption and deployment of photonic technologies in innovative products. The service to be provided to the SME should be driven by its business needs and the implementation must be flexible and fast to better cope with the speed of innovation in ICT and the SME requirements.

Large projects are expected to achieve critical mass and to better exploit EU-added value. The action may involve financial support to third parties in line with the conditions set out in Part K of the General Annexes. The consortium will define the selection process of additional users and suppliers for which financial support will be granted (typically in the order of EUR 30.000 – 100.000[11] per party). A maximum of 50% of the EU funding requested by the proposal should be allocated to this purpose.[12]

ii. Application driven core photonic devices integrated in systems: Actions should address validation and demonstration of photonic based systems for the target applications. Actions should also include standardisation activities. They should demonstrate strong industrial commitment, be driven by user needs and concrete business cases supported by strong exploitation strategies, and cover the whole value/supply chain and the end-user. Focus is on one of the following themes:

1. **Biophotonics: imaging systems for in-depth disease diagnosis:** The objective is the demonstration and validation in real-settings of innovative, easy to operate, compact, and non- or minimally invasive imaging systems to support diagnosis of age and life-style related diseases. The imaging system should either be label-free or be based on already/rapidly safety-approved labels. The feasibility and validity of the diagnostics approach should already have been demonstrated and it should potentially have a significant advantage with respect to current diagnostic approaches. The action should further develop, improve and assess the imaging system under a sufficient range of realistic conditions and disease profiles. The evaluation of its usability and applicability and its validation in clinical settings should be included.Actions should be driven by medical equipment manufacturers that are capable of and committed to the commercialisation of the solutions and include teams of physicians/clinicians to take part in the development and the functional and quantitative validation. Clinical trials are not covered by these actions and will normally take place after these actions.

2. **Sensing for process and product monitoring and analysis:** The prototyping and testing of new process analytical instrumentation for on-line/in-line control, targeting the food and pharmaceutical industry, based on compact and miniaturized photonics sensors that include novel key photonics components and modules. This new instrumentation should show significant improvements beyond the state of the art in sensitivity, specificity, long term stability (including calibration stability), high measurement rate, and reliability. Instruments should have self-testing/-monitoring functionalities and on-site calibration capabilities. The significant advantages compared to

10 Wherever appropriate, actions could seek synergies and co-financing from relevant national/regional research and innovation programmes, or from structural funds addressing smart specialisation. Actions 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.

11 In line with Article 23 (7) of the Rules for Participation the amounts referred to in Article 137 of the Financial Regulation may be exceeded, and if this is the case proposals should explain why this is necessary to achieve the objectives of the action.

12 It is recommended to also use established networks reaching out to SMEs like the Enterprise Europe Network and the NCP network for calls publications and awareness raising towards SME's.

conventional sensors in terms of performance or cost, as appropriate, have to be demonstrated in a specific industrial application for monitoring product quality in real settings.

The Commission considers that proposals requesting a contribution from the EU of between EUR 8 and 10 million (for theme b.i) and between 6 and 8 million (for theme b.ii) would allow these themes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Minimum one action per theme will be selected.

c. Coordination and Support actions

Supporting the industrial strategy for photonics in Europe: the objective is to support the development and implementation of a comprehensive industrial strategy for photonics in Europe. The action should include the development of strategic technology road-maps, strong stakeholder engagement (in particular Photonics21 stakeholders, National Technology Platforms, regional Clusters, end-user industries), coordination of regional, national and European strategies and priorities, and development of financial models and financial engineering to facilitate access to different sources of financing.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 3 million would allow this theme to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. No more than one action will be funded.

Expected Impact

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

a. Research and Innovation Actions

i. Agile Petabit/s Optical Core and Metro Networks

- next generation agile, high-capacity and energy efficient core and metro networks to support the highly connected and communicating society;
- Secured industrial leadership in optical communications systems for core and metro networks and reinforcing the full value chain in Europe.

ii. Photonic integrated circuit (PIC) technology

- Industrial volume manufacturing in Europe of PICs with significant competitive advantages in cost/performance and with reduced development costs;
- New or significantly enhanced integration technology platforms for a more competitive European photonic industry.

iii. Disruptive approaches to optical manufacturing by 2 and 3 D opto-structuring

- Technology leadership in optical manufacturing of 2 and 3 D opto-structuring;
- Emergence of innovative optical components or material for specific applications.

b. Innovation Actions

i. An Innovation Incubator for SMEs

- Broader and faster take-up of photonics in innovative products, in particular by SMEs.

ii.1. Biophotonics: imaging systems for in-depth disease diagnosis

- Substantially improved and wider deployed in-depth diagnosis, and more effective treatment of age and life-style related diseases;
- increased market presence in the Diagnostic and Analysis Imaging Systems and increased European competitiveness of the medical equipment industry.

ii.2. Sensing for process and product monitoring and analysis

- Increased process monitoring efficiency in the food and pharmaceutical industries and reduction of waste along the logistic food and drugs chain;
- Increased competitiveness of the European process and product monitoring equipment industry.

c. Coordination and Support actions

- Reinforced value chains and deployment of photonics technologies by stronger cooperation of photonics stakeholders, clusters and end-users;
- Increased competitiveness of the European photonics sector and improved access to risk finance for the photonics sector in Europe.

ICT-31-2017: Micro- and nanoelectronics technologies

RIA ☑ IA ☑ CSA ☑

Specific Challenge

While the state-of-the-art micro/nano-electronics technologies and their manufacturing are being further advanced towards market-readiness in the context of the ECSEL Joint Undertaking, it is essential to prepare for the future of the electronics industry the next wave of industry-relevant technologies to extend the limits (technological and/or economic) mainstream technologies will be facing in the medium term[13]. This is essential to maintain and increase Europe's longer-term capacity in the design and manufacturing of these technologies and to strengthen the competitiveness and market leadership of the many industries innovating through these technologies.

Scope

a. Research and Innovation actions

The work must be in the scope of one of the following topics:

- the development of new approaches to scale functional performance of information processing and storage substantially beyond the state-of-the-art technologies with a focus on ultra-low power and high performance. Work may address materials, processes, device and component architectures, system micro-architectures (processor and memory), security, design, modelling, simulation and nano-characterization, and must consider integration, systemability and manufacturability. Technologies exploiting the quantum effects in solid-state devices are also relevant. Advanced explorative technology development at TRL 2-3 is called for.
- 3D sequential integration (at transistor scale) possibly mixed with 3D parallel integration (at circuit level) for system solutions to increase functionalities and capabilities. Work could address interconnects (intra-layer and vertical structures), design challenges (3D design kits and tools, power models and optimization), prototyping and test methods. Proposals at TRL 2-3 are called for.

International cooperation with clear EU industrial benefits may be considered preferably with nations that have substantial research in the area (e.g. Japan, South Korea, Taiwan, and the USA).

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

b. Innovation action[14]

In **Equipment Assessment Experiments**, suppliers of innovative high-tech equipment install, assess and validate their prototypes or products that have left the R&D phase in environments that are very close to real-life conditions in cooperation with end-user. Proposals at TRL 6-7 are called for.

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.

c. Coordination and Support actions

In view of promoting the attractiveness of careers in micro/nanoelectronics towards young people, a dedicated pan-European challenge event should be proposed to showcase the possibilities offered by state-of-the-art hardware technologies (similar to the European code week for software apps). The sustainability of this event should also be addressed.

The Commission considers that proposals requesting a contribution from the EU of about EUR 0.5 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

Proposals should address the following impact criteria and provide metrics to measure and monitor success

a. Research and Innovation actions

The actions will aim at contributing to the future growth in Europe of the micro-/nanoelectronics and related industries.

- The proposals must describe how the proposed developments of new/enabling technologies will contribute to the target of doubling the economic value of semiconductor component production in Europe within the next

[13] Graphene is covered by the eponym FET Flagship initiative

[14] Access actions (including EuroPractice-type actions) are addressed under ICT-4

10 years as set by the Electronics Leaders Group in their strategic roadmap[15] and implementation plan[16].

- The proposals must outline a realistic roadmap for further progressing on the TRL range beyond the project timeframe and a concrete business perspective describing expected markets for the industrial partners and impact for European industry and society at large.

b. Innovation actions

- Proposals should clearly demonstrate the route from assessment to first use of the equipment. The user requirements of the equipment to be assessed should represent significant improvements to existing equipment in terms of capability, precision, efficiency or other characteristics opening new avenues of deployment.

c. Coordination and Support actions

- The actions will raise the awareness of young people for the potential offered by a technological career thereby attracting more students to the field.
- The proposed event should have ambitious targets in the number of participations (reach-out to thousands of students) and the scope of the activities (designs and prototypes) to be showcased.

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

EEB-05-2017: Development of near zero energy building renovation

RIA ☒ IA ☑ CSA ☒

Specific Challenge

Buildings and more specifically the housing sector represent about 40% of EU energy consumption. Ambitious renovation of the ageing building stock offers huge potential to reduce that energy consumption. Lowering the energy costs for households while increasing in-house comfort will not only help to achieve EU environmental objectives, but will also benefit EU economy and contribute to social well-being.

A large-scale deep rehabilitation of the residential building stock to match the net-zero energy standards at affordable price must be achieved. Breakthrough solutions are required to reduce energy consumption in building (e.g. in space heating/cooling and domestic hot water production, maximising the envelope performances, heat recovery and local use of renewables) with the support of advanced BEM (Building Energy Management) systems. Proposals should go beyond the state of the art and previous project results of the EeB PPP.

Scope

Research should address in-depth analysis and subsequent improvement of the renovation process, including innovative technical elements/products/processes aiming to improve the decision-making, and should be based on a collaborative multi-value multi-stakeholder exercise. Methodology, guidelines and effective operational tools are needed to ease the selection between renovation scenarios. The analysis should take into account life cycle assessment, life cycle costing, indoor environment quality, as well as user behaviour and acceptance. Research should lead to innovative concepts for a systemic approach to retrofitting which integrates the most promising cost-effective technologies and materials, in order to reduce heat losses through the building envelope and also the energy consumption by ventilation and other energy distribution systems, while increasing the share of renewable energy in buildings.

The new tools will help revalorisation of existing buildings in the long term, including the energy performance of the building as a factor of the total property value. This should be reflected in the definition of innovative business models where all relevant actors are involved, including public authorities and investors.

Proposals should aim at maximizing the capacity of replication of the developed concepts and methods for integrated sustainable renovation. Large-scale market uptake should be addressed, for example by targeting buildings with similar use conditions and/or comparable blocks of buildings or districts in need for renovation.

Proposals should show clear evidence of technical and financial viability of the solution through their application on real case demonstrations.

[15] https://ec.europa.eu/digital-agenda/en/electronics-roadmap-europe

[16] https://ec.europa.eu/digital-agenda/en/news/european-industrial-strategic-roadmap-micro-and-nano-electronic-components-and-systems-0

Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL 6. This topic addresses cross-KET activities.

A significant participation of SMEs with R&D capacities is encouraged.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 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.

Expected Impact

- Reduction of at least 60% in energy consumption in order to reach the target of near zero energy compared to the values before renovation, while enhancing indoor environmental quality.
- Decrease of installation time by at least 30% compared to typical renovation process for the building type.
- Demonstration of a high replicability potential and of large market uptake capacity.
- Affordability considering all costs involved, with a payback period below 15 years.
- New generation of skilled workers and SME contractors in the construction sector capable of applying a systemic approach to renovation.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

EEB-07-2017: Integration of energy harvesting at building and district level

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Integration of energy harvesting approaches is a major challenge, in particular the development and integration of different renewable energy sources at building and district scale.

The envelope should be considered as an active and/or adaptive skin that interacts with the external environment and strongly influences the building energy performance and indoor comfort. Indeed, in view of a large-scale deployment of nearly-zero energy solutions in existing buildings, besides reducing energy demand through highly insulating materials and reduction measures, the possibility to harvest energy in the building envelope is of great importance.

The district dimension should be taken into account, both because of a higher potential for integration and optimisation of renewable energy sources, and because of the potential of additional energy harvesting approaches.

Scope

Proposals should aim at maximising the harvesting of renewable energy (for heating, cooling, electricity, domestic hot water, etc.) at building and district scale (e.g. exploiting large renewable energy source installations and heating and cooling networks). Research results should contribute to drastic energy saving and CO2 emission reduction while enabling massive replication in low zero energy buildings and energy self-sufficient districts. the focus is on a cost-effective and easy installation in a wide variety of buildings and surroundings.

Buildings are connected with various entities like suppliers and distribution system operators through different networks (internet, smart meter linked to the grid, energy storage systems, electric vehicles, etc.). Therefore, proposals should take into account an appropriate integration of monitoring and control systems for the developed solutions, combining, where relevant, additional functionalities such as safety and security.

Proposals should be flexible enough to cope with different designs and architectural concepts, with components being especially shaped and integrating different material combinations (such as glass, pre-casted elements, membranes).

The modular dimension is important to allow a cost-effective and easy installation in a wide variety of buildings and processing practices.

Proposals should enable a reduction of maintenance and operation costs, in particular when many sensors and actuators are cost-effectively distributed throughout the envelope.

Applicability in different geographical areas is important.

Clear evidence of technical and economic viability should be provided by validating and demonstrating the proposed adaptable envelope in real case retrofitting projects.

Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL 6.

A significant participation of SMEs with R&D capacities is encouraged.

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

Expected Impact

- The cost related to new technologies should not exceed conventional standard building costs by more than 20%.
- Demonstration of the replicability potential in a real case-study.
- Solutions with a payback period of below 10 years.
- The integrated harvesting systems will cover at least 30-40 % of the overall energy demand for new buildings and 20% for renovated buildings.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

NMBP-04-2017: Architectured /Advanced material concepts for intelligent bulk material structures

RIA ☑	IA ☒	CSA ☒

Specific Challenge

The development of smart materials has been gathering pace over the past few years to develop novel concepts for intelligent components and structures with integrated functionalities that are able to communicate and interact with their environment, store data about their condition and react accordingly to external stimuli. Research in the areas of biomimetic bio-inspired engineering and nanomaterials can provide several examples of the development of smart materials and has seen a significant expansion. Examples include materials that can alter their physical properties, (e.g. viscosity, shape, colour and more) in response to temperature, stress, electrical or magnetic fields, convert sunlight into electricity, store energy, etc. Smart materials have also been used extensively in sensor developments in aerospace and automotive applications with the aim of producing intelligent structures and components that provide information of their in-service conditions However, there are several concepts that have not yet been implemented in industrial scale. Such technologies include self-repair or self-healing materials, materials for vibration suppression, lightweight composites that can inform the user of any internal damage without the need of time consuming and expensive Non-destructive Examination (NDE), materials or structures that can undergo shape change either passively or by activation, Functionally Graded composite Materials (FGMs), energy storing components, etc. There is a need for predictive modelling of materials functionalities for those materials for which there are currently no accurate commercial or open-source codes available.

Scope

Proposals are sought to address specific industrial needs and facilitate the implementation of smart materials for applications in transport, consumer goods and ICT. The potential extension of these applications to other industrial sectors such as e.g. oil & gas and petrochemicals will be an asset. The technical challenges to be addressed relate to the development, processing and integration of smart materials with new functionalities, as e.g. for: advanced sensors (nanosensor technologies), damage detection, self-repair, self-actuation, self-sensing morphing, magnetic functionality (for non-magnetic materials), optical functionality, sound and vibration damping, thermal management in ICT applications. Material concepts based on bio-inspired solutions can also be considered. Modelling of the properties of relevance to manufacturing should be considered and further developed. Although the materials most suited to such development are lightweight advanced composites from different material classes, (like multiferroics, polymeric, ceramic, glass or metal matrix composites, organic fibrous materials). It is expected that such smart materials may make use of the unique properties possessed by nanoparticles and therefore the development of nanomaterial based intelligent components will be within the scope of the call. The development of such material structures has to be accompanied by high resolution analytical tools that are able to simulate and characterise the materials on all scales and, moreover, to track and reveal their function –structure relations in situ. The functionalities of smart materials will require the identification of gaps in standards and future pre-normative activities will have to be addressed as part of the scope. For this topic proposals should also be able to demonstrate in addition to the development concept, the feasibility of such technologies in terms of cost, production and processing methodologies, reuse/recycling of materials at end of life and reliability. Industrial and/or additional experimental partners should ensure broad validation and adoption of both the software and the materials.

The implementation of this topic is intended to start at TRL 4 and target TRL 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 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

The implementation of novel smart material technologies is expected to pave the way for innovative environmentally friendly smart products:

- Enhancing the market opportunities for European industries;
- Improving consumer safety;
- Reducing maintenance costs;
- Improving resource efficiency;
- Contributing to a future circular economy;
- Improved understanding of materials properties based on theoretical materials models.

Enhancing the knowledge base in the EU not only at the R&D level but also at the manufacturing and production level, creating a highly skilled workforce with improved levels of job satisfaction.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

NMBP-05-2017: Advanced materials and innovative design for improved functionality and aesthetics in high added value consumer goods

RIA ☒	IA ☑	CSA ☑

Specific Challenge

Creative industries have been defined as one of the most active, significant and relevant new emerging industrial sectors in the European economy (Report on Emergency Industries, PwC, 2012). The creative industries linked to manufacturing (e.g. architecture, automotive, art, crafts, supports for cultural items, decoration, fashion, furniture, lighting, interior design materials and products, jewels, luxury, media supports, publishing, sport and toys) are generators of competitive advantages that cannot be reproduced elsewhere, promoters of local development and drivers of industrial change (COM(2012)537 'Promoting cultural and creative sectors for growth and jobs in the EU').

Creative SMEs in particular can make use of design as a strategic tool to create innovative products and services addressing new consumers' standards and societal challenges while assuring competitive and sustainable development.

However, the future European exploitation of this rich sector depend on the EU ability to support high-growth creative SMEs and start-ups in exploiting highly innovative technological advances in materials for commercial, cultural and societal applications.

To promote design-driven innovation, a number of action lines have been endorsed by the Commission, including integrating design into research and development and promoting new collaborative innovation strategies ('Implementing an Action Plan for Design-Driven Innovation', SWD(2013)380).

Scope

Proposals should address the development of innovative advanced material solutions (e.g. superhydrophobic/superoleophobic nanomaterials and nanoscale systems, self-cleaning and self-healing systems, smart textile fabrics and papers, biomimetic, shape change/memory materials, self-assembling systems, energy harvesters) for use in the creative industry sectors defined above to make urban living significantly easier, more sustainable, more comfortable, more secure and more functional. Creativity, cultural and societal values, alongside specialist knowledge, should be driving the material innovation (e.g. increased performance, lightness, safety, sustainability, improved lifetime) to add value to products through the use of new intangible material functionalities (e.g. creative design, artistic expression, trend translation, enhanced sensations, cultural values).

Proof of concept in terms of product and/or process must be delivered within the project, excluding commercially usable prototypes (in compliance with European Commission Communication 2006/C323/01), but convincingly demonstrating scalability towards industrial needs.

In order to ensure the industrial relevance and impact of the research efforts, the key properties improvement and commercial potential of the innovative technologies compared to state-of-the-art solutions currently available on the market should be convincingly assessed in the proposal. Sustainability aspects in the whole life cycle of the final products should be taken into account. The active participation of designers, artists, societal stakeholders, material

scientists, materials suppliers, researchers, manufacturers and end users of the resulting products represents an added value and this will be reflected in the second stage of the evaluation. As relevant, the proposed activities should address sex and gender specific aspects[17].

Activities are expected to focus on Technology Readiness Levels 4 to 6, and target Technology Readiness Level 7.

A significant participation of SMEs with R&D capacities is encouraged.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 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.

Expected Impact

- Novel, higher added-value, better performing, sustainable, versatile, appealing designs and creative solutions for consumer goods based on innovative advanced materials or structures;
- Good integrability of the proposed innovative materials in final products (e.g. using a modular approach) and quickly reconfigurable to new custom requirements;
- Promoting new collaborative innovation strategies and practices along the value chain to develop commercial, cultural and societal applications with a strong user orientation, creating new business opportunities for the European industry and contributing to the circular economy in terms of one or more of the following: increased competiveness, faster recovery of investment, access to new markets, access to new customer segments, increased business effectiveness, increased costumer engagement, increased environmental sustainability;
- Enhancing innovation capability and competiveness of European SMEs by effectively combining and transferring new and existing knowledge with 'intangible' factors (e.g. creative design, artistic expression, trend translation, enhanced sensations, cultural values);
- Increasing awareness of designers about new materials;
- Contribute to achieving the relevant EU policy objectives in COM(2012)537, 'Promoting cultural and creative sectors for growth and jobs in the EU'.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

NMBP-07-2017: Systems of materials characterisation for model, product and process optimisation

RIA ☑	IA ☒	CSA ☒

Specific Challenge

As material systems and device structures become nanosized and nanostructured, significant challenges exist with respect to their design and the tailoring of their functions in a controlled way. The use of discrete materials models, as a bridge for linking and coupling nanostructure features to macroscopic device functionality is gaining increasing importance in the fast and reliable development of new materials, devices, and the control of the related production processes. Characterisation techniques and experimental data for process optimisation and model validation are key in such developments.

Europe has a large number of first-class laboratories for characterisation in the field of advanced materials and nanotechnologies. In some cases, regional hubs of laboratories addressing characterisation for specific industrial or application sectors have already been successfully established. Nevertheless, there is an ever increasing need for a strong transnational and trans-sectorial coordination and optimisation of existing characterisation technologies and their utilisation for the benefit of widespread process optimisation and model validation. This includes the need for widely agreed experiment protocols, multi-technique and multi-scale characterisation approaches, metadata descriptions of interpretation tools and accessible, relevant, and reliable data bases for raw and interpreted data.

Scope

In the triangle of manufacturing, modelling, and experimentation, the projects should develop an open innovation environment for the optimisation of materials, materials behaviour and/or nano-device manufacturing processes, and for the validation of materials models[18] based on experimental characterisation.

[17] See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

[18] http://ec.europa.eu/research/industrial_technologies/modelling-materials_en.html

An open innovation environment should be created linking characterisation laboratories with capacities adapted to process optimisation and model validation needs. Also information on characterisation tools and expertise should be included.

Commonly agreed validation and measurement protocols should be developed which address the most relevant issues related to experiments, process optimisation and model validation. Projects should also document their protocols for the interpretation of raw experimental data and document reliable models for data interpretation where needed. The project may seek to agree standards for interpretation protocols. Meta data to describe all protocols should be agreed.

The same metadata should be used for interfacing existing characterisation databases to make search and linking between different, distributed databases effective and easy. The metadata should allow future extension to other sectors. Strategies and test rules pertaining to data integrity and quality mechanisms should be established. A concept to make raw and interpreted data citable should be developed and implemented for this system. The project should ensure wide spread participation.

Projects should bring together a representative number of players from public and industrial nanoscale characterisation laboratories, from manufacturers, and from the academic and industrial materials modelling communities. To ensure a wide coverage, these players should cover several industrial or application sectors. Existing regional/national hubs may also participate, but they need to connect in the project to players in other countries, possibly also other regional/national hubs.

The proposal should present a credible business plan for the maintenance of the open environment after the project duration.

Proposers are strongly encouraged to consult the stakeholders outside the consortium through existing groups such as the European Materials Modelling Council or the Characterisation cluster. Appropriate resources should be foreseen for clustering activities.

The implementation of this topic is intended to start at TRL 4 and target TRL 6.

This topic is particularly suitable for SMEs.

International standardisation, e.g. with the ISO, may be considered.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 4 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

- Increased speed of material and/or nano-device development through development of an open innovation environment;
- Wide acceptance of the proposed solutions beyond the consortium;
- Use of the protocols and systems in other relevant areas or sectors beyond the ones covered by the project;
- Use of the protocols in the development of new standards;
- Clear, prospects for quantified, socio-economic gains from the proposed solutions should be addressed, supported by quantifications;
- The maintenance aspect of the developed databases beyond the lifetime of the project should be addressed.

NMBP-13-2017: Cross-cutting KETs for diagnostics at the point-of-care

RIA ☑ **IA** ☒ **CSA** ☒

Specific Challenge

Research and technology development at the interface of key enabling technologies has the potential to provide novel technological Micro-Nano–Bio integrated Systems (MNBS) platforms to enhance the ability to sense, detect, analyse, monitor and act on phenomena from macro (e.g. body, organ, tissues) to nano scale (e.g. molecules, genes). These developments have a high potential for facilitating personalised and preventive healthcare. However, the translation of laboratory proven concepts to the clinical environment involving pre-clinical and clinical testing, prototyping, and small series manufacturing is currently lagging. Business development and market growth are therefore still limited. The challenge is to bring new promising laboratory proven MNBS concepts for addressing priority healthcare needs from the laboratory to the clinic.

Scope

The focus is on further development into a clinical setting of novel MNBS platforms, techniques and systems that have already been proven in a laboratory setting (laboratory Proof-of-Concept). These must pertain to one or more of the following:

a. In vitro/in vivo diagnostics that are deployed at the point of care;

b. Therapy monitoring at the point of care.

Proposals should pay attention to facilitate clinical data harvesting, e.g. for medical regulatory purposes and/or to enhance epidemiological monitoring of health and disease patterns. As relevant, the proposed activities should address sex and gender specific aspects[19].

Proposals should demonstrate clear compliance with applicable Good Laboratory Practice /Good Clinical Practice /Good Manufacturing Practice, and be consistent with ISO and other regulations (both national and European). The translation from the pre-clinical phase to early clinical testing, including design and pilot manufacturing in appropriate volume for clinical testing (small series), pre-clinical and early clinical testing is a necessary part of the work-up. Attention should be paid to the requirements for Health Technology Assessment (HTA). Standardisation issues have to be taken into account where appropriate.

Activities are expected to commence at Technology Readiness Levels 3/4 and reach 5-6.

A significant participation of SMEs with R&D capacities is encouraged.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 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

Proposals should address one or more of the following impact criteria and provide metrics to measure and monitor success.

- Address priority needs in healthcare diagnostics and / or therapy monitoring, for the benefit of patients;
- Provide affordable systems with unique features that address specific well identified requirements in healthcare;
- Progress the development of advanced integrated MNBS based diagnostic health platforms, techniques or systems from the laboratory Proof-of-Concept to the clinical setting;
- Establish a world-class European competitive industrial R&D and manufacturing competence in Micro-Nano-Bio Systems integration for healthcare diagnostics applications;
- Strengthening the industrial value chain and progress to marketisation;
- Early involvement of regulatory bodies and patients in the new developments.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

This topic will be co-funded by LEIT-ICT and LEIT-NMBP within the context of a Cross-KET initiative for Health, for a total budget of EUR 15 000 000.

NMBP-15-2017: Nanotechnologies for imaging cellular transplants and regenerative processes in vivo

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Detection and monitoring of cell and tissue transplants in vivo is of utmost importance for development of clinical cell therapy. Suitable nanotechnology-based imaging approaches with high sensitivity should allow for monitoring of cell viability, engraftment and distribution, also through the use of nanomaterials for cells marking. Appropriate imaging techniques have been developed for application in small animals, but are not available yet for use in preclinical large animal models and patients. In particular, such technologies will represent an important safety measure enabling early detection of cell based therapy.

Scope

Proposals should focus on the following:

- Development of highly sensitive imaging approaches enabling discrimination of living cell and tissue transplants based e.g. on optical imaging, magnetic resonance imaging and / or nuclear medicine techniques;

[19] See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

- Monitoring should be highly sensitive, in best case allowing for detection of single cells and cell morphologies;
- Possibility of non-invasive whole body monitoring (magnetic, optical) in large animals;
- Development of clinically applicable imaging approaches, taking into account medical regulatory aspects;
- Interpretation of the data with theoretical models (to be developed if necessary).

As relevant, the proposed activities should address sex and gender specific aspects[20].

Activities are expected to commence at Technology Readiness Levels 3/4 and reach 5/6.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 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.

Expected Impact

- Availability of novel highly sensitive nanotechnology-based imaging approaches allowing for monitoring of survival, engraftment, proliferation, function and whole body distribution of cellular transplants in preclinical large animal models and patients;
- Imaging technologies facilitating the provision of new regenerative therapies to patients;
- Opening of a new market sector for imaging equipment and supplies, reinforcement of the European healthcare supply chain and improvement of the competitiveness of the European healthcare sector.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

NMBP-16-2017: Mobilising the European nano-biomedical ecosystem

RIA ☒ **IA** ☒ **CSA** ☑

Specific Challenge

Developing innovative nanomedical products for a more personalized, predictive and efficient medicine requires further integration of nanotechnologies aiming at applications in human health notably with further Key Enabling Technologies. It also needs a functioning ecosystem of actors, in which the research, translation, regulation, standardization and take-up of innovative nanomedicines by the different European healthcare systems is stimulated. End-of-life/disposal and recyclability issues should also be addressed as appropriate.

Scope

Supporting the development of an ecosystem for nanomedicine in Europe, including activities such as coordinating national platforms and regional clusters; developing common training material and services; international cooperation related to community building, road-mapping, regulation, manufacturing, reimbursement and pricing, standardization and recyclability; and reaching out to attract the interest of citizens, young talents and young entrepreneurs. Collaborations with relevant technology platforms or similar initiatives in Europe or worldwide will allow deeper and more effective cross-KETs activities for innovative integrated solution and well as a consolidated international strategy for the sector.

Attention should be paid to achieve a cross-regional, cross-sectoral and cross-technological approach, based on the analysis of relevant roadmaps, strategic research agendas or smart specialisation strategies which have listed nanomedicine or personalised Medicine as one of their priorities. These different approaches might for instance be united into one “meta” roadmap.

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

- Increased take-up of innovative Nanomedicine solutions by industry and SMEs, end-users, regulatory and public authorities, healthcare insurances, doctors and patients, research organisations and academia;
- Improvement of cross-KETs activities to provide better integrated healthcare solutions;
- Increased international networking with new potential market opportunities;
- Improvement of the competitiveness of the European healthcare sector.

[20] See definition of the 'gender dimension approach' in the introduction of this Work Programme part.

NMBP-29-2017: Advanced and realistic models and assays for nanomaterial hazard assessment

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Risk assessment is often largely based on the toxicological profile of the material in question. The reason is that the costs related to hazard assessment are usually not in balance with the costs for exposure monitoring, let alone risk containment or risk mitigation. However with the very big number of new material likely to enter production and use, the usually short period between development and marketing and the increase in societal risk aversion, the classical toxicological testing paradigm so far focusing on in vivo testing is gradually but steadily shifting towards in-vitro and in-silico testing approaches. This is particularly true in the field of nanosafety where, in front of potentially thousands of different nanomaterials, economic constraints make it essential to develop and establish robust, fast and yet reliable and realistic methods that should be applied in figuring out "nanomaterials of concern".

Significant progresses have been made in assessing nanomaterial hazard. Yet, knowledge gaps remain on long-term effects (low doses, chronic exposure), both for human health and the environment. Questions also arise on the adequacy of the models used in existing in-vitro and in-silico testing and on the relevance of the exposure conditions (e.g. linked to the current understanding of the nanomaterial-biomolecule-cell interface) to correctly assess and predict real-life hazards. It is also necessary to prepare the ground for the next challenge, defining hazard profiles based on in-silico testing alone.

Scope

With a view to intelligent testing strategies (ITS) for nanomaterials, it is of high priority to develop and adopt realistic and advanced in vitro tests which have the potential to substantially improve the relevance of in-vitro approaches. Current in-vitro experiments mostly rely on established immortalized single cell lines, which often do not reflect the in-vivo situation. Therefore, new or advanced models, such as co-culture models, 3D cultures or primary cell models should be developed for relevant endpoints lacking, or having inadequate, in-vitro models. Transport through biological barriers could also be addressed, for instance with the objective of assessing the true internal dose of the materials to which living organisms are being exposed, as well as disease models or models with impaired barriers.

Low-level chronic exposure is a likely scenario as many ENMs will probably exist at very low concentrations in the environment and potentially be persistent. Thus, assays and models with low chronic exposure, elucidating toxicokinetics, different mechanisms of action and adverse outcome pathways, as well as specific disease models, should be developed and assessed against appropriate animal studies and could include for instance effects on kinetics, growth, reproduction, metabolism, and behaviour. Research could also focus on long-term, ecologically relevant, effects in realistic environmental concentrations of ENMs.

The transformations in biological or environmental matrices have been demonstrated as having potentially significant effect on the ENM tests results. Therefore, dosing with realistic exposure levels and conditions should be an integral part of the developments, taking into consideration the dynamic and complex nature of environmentally induced transformations with realistic external and internal forms and levels of exposure.

For validation purposes and to ensure that the experimental results can form a solid and meaningful basis for grouping, read-across, and modelling purposes, the testing should be performed on sets of well-defined and characterised libraries of nanomaterials and, when possible, on nanomaterials for which high-quality in-vivo data are already existing (to minimize animal testing).

Activities are expected to focus on Technology Readiness Levels 4 to 6.

This topic is part of the open data pilot.

This topic is particularly suitable for international cooperation.

The Commission considers that proposals requesting a contribution from the EU between EUR 10 and 13 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

No more than one action will be funded.

Expected Impact:

- The research approach should be innovative and represent a significant advance beyond the current state-of-the-art. Research should focus on provision of solutions to the long-term challenge of nanosafety and nanoregulation;
- New models and assays for use in in-vitro and in-silico testing improving prediction of chronic effects in a broad array of representative organisms and changes in ecosystem function;

- Improved predictive power of in-vitro and in-silico approaches for in vivo systems to support acceptance in a regulatory framework;
- Developed test guidelines for further standardisation, and ring testing (including guidance on design of the ring testing).

5 iii. Leadership in Enabling and Industrial Technologies - Space

GALILEO-3-2017: EGNSS professional applications

RIA ☒ IA ☑ CSA ☒

Specific Challenge

Professional applications are covering different market segments. Precision agriculture, mapping and surveying have been the pioneers in the use of GNSS since the early years. The challenge is to make these applications more affordable, easy to use and integrated with other solutions and technologies, including for example earth observation, e.g. Copernicus services, in order to enable new targeted innovative solutions. EGNSS is offering additional accuracy and features, such as multiple frequencies and the high precision service in the frame of the future commercial service, contributing to enabling these innovative solutions, including in challenging environments. Power networks, telecommunication networks and financial transactions[21] are today synchronised, many of them using GNSS. These networks are becoming more and more distributed (e.g. distributed power generation of renewable energies), interconnected and more demanding in terms of synchronisation performances (e.g. in 4G-LTE and future internet), or requiring authenticated solutions as for the financial transaction time stamping. The specific challenge is in this case to build on the enhanced capabilities offered by Galileo that will provide high accurate timing information and authentication services, to develop a new generation of high performing, reliable and EU independent timing and synchronisation applications that can cope with these emerging and demanding needs.

Scope

Proposals should aim at developing new innovative applications, building also on the combination of EGNSS with earth observation and Copernicus services, with commercial impact or with satellite communication. Proposals should have a clear market uptake perspective. Below are some areas which are identified as especially promising for further EGNSS application development:

Agriculture: Automated machine guidance, precision farming and machine control and field boundary measurements are possible areas to be addressed.

Surveying and Mapping: Land survey, marine survey, cadastral and geodesy, and construction are possible areas to be addressed.

Timing and Synchronisation: Telecommunications, power generation and finance are possible areas to be addressed.

Other professional applications: clearly demonstrating amongst others the contribution of EGNSS differentiators, the potential of integration with earth observation data, and the future commercial potential are also invited.

For all the professional areas, the development and innovation should build on:

- Multiple-frequencies E1, E5 and E6;
- Galileo specific signal modulation, e.g. AltBOC;
- High precision and authentication services that will be provided by Galileo, i.e. in the frame of the commercial service;
- Fusion with other data, such as from earth observation satellites or other in-situ sensors.

EGNSS should be part and parcel of the envisaged solution(s). However, where a combination of EGNSS with other technologies is required to make the application(s) work, this is not excluded from the scope.

In projects to be funded under this topic participation of industry, in particular SMEs, is encouraged.

The proposal shall have a clear intention to commercialise the products and services developed, including a business plan.

Proposals addressing PRS (Public Regulated Service) related applications are not in the scope of this action.

[21] Cf. also Article 50 of Directive 2014/65/EU on Markets in Financial Instruments.

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

Activities should aim at developing highly innovative applications taking advantage of Galileo and EGNOS aiming at decreasing the barriers to access such professional applications, in term of price of the solution and easiness to use, increasing the number of users and explore new innovative use of GNSS. Specifically for agriculture the expected impact is also to improve the productivity and decrease the environmental impact. For timing and synchronisation applications, the expected impact is to contribute to cope with emerging network synchronisation needs in terms of accuracy and robustness, while contributing to improve EU dependency from other GNSS.

COMPET-1-2017: 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 conditio-sine-qua-non for achieving Europe's strategic objectives. "Non-dependence" refers to the possibility for Europe to have free, unrestricted access to any required space technology. Whenever possible multiple (>1) sources for the critical technologies shall be promoted across Europe. Reaching non-dependence in certain technologies will open new markets to our industries and will increase the overall competitiveness of the European Space sector.

Scope

Research in technologies for European non-dependence and competitiveness has been undertaken within the frame of the Joint EC-ESA-EDA Task Force on Critical Technologies for European non-Dependence, launched in 2008. The Joint Task Force recently updated the list of actions for 2015-2017[22].

Activities shall address technologies identified on the list of Actions for 2015/2017 focusing on those areas that have not so far benefitted from prior Framework Programme funding and representing the highest potential for being implemented through the types of action available in Horizon 2020.

Accordingly, the following priority technologies have been identified:

- U09 - Cost effective multi - junction solar cells for space applications.
- U16 - Space qualified GaN components and demonstrators.
- U17 - High density (up to 1000 pins and beyond) assemblies on PCB and PCBs.
- U21 - Very high speed serial interfaces.
- U23 – Development of large deployable structures for antennas.
- U26 - Space qualified carbon fibre and pre-impregnated material sources for launchers and satellite subsystems.

Technological spin in and/or bilateral collaborations should be enhanced between European non-space and space industries and proposals are expected to provide advanced critical technologies that are of common interest to different space application domains (e.g. telecom, Earth observation, science, etc.), or even with applicability to terrestrial domains.

Proposals should strive to go beyond the present state-of-the-art or, preferably, the expected state of the art at the time of completion if alternative technologies are being developed outside Europe. High level specifications and key requirements can be found in the list of actions for 2015-2017.

Proposals should include a work package dedicated to the development of a commercial evaluation of the technology, and should address how to access the commercial market with a full range (preload) of recurring products.

A maximum of one proposal per identified priority technology line will be selected for funding.

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

[22] Excerpt from "Critical Space Technologies for European Strategic Non-Dependence – Actions for 2015/2017" (http://ec.europa.eu/growth/sectors/space/research/horizon-2020)

In projects to be funded under this topic participation of industry, in particular SMEs, is encouraged.

Expected Impact

- Reduce the dependence on critical technologies and capabilities from outside Europe for future space applications, as identified in the list of Actions for 2015/2017 as part of the Joint EC-ESA-EDA task force on Critical Technologies;
- 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;
- Enhance the technical capabilities and overall competitiveness of European space industry satellite vendors on the worldwide market;
- Open new competition opportunities for European manufacturers by reducing the dependency on export restricted technologies that are of strategic importance to future European space efforts;
- Enable the European industry to get non-restricted access to high performance technologies that will allow increasing its competitiveness and expertise in the space domain;
- Improve the overall European space technology landscape and complement the activities of European and national space programmes;
- 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.

COMPET-2-2017: Competitiveness in Earth observation mission technologies

RIA ☑ IA ☒ CSA ☒

Specific Challenge

European industrial competitiveness in Earth observation depends on the availability of demonstrated/validated systems and sub-systems for operational and advanced missions in the commercial and institutional domain, but also on the readiness in the emerging market for innovative missions relying on small and very small systems (constellation, formation flying and fractionated instruments).

The specific challenge, for the mid-term is to bring the Technology Readiness Levels (TRL) forward for a number of Earth observation technologies and to ensure the readiness of European solutions to propose and support new mission concepts taking advantage of nano-, micro- and mini-satellites.

In recent years small satellites have become more attractive due to lower development costs and shorter lead times. There is a natural trade-off to be made between spacecraft size and functionality, but advances in both miniaturization and integration technologies have diminished the scope of that trade-off.

Moreover, within the context of preparatory work for the next generation of the Copernicus space component, mission concepts will be developed by European industry based on mature Earth observation technologies and solutions.

Scope

The aim of this topic is to demonstrate, in a relevant environment, technologies, systems and sub-systems for Earth observation. Proposals should address and demonstrate significant improvements in such areas as miniaturisation, power reduction, efficiency, versatility, and/or increased functionality and should demonstrate complementarity to activities already funded by Member States and the European Space Agency.

Proposals that develop technologies targeting TRL 6, or lower TRLs, are welcome.

Proposals are sought with relevance in the domain of technology development for space in the fields of:

- Optical technologies for high precision sensing, including high stability structures, stable and lightweight mirrors, large focal planes, adaptive optics and wave front error (WFE) control techniques.
- Detector technology and complete detection chain enhancement in the domains of CMOS-TDI and Infrared for Earth observations in orbit aiming at higher resolution and performance.
- Space sensors, atmospheric sounders and space technology and mission concepts for operational high resolution emission measurements, particularly of climate change determining Greenhouse gases such as CO_2 and methane.
- Active antennas for radar - exploring lower (P and S) and higher (X and Ka) frequency ranges - Transmit/Receive Modules (TRMs), digital beam-forming and waveform generation, large deployable reflectors.

- High performance and miniaturised optical (ultra-violet, visible, infra-red), and SAR sensors. Remote sensing of the Earth by means of multi-mission payloads in support of the hydrological cycle modelling and prediction, and accurate weather forecast.
- Sensors, actuators and control technologies for high precision Attitude and Orbital Control Systems (AOCS), in particular for small satellites, and Guidance, Navigation and Control (GNC).
- Technologies to advance in fractionated systems and formation flying for Earth Observation.

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

In projects to be funded under this topic participation of industry, in particular SMEs, is encouraged.

Expected Impact

- The proposals must describe how the proposed developments will contribute to strengthening Europe's position in industrial competitiveness in technologies for Earth observation payloads and mission, despite the target platform size and scalability.
- The technologies to be addressed in the proposals will represent significant improvements to existing Earth observation missions in terms of capability, precision, efficiency or other characteristics, opening new avenues for future space systems.
- Substantially improved in-depth state-of-the-art technologies in key areas such as optical and radar systems, sounders, lidars and detectors for Earth observation.
- 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.

COMPET-3-2017: High speed data chain

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Satellite missions with higher productivity add growing data requirements on missions. As a result high speed data handling, processing and transfer are required. These growing requirements are shared among a variety of applications, with a main focus on Earth observation and Telecommunication systems, and with applications also in Science and Exploration. Data challenges have to be addressed within the data chain on-board the satellites (e.g. processing, storage, compression, optimisation) and between the satellite and other terminals that can be located on ground or air-borne platforms, and also on-board other satellites. In particular, next generation Earth observation sensors pose the most challenging requirements for data links (in the Gbps range), including links from orbit to ground and inter-satellite communications (LEO to ground or GEO to ground), and including technology transfer related to very small LEO satellites (nano and cubesats), as well as direct ground link to very small LEO satellites (nanosat and below, including cubesats) considering optical technologies.

Faster processing, larger storage, and high bandwidth transmissions to users will be needed. Moreover, smart on-board data compression and optimisation will become a growing necessity. All these improvements will be required to efficiently support the next generation of data intensive missions. To support this future scenario, innovations must be brought to the payload data management system (including data optimisation processes), to inter-satellite links, to satellite-ground communication, and to the ground segment data handling system.

Moreover, within the context of preparatory work for the next generation of the Copernicus space component, mission concepts will be developed by European industry based on mature Earth observation technologies and solutions.

Scope

Activities shall aim at providing advanced on-board data handling and transfer for Earth observation and Telecommunication systems. These activities shall address the future challenge of high data rates transmission and significant improvements in data throughput:

- Re-configurable high data rate links including high frequency bands: direct and interoperable links between LEO satellites and links to Earth and mobile or aerial platforms (including X band, Ka band and optical), or direct links between GEO satellites and Earth or mobile or aerial platforms, and inter-satellite links (beyond the specifications of the European Data Relay System – EDRS).
- On-board data processing, implementation of complex data algorithms (e.g. by means of programmable Digital Signal Processors – (DSPs).

- On-board data compression systems to improve on-board data storage (memory modules for new memory devices).
- High data rate image (optical and/or radar) and video processing, such as lossless compression, image enhancement techniques, etc.
- Improved on-board data storage (management of memory modules for new memory devices).
- Anticipate how the ground segment will cope with higher data rates to improve the overall data throughput. In particular to address the required evolution of technologies, architectures, products and end-user expectations.
- Anticipate the necessity to link innovative ground segment architectures addressing new ICT technologies, including cloud, in the "Big Data" domain and the rise in user demand for wide access to Near Real Time (NRT) data in social media and mobile applications.

A maximum of one proposal, exploiting NRT quality of data, with due regard to interoperability of interfaces to both innovative ICT dissemination architecture and applications, will be selected for funding.

The Commission considers that proposals addressing the full data chain (processing and compression, storage and transmission), or a coherent part of it, requesting a contribution from the EU of between EUR 5 to 7 million, and proposals addressing the rise in user demand of NRT data, requesting a contribution of between EUR 2 to 3 million would allow this specific topic to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

In projects to be funded under this topic participation of industry, in particular SMEs, is encouraged.

Expected Impact

- To provide elements for the high data chain management (including processing and compression, storage and transmission) and support technologies to data intensive next generation Earth observation and Telecommunications systems.
- 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.

COMPET-7-2017: Technology transfer and business generators

RIA ☒	IA ☒	CSA ☑

Specific Challenge

The number of space-related Business Incubation Centres (BICs) supporting space-related businesses is growing in Europe, led by national and ESA technology transfer initiatives. There is a need to continue to inspire entrepreneurs to turn space-related business ideas into commercial endeavours and to promote opportunities for new and existing start-ups coming from space and non-space sectors.

Scope

BICs, as part of their standard offer, routinely offer commercial/high-growth business support to high-tech start-ups. BICs supporting space-related companies should be supported in order to give entrepreneurs comprehensive space-specific commercial and technical assistance to help them start-up businesses that apply space technology to non-space industrial, scientific and commercial fields, and vice-versa. This activity will not support the establishment of additional BICs, but should assist entrepreneurs and other innovation agents. overcoming financial, administrative and networking barriers to innovation. In particular, it should contribute to access public funding opportunities, such as the SME instrument of the European Union, as well as potentially other funding opportunities from Member States, ESA and regional authorities. The take up of applications developed in the context of Galileo, EGNOS and Copernicus is encouraged. This action should be complementary to the ESA BICs (that already offer space-specific support) and the European Enterprise Network (EEN) approach, and should encompass other incubation centres that support space-related companies, particularly those exploiting the applications of space data and services.

The Commission considers that one proposal requesting a contribution from the EU in the range of EUR 1.0 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

Creating opportunities for new and existing start-up coming from space and non-space sectors to access finance including SME instrument to develop viable business cases.

7. Innovation in SMEs[23]

SMEInst-01-2016-2017: Open Disruptive Innovation Scheme

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

The challenge is to provide support to a large set of high risk innovative Startups and SMEs in the ICT sector. Focus will be on companies proposing disruptive ICT concepts, products and services applying new sets of rules, values and models which ultimately create new markets (e.g. by tackling non consumption) or disrupt existing markets.

The objective of the ODI is threefold:

1. Nurture promising innovative and disruptive ideas;

2. Support their prototyping, validation and demonstration in real world conditions;

3. Help for wider deployment or market uptake.

Proposed projects should have a potential for disruptive innovation and fast market up-take. In particular it will be interesting for entrepreneurs and young innovative SMEs, including start-ups that are looking for swift support to their innovative ideas.

SMEInst-02-2016-2017: Accelerating the uptake of nanotechnologies advanced materials or advanced manufacturing and processing technologies by SMEs

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

Research results should be taken up by industry, harvesting the hitherto untapped potential of nanotechnologies, advanced materials and advanced manufacturing and processing technologies. The goal is to create added value by creatively combining existing research results with other necessary elements[24], to transfer results across sectors where applicable, to accelerate innovation and eventually create profit or other benefits. The research should bring the technology and production to industrial readiness and maturity for commercialisation after the project.

SMEInst-04-2016-2017: Engaging SMEs in space research and development

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

To engage small and medium enterprises in space research and development, especially those not traditionally involved in it and reduce as much as possible the entry barriers to SMEs for Horizon 2020 funding. The actions under this topic could cover any aspect of the Specific Programme for Space (Horizon 2020 Framework programme and Specific programme). However, it is considered that actions in the areas of applications, especially in connection to the flagship programmes Galileo and Copernicus, spinning-in (i.e. application of terrestrial solutions to challenges in space) and the development of certain critical technologies could be adequately suited for this call.

SMEInst-05-2016-2017: Supporting innovative SMEs in the healthcare biotechnology sector

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

The healthcare biotechnology sector offers huge business and commercial opportunities; however it also requires heavy and risky investments which are often lacking in Europe, hampering the development of the industry.

The challenge includes either:

a) Cell technologies in medical applications (all phase 1 and phase 2 deadlines in 2016 and 2017)

Cell technologies include cell manufacturing (culture, multiplication, scale-up and automation), preservation, banking and transport; identification, cell sorting and delivery, imaging, tracking, process and quality control; genetic engineering and gene editing; production of therapeutic biomolecules. The medical applications of cell

[23] all SMEInst-xx-2016-2017 share scope and expected impact

[24] ttp://ec.europa.eu/enterprise/policies/innovation/files/swd-2012-458_en.pdf.

technologies include diagnostics and biosensors; cell and gene therapy, tissue engineering, bio-artificial organs, haematology, immunotherapy, and vaccine and antibody production; predictive toxicology, synthetic biology, and modelling development and disease processes.

However, the diversity, complexity and variability of living cells pose challenges for bringing safe, reliable, regulatory-compliant and cost-effective products to the market and to the patient. SMEs developing cell-based products and processes have limited financial resources to take the critical steps to move from proof of concept to practical application while at the same time addressing considerations such as scale-up/scale-out, automation, logistics, regulatory pathways and business models.

Particular attention should be given to dialogue with regulators and compliance with safety and regulatory requirements, such as those pertaining to cell procurement, GMP, ethics, clinical trials, ATMPs and medical devices.

The challenge addresses cells from any eukaryotic source though their eventual application must be to human medicine.

Or:

b) Clinical research for the validation of biomarkers and/or diagnostic medical devices (only at the first cut-off date in 2017 and for phase 2 applications - phasing out of the topic PHC-12-2014/2015 introduced in the Work Programme 2014-2015)

Biomarkers are used in clinical practice to indicate both normal and pathological conditions. They are also used for predictive or prognostic purposes. They are being used increasingly in medicine and many potential new biomarkers are proposed every year. However, only a few of these have been validated for clinical use. To achieve validation a robust analytical method is required and a link to a pertinent clinical process or endpoint needs to be demonstrated.

This validation process should provide evidence for high analytical value, appropriate sensitivity and specificity, and clinical validity. Particular attention should be given to validation of biomarkers with potential for rapid uptake into clinical practice. Both in vivo and in vitro potential biomarkers are eligible. Priority is given to the validation of disease-related biomarkers (i.e. diagnostic, susceptibility/risk, monitoring and prognostic biomarkers). Validation of the clinical performance of new diagnostic devices can also be supported, either in combination with the biomarker validation or against existing standards.

SMEInst-06-2016-2017: Accelerating market introduction of ICT solutions for Health, Well-Being and Ageing Well

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

The challenge is to help overcome the current gaps in exploitation of promising research results in ICT for Health, Well-being and Ageing well and to stimulate increased availability and market uptake of relevant ICT products and services This concerns both interoperable and secure eHealth4 solutions for consumers and institutional healthcare delivery building on standards and new ICT solutions and innovation ecosystems for ageing well building on open software platforms, in order to deliver new and more efficient care to European citizens and respond to new market opportunities for SMEs.

Particular attention should be given to potential for disruptive innovation and fast market up-take in ICT for health, wellbeing and ageing well. In particular it will be interesting for SMEs and young companies that are looking for swift support to their innovative ideas.

SMEInst-09-2016-2017: Stimulating the innovation potential of SMEs for a low carbon and efficient energy system

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

SMEs play a crucial role in developing resource-efficient, cost-effective and affordable technology solutions to decarbonise and make more efficient the energy system in a sustainable way. They are expected to strongly contribute to one or a combination of more than one of the challenges outlined in the legal base of the Horizon 2020 Societal Challenge 'Secure, Clean and Efficient Energy'[25], in particular with regard to:

[25] Council decision No 2013/743/EU establishing the Specific Programme implementing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020)

- Reducing energy consumption and carbon footprint by smart and sustainable use (including energy-efficient products and services as well as 'Smart Cities and Communities'),
- Low-cost, low-carbon electricity supply (including renewable energy as well as carbon capture and storage and re-use),
- Alternative fuels and mobile energy sources,
- A single, smart European electricity grid,
- New knowledge and technologies, and
- Robust decision making and public engagement.

SMEInst-10-2016-2017: Small business innovation research for Transport and Smart Cities Mobility

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

The European transport sector must have the capacity to deliver the best products and services, in a time and cost efficient manner, in order to preserve its leadership and create new jobs, as well as to tackle the environmental and mobility defies. The role of SMEs to meet these challenges in all the areas of the Transport Specific Programme[26] is critical as they are key players in the supply chains. Enhancing the involvement of weaker players in innovation activities as well as facilitating the start-up and emergence of new high-tech SMEs is of paramount importance. SMEs are pivotal for delivering the innovations needed for greater sustainable and smarter mobility, better accessibility and logistics serving business and citizens, and thus higher economic growth, in a context where the majority of population lives in urban and urbanised areas. Actions to develop new services, products, processes, technologies, systems and combinations thereof that contribute to achieving the European transport and mobility goals defined in the 2011 Transport White Paper could be particularly suited for this call.

SMEInst-11-2016-2017: Boosting the potential of small businesses in the areas of climate action, environment, resource efficiency and raw materials

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

Innovative SMEs have been recognised as being able to become the engine of the green economy and to facilitate the transition to a resource efficient, climate-smart circular economy. They can play an important role in helping the EU to exit from the economic crises and in job creation. The potential of commercialising innovative solutions from SMEs is however hindered by several barriers including the absence of the proof of concept, the difficulty to access risk finance, the lack of prototyping, insufficient scale-up studies, etc. Growth therefore needs to be stimulated by increasing the levels of innovation in SMEs, covering their different innovation needs over the whole innovation cycle.

Innovative SMEs should be supported and guided to reach and accelerate their full green growth potential. This topic is targeted at all types of eco-innovative SMEs in all areas addressing the climate action, environment, resource efficiency and raw materials challenge – including but not restricted to the 2016-2017 strategic priorities of systemic eco-innovation and circular economy, nature-based solutions, climate services, sustainable supply of raw materials, harnessing GEOSS Earth observation data, cultural heritage for sustainable growth, and water – focusing on SMEs showing a strong ambition to develop, grow and internationalise. All kinds of promising ideas, products, processes, services and business models, notably across sectors and disciplines, for commercialisation both in a business-to-business (B2B) and a business-to-customer (B2C) context, are welcome.

SMEInst-13-2016-2017: Engaging SMEs in security research and development

SME instrument phase 1 ☑ **SME instrument phase 2** ☑

Specific Challenge

To engage small and medium enterprises in innovation activities in the domain of security, especially those not traditionally involved in it, and reduce as much as possible the entry barriers to SMEs for Horizon 2020 funding.

[26] Council Decision of 3 December 2013 establishing the specific programme implementing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020), Part III – 4. Smart, green and integrated transport.

The actions under this topic should cover any aspect of the Specific Programme for "secure societies - protecting freedom and security of Europe and its citizens" (Horizon 2020 Framework programme and Specific programme):

7.1. Fighting crime, illegal trafficking and terrorism, including understanding and tackling terrorist ideas and beliefs

7.2. Protecting and improving the resilience of critical infrastructures, supply chains and transport modes

7.3. Strengthening security through border management

7.4. Improving cyber security

7.5. Increasing Europe's resilience to crises and disasters

7.6. Ensuring privacy and freedom, including in the Internet, and enhancing the societal legal and ethical understanding of all areas of security, risk and management

7.7. Enhancing standardisation and interoperability of systems, including for emergency purposes

7.8. Supporting the Union's external security policies, including through conflict prevention and peace-building

Scope

The SME instrument consists of three phases, including a coaching and mentoring service for beneficiaries. Participants can apply to phase 1 or directly to phase 2.

In phase 1, a feasibility study shall be developed in order to verify the technological/practical as well as economic viability of an innovation idea/concept with considerable novelty to the industry sector in which it is presented (new products, processes, design, services and technologies or new market applications of existing technologies). The activities could, for example, comprise risk assessment, market study, user involvement, Intellectual Property (IP) management[27], innovation strategy development, partner search, feasibility of concept and the like to establish a solid high-potential innovation project aligned to the enterprise strategy and with a European dimension. Bottlenecks in the ability to increase profitability of the enterprise through innovation shall be detected and analysed during phase 1 and addressed during phase 2 to increase the return in investment in innovation activities. The proposal should contain an initial business plan based on the proposed idea/concept. It should outline the specifications of a more elaborate business plan, which is to be the outcome of the project, and the criteria for success.

Funding will be provided in the form of a lump sum of EUR 50.000. Projects should last around 6 months.

In phase 2, innovation projects[28] will be supported that address the specific challenges identified and that demonstrate high potential in terms of company competitiveness and growth underpinned by a strategic business plan. Activities should focus on innovation activities such as demonstration, testing, prototyping, piloting, scaling-up, miniaturisation, design, market replication and the like aiming to bring an innovation idea (product, process, service etc.) to industrial readiness and maturity for market introduction, but may also include some research. For technological innovation, Technology Readiness Levels of 6 or above (or similar for non-technological innovations) are envisaged; please see part G of the General Annexes.

Proposals shall be based on an elaborate business plan. Particular attention must be paid to IP protection and ownership; applicants will have to present convincing measures to ensure the possibility of commercial exploitation ('freedom to operate').

Proposals shall contain a specification for the outcome of the project and criteria for success. They will include an explanation of how the results of the supported project are to be commercialised and of what kind of impact on the company is expected.

The Commission considers that proposals requesting a contribution from the EU of between EUR 0.5 and 2.5 million[29] would allow phase 2 to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts (higher or lower). Projects should last between 12 and 24 months.

[27] This is not limited to the costs of acquiring and enforcing European or international IPR titles but could include auditing and risk management schemes to protect IP assets across planned supply and distribution chains and more generally IP valorisation plans to enhance return on investment and lever commercial investment into the relevant project.

[28] In the case of SMEInst-05-2016-2017, research type activities in medical application and clinical validation, including support for clinical studies and trials, will be predominant and will necessitate reimbursement at 100%. The Technology Readiness Levels indication does not apply.

[29] In the case of SMEInst-05-2016-2017, phase 2 proposals can request a contribution from the EU of between EUR 1 and 5 million.

Phase 3 of the SME Instrument aims to increase the economic impact of the funding provided by the SME Instrument phase 1&2 grants and by the business coaching. Phase 3 is not subsequent to phase 1 and/or 2, but provides specific support to SME instrument beneficiaries during and after phase 1 or 2.

All support under phase 3 of the SME instrument will be accessible through a single, dedicated entry point, which will serve as an information portal and a networking space.

This platform will offer access to two main strands of services:

- Access to markets
- Access to finance

In addition, phase 3 will create opportunities for partnering, networking and training, which are set out in the Dedicated Support Actions at the end of this call.

SME instrument beneficiaries are also offered dedicated business innovation coaching and mentoring support. This service is facilitated by the Enterprise Europe Network and delivered by a dedicated coach through consultation and signposting to the beneficiaries. The coaches are recruited from a central database managed by the Commission and have all fulfilled stringent criteria with regards to business experience and competencies.

Throughout the three phases of the instrument, the Network will complement the coaching support by providing access to its innovation and internationalisation service offering. This could include, for example, depending on the need of the SME, support in identifying growth potential, developing a growth plan and maximising it through internationalisation; strengthening the leadership and management skills of individuals in the senior management team and developing in-house coaching capacity; developing a marketing strategy or raising external finance.

Expected Impact

- Enhancing profitability and growth performance of SMEs by combining and transferring new and existing knowledge into innovative, disruptive and competitive solutions seizing European and global business opportunities.
- Market uptake and distribution of innovations[30] tackling the specific challenges in a sustainable way.
- Increase of private investment in innovation, notably leverage of private co-investor and/or follow-up investments.
- The expected impacts should be clearly described in qualitative and quantitative terms (e.g. on turnover, employment, market seize, IP management, sales, return on investment and profit).

INNOSUP-01-2016-2017: 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 cross-cutting or emerging technologies, advanced manufacturing, ICT, eco-innovative and resource-efficient solutions, new business models, service innovation and design. The potential 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.

[30] In the case of SMEInst-05-2016-2017, the development of innovative solutions should lead to value creation through the increased use of cell-based products/processes, biomarkers and/or diagnostic medical devices in industrial or clinical settings, and should contribute to technical and regulatory progress in these domains.

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 being supported as third party enterprises.

Background information on the systemic approach and strategic focus to be envisaged is provided to applicants.[31] Synergies with the European Structural and Investment Funds that may further support such large-scale demonstration projects will also be actively encouraged, 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 expected results foreseen. 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 proposal 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.

This action allows for the provisions of financial support to third parties in line with the conditions set out in part K of the General Annexes.

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, Knowledge and Innovation Communities, European Technology Platforms, European Innovation Partnerships etc.
- Contribute to regional smart specialisation strategies by capitalising upon concentrated and complementary

[31] Information (e.g. results from ongoing studies and expert analyses) is available at the EU Cluster Portal athttp://ec.europa.eu/growth/smes/cluster/and a background note has been made available at the topic related pages under Conditions & Documents at the Participant Portal at
http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/2350-innosup-1-2015.html

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-03-2017: Technology services to accelerate the uptake of advanced manufacturing technologies for clean production by manufacturing SMEs

RIA ☒ IA ☒ CSA ☑

Specific Challenge

Foresight studies show that the massive integration of advanced manufacturing will displace in a few years many of the current traditional manufacturing processes. In particular, energy and resource-efficient and low carbon technologies and the circular economy will be key drivers of innovation in SMEs. To remain competitive, manufacturing SMEs will increasingly need to rely on advanced manufacturing technologies for clean production. These technologies enable the development of new production processes, but also improve the manufacturing of existing products by reducing production costs, the reliance on raw materials and the consumption of energy, while diminishing the adverse impacts on the environment by reducing the generation of waste and pollution.

Currently, only one third of manufacturing companies in the EU has used advanced manufacturing technologies so far and plans to use them in the next year[32]. The challenge is to provide technology support to SMEs who lack resources and/or competences to integrate innovative advanced manufacturing technologies for clean production.

SMEs' access to technology services and facilities remains difficult in many regions of the EU (a recent inventory shows that two thirds of the technology infrastructures providing services to SMEs in the field of advanced manufacturing are located in only four Member States[33]). In this context, the High Level Group on Key Enabling Technologies (KETs) recommended in its report of June 2015 to ensure pan-European access of manufacturing companies to "premier-class" technology infrastructures in the field of KETs. As a first step, the Commission has published an inventory of existing technology infrastructures in the EU capable of providing SMEs with technology services and facilities in the field of KETs[34].

Scope

In order to ensure cross-border access of manufacturing SMEs to technology services and/or facilities enabling them to integrate innovative advanced manufacturing technologies for clean production into their production process, the action will consist of all the elements listed below:

- Establish one-stop shop access for SMEs to technology services and/or facilities from a network of technology infrastructures in the field of advanced manufacturing for clean production.

  The technology infrastructures should have the capacity to deliver services such as prototyping, testing, pilot production, engineering, training as well as expertise and advice (in technology but also on the overall innovation process) in order to assist SMEs to integrate innovative advanced manufacturing technologies for clean production into their production processes. The service provided to the SME should be driven by its business needs and the implementation should be flexible and fast to cope with the pace of innovation and the SME requirements. The consortium will define capacity and quality criteria and the network should be open to all technology infrastructures able to deliver services in compliance with these criteria. Criteria for monitoring the quality and impact of the services provided to the SMEs should also be established.

Proposals should outline how the network will develop a common coherent methodology to support SMEs in integrating innovative advanced manufacturing technologies for clean production into their production process, including how to reach out to SMEs across Europe.

Proposers are encouraged to link to existing or emerging regional and national networks in the field of advanced manufacturing for clean production, in particular in the context of smart specialisation.

[32] Flash Eurobarometer, Innobarometer 2015 – EU business innovation trends.

[33] Namely Germany, the UK, France and Spain

[34] http://ec.europa.eu/growth/industry/key-enabling-technologies/eu-actions/help-smes-access/index_en.htm

- Using the established network with one-stop shop access, provide cross-border services to a critical mass of manufacturing SMEs, over a period of maximum 3 years, to enable them to integrate innovative advanced manufacturing technologies for clean production into their production process and make informed decision for further investment. The services should bring together all relevant actors and the experts necessary to enable SMEs to integrate innovative advanced manufacturing technologies into their production process and assist them in customising and applying these solutions in their respective environments.

  The action is expected to include financial support to third parties in line with the conditions set out in part K of the General Annexes. The third parties are expected to be SMEs willing to integrate cutting-edge advanced manufacturing technologies into their production process in an innovative way which requires the purchase of a technology service and/or access to specific technology facilities. The consortium will define the criteria for selecting the proposals submitted by the SMEs (such as expected substantial improvement of the environmental performance, innovativeness, expected significant competitive advantage) as well as the criteria for identifying the technology infrastructures capable of providing the necessary services to the SMEs. The consortium will also define the process to select the best offer from the technology infrastructures within the network to provide the required services at the best value for money for each proposal submitted by SMEs. Grants awarded to third parties shall be provided as a lump sum not exceeding EUR 60,000 and should not cover the full cost of the service provided to the SMEs.
- Activities and measures to achieve the long-term sustainability of the scheme, including governance and dissemination. This includes the development of a business plan. Collaboration with national and regional authorities in charge of innovation support programmes is encouraged.

  Proposals should cover advanced manufacturing technologies for clean production from a circular economy perspective. This can include advanced manufacturing technologies allowing reduced energy, materials and water consumption, reduced waste generation and emissions, the use and re-use of recovered and recycled materials, biomass and/or other renewable inputs, the making of modular products and easier disassembly and separation, as well as process control technologies.

  Proposers are encouraged to link with ongoing activities in relevant Public-Private Partnerships (PPPs) such as the Sustainable Process Industry (SPIRE)[56] and the Factories of the Future (FoF)[57] and their stakeholders.

Proposers are encouraged to liaise with the Enterprise Europe Network, and cluster organisations, in particular for dissemination activities and identification of the. manufacturing SMEs having a big potential and willingness to adopt innovative advanced manufacturing solutions for clean production.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 4.9 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

- Attract a significant number of new SMEs users of innovative advanced manufacturing technologies in the manufacturing sector, leading to significant and quantifiable increase in their productivity, environmental performance and/or in market shares due to increased quality and innovativeness of products;
- Creation of a self-sustainable ecosystem gathering technology infrastructures, SME users and suppliers of innovative advanced manufacturing technologies, and providing access to technology services and facilities through a marketplace, covering a large number of regions and their smart specialisation;
- Deployment of a critical mass of innovative solutions to apply advanced manufacturing technologies into the production processes of SMEs.

8. Health, demographic change and well-being

SC1-PM-08–2017: New therapies for rare diseases

RIA ☑ IA ☒ CSA ☒

Specific Challenge

Rare diseases are diseases which affect not more than 5 per 10 000 persons in the European Union, as defined in the context of the EU legislation. A considerable amount of knowledge has been generated by biomedical research in recent years, yet most of the 6 000 to 8 000 rare diseases are lacking therapies despite many of these diseases being life-threatening or chronically debilitating.

Specific problems posed in therapy development for rare diseases include the small and dispersed patient populations and the nature of the therapies proposed, which are often highly specialised and novel. Amongst other

challenges, this leads to the requirement for seeking early advice of regulatory authorities during development. In addition, despite the special incentives for the development of orphan medicinal products, and the often high prices of some of the developed therapies, the limited market for such therapies lead to a low commercial return, and/or limited access.

Scope

Support will be provided to clinical trials on substances where orphan designation has been given by the European Commission, where the proposed clinical trial design takes into account recommendations from protocol assistance given by the European Medicines Agency, and where a clear patient recruitment strategy is presented. Clinical trials may focus on a range of interventions with an orphan designation, from small molecule to gene or cell therapy, may include novel interventions and/or repurposing of existing and known interventions. The intervention must have been granted the EU orphan designation at the latest on the date of the full proposal call closure. A concise feasibility assessment justified by available published and preliminary preclinical or clinical results and supporting data shall also be provided. Appropriate plans to engage with patient organisations, Member States health authorities and considerations of efficacy/potential clinical benefit as well as early indication on health economics should be integrated in the application. In addition to the clinical trial, proposals may also include limited elements of late stage preclinical research and/or experimental evaluation of potential risks which must be complementary/contribute to the clinical trial(s) carried out within the proposal. The centre of gravity must clearly be the clinical trial(s). The participation of SMEs is encouraged.

Selected proposals shall contribute to the objectives of, and follow the guidelines and policies of the International Rare Diseases Research Consortium, IRDiRC (www.irdirc.org).

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

- In line with the objectives of the Union pharmaceutical legislation on orphan medicinal products, proposals shall contribute to advance the development of new therapeutic options with concrete benefits for patients living with rare diseases.
- Rapid progress in orphan drug development due to well-prepared clinical trials and a multinational multicentre clinical trial with an appropriate number of patients.
- Develop a preliminary assessment of the potential economic and public health aspects of the new therapeutic option.
- Contribute to growth of SMEs involved in drug development.
- In line with the Union's strategy for international cooperation in research and innovation, proposals shall contribute towards IRDiRC objectives.

SC1-PM-10–2017: Comparing the effectiveness of existing healthcare interventions in the adult population

RIA ☑ **IA** ☒ **CSA** ☒

Specific Challenge

Effective health care and prevention may be improved by additional evidence as to the most effective health interventions. Growing numbers of patients affected by chronic diseases also call for efficiently managing co-morbidities.

Scope

Proposals should compare the use of currently available preventative or therapeutic (pharmacological as well as non-pharmacological) healthcare interventions in adults[35]. While there is no restriction on the diseases or interventions to be the focus of proposals, preference will be given to proposals focusing on interventions with high public health relevance and socio-economic impact, i.e. interventions addressing conditions that are particularly frequent, may lead to co-morbidities, have a high negative impact on the quality of life of the individual and/or are associated with significant costs or where savings can be achieved. A cost effectiveness analysis must be included. Given the focus on existing interventions, proposals will aim to contribute to improve interventions, take decisions about the discontinuation of interventions that are less effective or less cost-effective than others, and make recommendations on the most effective and cost-effective approaches. A comprehensive array of clinical and

[35] Screening and / or the involvement of elderly populations are not excluded.

safety parameters, as well as health and socio-economic outcomes (e.g. quality of life, patient mortality, morbidity, costs, and performance of the health systems) for chosen populations should be assessed. Agreed core outcome sets (COS) should be used as endpoints in conditions where they already exist, in other cases efforts should be made to agree on such COS. Randomised controlled trials, pragmatic trials, observational studies, large scale databases and meta-analyses may be considered for this topic. Where relevant the study population should address gender as well as socio-economic differentials in health and/or any other factors that affect health equity.

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

This topic is to provide the required evidence base for:

- more effective and safer interventions at individual and population level;
- enhanced compliance with healthcare interventions in the adult population;
- the use of health technology assessment methodology in this target group.

In particular:

- Improvement of individual patient outcomes and health outcome predictability through tailoring of interventions.
- Improvement of guideline development for prevention or treatment of diseases and the management of comorbidities.
- Provision of more accurate information to patients, caregivers and prescribers.

SC1-PM-16–2017: In-silico trials for developing and assessing biomedical products

RIA ☑ IA ☒ CSA ☒

Specific Challenge

In biomedical, pharmaceutical and toxicology research, the safety and efficacy of biomedical products are ultimately tested on humans via clinical trials after prior laboratory testing in vitro and/or in vivo on animal models. The complete development chain of a new biomedical product and its introduction to the market is very long and expensive. Alternative methodologies to reduce the animal and human testing are needed in order to answer both the ethical issues and the imperfection of predictions issued from laboratory and animals when applied to humans. Computer modelling and simulation is currently used to a certain degree in pharmacokinetics, pharmacodynamics or mechanical simulations (e.g. fluid dynamics simulations). A research and technological roadmap for "in-silico clinical trials" is currently being developed. Preliminary results show the strong interest/potential benefit to expand the computer-modelling in drugs and other biomedical products including bioactives, medical foods research by developing new ways for in-silico testing.

Scope

Proposals will develop innovative in-silico trials for designing, developing and assessing drugs, radiation and other biomedical and bioactive products. They will build on comprehensive biological and biomedical knowledge management and advanced modelling paradigms in order to be able to simulate the individual human physiology and physiopathology at the biological levels relevant for the biomedical product under study (at the cell level, tissue level or organism level) and the interaction with the product, thus taking into account the variability among individuals (for example, molecular pathways, cellular microenvironments, microbiota, genetics, gender characteristics, behaviours, comorbidities, development, diet). Virtual populations of individual patients will be built for simple or composite diseases, for example, from the patient-specific models by variations of different parameters and will allow simulating the action of the products and predicting the treatments outcomes in order to develop a personalised medicine approach. The proposed in-silico trials will be the result of a multidisciplinary effort (e.g. within the fields of computational modelling, systems biology, tissue mechanics, biology, pharmaceutics, medicine) and will also explore and inform of the reasons of fails and suggest improvements. To help establishing such computer simulated trials, measures for validation (human trials, animal studies, validation in cell cultures) of the in-silico models shall also be included in the proposed projects. The benefit for human health, environment and animal welfare should be analysed and quantified. Contact with regulators and consideration of the regulatory framework issues are highly recommended.

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

- Reducing the size and the duration of the human clinical trials
- A more effective human clinical trials design
- Leading to a significant reduction of animal testing
- Innovative medical products on the market with lower development costs and/or shorter time-to-market
- Improving prediction of human risks for new biomedical products including medical foods
- Improving drug repositioning
- Potential of re-use of the developed in-silico models in the chemical testing.
- Setting standards for in-silico trials.
- Providing libraries of virtual patients that can be re-used in pre- and post-competitive testing of biomedical products

SC1-PM-17–2017: Personalised computer models and in-silico systems for well-being

RIA ☑ **IA** ☒ **CSA** ☒

Specific Challenge

There is continuous progress in systems medicine, multi-scale modelling and patient-specific modelling aspects. But these opportunities have been inconstantly explored for the entire chain of health and disease. Thus, there are very few in well-being, prevention or rehabilitation while these areas are crucial for reducing healthcare needs, building sustainable healthcare and for assuring a healthy and motivated workforce. More, innovative methods are needed for better understanding and analysing brain, neurobiological and the gut-brain axis and the stress-related disorders or whole body data (e.g. where the development of multiscale and high spatiotemporal resolution imaging methods are critical) and their interactions with social, environmental, lifestyle, occupational, economic etc. factors that promote well-being and health. Well-being is a consequence of resilience to challenges and illness and of better prevention adapted to predispositions and behaviours (including gender), of better consideration given to the functional troubles, of better recovery and rehabilitation after illness.

Scope

Proposals should aim at the development of new integrative dynamic computer-models and simulation systems of acceptable validity, with the potential to being reused, build on open service platforms and with application in well-being, health and disease. The projects have to support computer modelling and simulations able to aggregate various information sets e.g. molecular, biochemical, medical imaging, social, lifestyle, economic, occupational, microbiome, environmental, developmental, psychological, gender etc. into robust predictors for resilience in coping with and overcoming challenges and stresses and for recovery after challenges and illness. They will process and apply individual/patient-specific information in a multi-scale approach required for integrating information at a certain biological level within a wider context (at least one biological level from molecule to entire body). Proposals will focus on multi-disciplinary research in medicine, SSH and ICT and should take advantage when relevant of existing large databases in clinical medicine, biomedical or occupational research, environmental sciences, Social Sciences and Humanities (SSH), so enabling and facilitating the accumulation and relinking of complex and heterogeneous data collections. The models integrated in these multi-scale and multi-disciplinary approaches will have their predictive capability validated by state-of-the-art clinical and/or laboratorial studies and/or against large health registries. Whenever relevant, proposals will integrate data collected over time in order to inform on individual trajectories with periods of well-being and periods of illness and on the heterogeneity of resilience and recovery that can be different during the individual lifetime.

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

- Benefit for health and well-being: new personalised interventions for increasing resilience and recovery.
- Advancements in medical computer-modelling and simulation that takes into account time and spatial scales.
- Supporting predictive and preventive approaches in medicine, neurosciences and life sciences.
- Improving knowledge about well-being and association with life circumstances.

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

SFS-05-2017: Robotics Advances for Precision Farming

RIA ☑ IA ☒ CSA ☒

Specific Challenge

The specific challenge here is to help attain high levels of precision in modern farming through the smart use of robotics. The technological challenge is to develop and demonstrate new robotics technologies in real-world scenarios involving such as automated mobility around irregular farmland areas, accurate sensing of crop and livestock conditions, and dextrous manipulation of farmed produce. Farming is facing many economic challenges in terms of productivity, cost-effectiveness and increasing labour shortage. Precision farming automation will increase farm productivity, reduce manual labour for laborious tasks and help to make farm holdings more sustainable. Many modern farmers already use high-tech solutions, e.g. digitally-controlled farm implements and even unmanned aerial vehicles. There are partially and fully automatic devices for most aspects of agricultural functions from grafting to seeding and planting, from harvesting to sorting, packaging and boxing, and livestock management. However, current systems still have significant drawbacks, in particular in terms of flexibility, efficiency, robustness, high operator cost and capital investment.

Precision farming using robotics technology applied to existing systems on a 1:1 scale where appropriate (the scale may differ according to the specific agricultural application) can lead to more resource-efficient and environment-friendly agricultural production. Roboticised precision farming not only promises to increase yields by optimising growth and harvesting processes, but could also lead to lower fertiliser and pesticide usage and improved soil quality through more targeted interventions. Robots can also gather operational data on a broader basis than human-operated devices. However, there is insufficient cross-over between emerging generic advances in field robotics and the more specific, practical needs of the modern farming community.

Scope

Research and Innovation Actions will focus on the design, development and testing of robotics systems for precision farming, including autonomous or semi-autonomous farm vehicles or sophisticated sensors and intervention mechanisms. The actions will prioritise technologies such as selective harvesting, more targeted weed reduction or environment friendly fertilization, and / or livestock management, based on better planning and targeted intervention, using sensors (local and aerial, even maybe earth observation satellite). This will also allow the tagging of agricultural produce or livestock for better traceability and subsequent big data processing, optimizing the whole agricultural process.

The Commission considers that proposals requesting a contribution from the EU between EUR 2 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude the submission and selection of proposals requesting other amounts.

Expected Impact

- significant increase in farm productivity with more environment-friendly processes (e.g. reduced water use, toxic substance use and soil compaction);
- increase in the safety, reliability and manageability of agricultural technology, reducing excessive human burden for laborious tasks.

SFS-13-2017: Validation of diagnostic tools for animal and plant health

RIA ☒ IA ☑ CSA ☒

Specific Challenge

The simple, swift and reliable detection, accurate identification and proper quantification of pathogens and other factors affecting plant and animal health, including zoonotic agents, and correlates of infection (e.g. host-response biomarkers) and/or immunity are critical for the monitoring and control of their introduction or spread. These tools are essential to avoid or reduce costs to the economy, trade disruptions and sometimes even human health risks. The methods are used not only by competent authorities (i.e. the national authorities responsible for organising official controls), but also by private laboratories or directly by veterinarians at the point of care, practitioners and business operators.

In recent years, most research efforts have focused on the developing high throughput, generic, quick and cheap methods, a number of which have been validated on an intra-laboratory basis or through limited ring trials. Before

they are used outside research laboratories, these methods often have to undergo additional testing, e.g. further ring tests, development of reference materials, harmonisation or adaptation for implementation in field conditions (sampling methods, multi-targeting, pen-side tests, mobile analysis).

Scope

The projects aim to harmonise and validate (including through ring trials) existing and new protocols for the detection and quantification of pathogens and other factors of concern for the health of plants and terrestrial animals, and correlates of infection/immunity. Work will build on existing knowledge and resources, and support the further development of promising existing protocols to deliver close-to-market end-products, including swift, portable tools for field testing. Cooperation among stakeholders is encouraged to ensure the use of generic technologies for a broader spectrum of organisms. There should be liaison with EU and international reference and standardisation bodies. Projects should take due account of dissemination to relevant stakeholders to facilitate the uptake of results.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 3 million would allow this specific challenge to be addressed appropriately. Nonetheless this does not preclude the submission and selection of proposals requesting other amounts. Individual proposals should focus on either plants or animals. Funding will allow for support for at least one project relating to plants and one to animals.

Expected Impact

Projects outputs will result in:

- validated protocols for the detection and quantification of pathogens and correlates of infection/immunity;
- support for plant and animal health policies in the form of validated protocols to be used by competent authorities and reference laboratories;
- the bringing to the market of end-products, such as swift, portable tools for field-testing by veterinarians, practitioners and business operators.

More generally and in the longer term, the outputs will support the improvement of animal/plant health and food safety, thus contributing to the sustainability and competitiveness of the agri-food sectors.

SFS-22-2017: Smart fisheries technologies for an efficient, compliant and environmentally friendly fishing sector

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Resource efficiency in the fishing sector and its improvement has many dimensions, including in particular extraction, scientific assessment of fish stocks and monitoring for scientific or surveillance purposes. While promising new technologies are being developed in several fields (e.g. information technology, new detection, monitoring and surveillance techniques, new materials, aerospace, etc.) the pace of their introduction in the fishing sector is far from optimal. It is generally assumed that fishing, control and data collection are under-performing, may lack accuracy, and are unnecessarily expensive. The extraction sector could largely benefit by improving cost-efficiency and compliance, and limiting its environmental impact by taking advantage of technological progress. Knowledge, monitoring, surveillance and assessment of resources could similarly be improved by using modern technologies, including for instance unmanned vehicles or drone-like devices. The challenge lies in identifying the possibilities and ways to improve the uptake of high-level technology throughout the fisheries value chain, and the possibilities of improving resource efficiency for fishing operations and the activities surrounding them (e.g. monitoring, data, knowledge).

Scope

The proposals should explore opportunities to increase the use of innovative technologies in all fisheries-related activities, including the extractive sector, the collection of data and information and the monitoring of compliance with the rules. Proposals should assess the innovative potential and applicability of new technologies in the fishing sector with the aim of avoiding unnecessary fish mortality, damage to other marine resources and ecosystems; improving energy efficiency; and increasing overall economic efficiency and social acceptability. The expected results should be directly applicable to important fisheries in all European seas. The participation of SMEs that will benefit from the intellectual property and/or from the commercial use of the project outcomes is encouraged.

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

Expected Impact

To improve resource efficiency in the fishing sector, proposals should:

- Identify existing technologies and their potential for use in the fishing sector, bring these to a readiness level that means they can be used by the fishing sector across the EU and promote their uptake by end users.
- Improve the performance of fishing vessels in terms of resource efficiency, including effective use of resources for data collection and fish stock assessment.
- Reduce the cost of marine monitoring.
- Improve economic efficiency and profitability, avoiding increasing unnecessary fishing pressures and undermining sustainable resource use.
- Involve the fishing sector in collecting evidence for implementing marine policies.
- Improve compliance and reduce illegal, unreported and unregulated fisheries.
- Support the implementation of the EU Common Fisheries Policy and the Marine Strategy Framework Directive.
- Improve the professional skills and competences of those working and being trained to work within the blue economy.

BG-04-2017: Multi-use of the oceans marine space, offshore and near-shore: Enabling technologies

RIA ☒ **IA** ☑ **CSA** ☒

Specific Challenge

Combining several activities such as renewable energy, aquaculture, maritime transport and related services in the same marine space, including in multi-use platforms, can serve to divide and reduce the costs of offshore operations and the demand on the space needed for different activities. Research on multi-use platforms funded under the FP7 call 'The Oceans of Tomorrow' has already provided promising designs, technological solutions and models for combining activities in terms of economic potential and environmental impact. However, before reaching a demonstration pilot stage, further technological research and innovations are needed to reduce risks for operators and investors.

Scope

Proposals should develop combinations of innovative, cost-effective technologies and methods including automation and remote monitoring technologies, flexible structures and facilities in order to test concepts of multi-use platforms leading to pilot demonstration phases. They should test the sustainable operability of co-located maritime activities around coastal or deep sea environments. They should also address health and safety issues associated with multi-use marine platforms. Environmental and economic viability as well as societal acceptance should also be investigated, especially by involving local communities. Proposals should capitalise on the results of EU and national projects including those testing business models developed for multi-use platforms for their economic feasibility and environmental sustainability.

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

Expected Impact

To reinforce European competitiveness in the Blue Economy, proposals will:

- Bring technologies and selected designs of multi-use facilities at least to technology readiness level (TRL) 5, ensuring validation of technology in the relevant environment.
- Reduce costs of implementation and increase economic viability of multi-use platforms for the European maritime industry.
- Improve health and safety in multi-use marine platforms.
- Secure acceptance of these new developments by local communities and society-at-large.
- Contribute to the implementation of the Integrated Maritime Strategy and its environmental pillar, the Marine Strategy Framework Directive, and take due account of the Marine Spatial Planning Directive.
- Improve the professional skills and competences of those working and being trained to work within the blue economy.

BG-07-2017: Blue green innovation for clean coasts and seas

RIA ☒ IA ☑ CSA ☒

Specific Challenge

Debris, chemical and microbial pollution and algae jellyfish blooms are huge and increasing problems in the oceans, seas and coasts. For plastics alone, the economic and ecological cost is considerable when including beach clean-ups, tourism losses, and damages to the fishing and aquaculture industries. In spite of strong legislation such as EU directives, sea and coastal pollution remains high, and prevention and innovative coast and sea clean-up schemes remain a challenge. Many solutions are available to tackle these sources of pollution, including recycling, waste water treatment, teams of collectors, and specific equipment such as skimmer boats, beach cleaning machines or algae harvesting devices. However, there is a pressing need to develop powerful innovative methods and processes to clean coasts and oceans and to restore the ecosystems to a healthy and clean state. The foremost challenge is not only to remove litter and pollution, but to transform the collected waste into a resource stream in line with the concept of the circular economy.

Scope

The proposals should be for demonstration projects to clean and lay the ground for a healthy ocean or sea and its coasts in any given large geographic area(s), including regional seas or semi-closed sea basins such as the Mediterranean. The demonstration projects should develop and scale-up innovative processes and measures to clean the selected site[36] from visible (for example floating plastics or abandoned fishing gear) and invisible litter (micro-plastics) and pollutants[37], involving local communities and actors. Collected waste materials should be adequately processed so as to enable a subsequent usage/ exploitation/ re-usage. The proposals should apply an ecosystem approach, developing forecasting tools and models to identify areas where the proposed intervention is likely to be most effective in ecological and economic terms. Social acceptance and economic impact of the envisaged measures must also be considered and promoted, for example by disseminating the project results to relevant stakeholders.

In line with the objective of the EU Strategy for international cooperation in research and innovation (COM (2012) 497), proposals addressing the Mediterranean should contribute to implement the Research and Innovation Initiative for Blue Jobs and Growth in the Mediterranean Area (The BLUEMED Initiative).[38]

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

Expected Impact

To contribute to the implementation of EU Policies such as the Marine Strategy Framework Directive and its aim to achieve a good environment status for Europe's seas and oceans by 2020, proposals are expected to:

- Develop innovative technological methods or processes for cleaning coasts and seas and transforming waste into a resource.
- Reduce cleaning up/restoration costs through cost-effective solutions, in particular through enhanced resource efficiency.
- Increase awareness and acceptance of civil society about the importance of healthy oceans and seas, devoid of litter and pollutants, in civil society.
- Progress towards reducing pollution and debris (macro, micro and nano) in regional sea basins and beyond, and towards restoring marine ecosystems.
- Improve the professional skills and competences for those working and being trained to work within the blue economy.

[36] Each site should be substantial in size and include or be adjacent to different activities.

[37] The exact selection of pollutants and litter will depend on the area selected. However, the choice of the area must be such that several sources of pollution are addressed.

[38] The "Research and Innovation Initiative for Blue Jobs and Growth in the Mediterranean Area (The BLUEMED Initiative)" aims to advance a shared vision of a Mediterranean Sea that is healthy, productive, resilient, understood and valued so as to promote the well-being and prosperity of our citizens and future generations and boost socio economic growth and jobs. It was jointly developed by Cyprus, Croatia, Greece, France, Italy, Malta, Portugal, Slovenia and Spain and presented by the Italian Presidency during the Competitiveness Council of 04-05 December 2014. In March 2015, a Strategic Research and Innovation Agenda was developed.

10. Secure, Clean and Efficient Energy

EE-11-2016-2017: Overcoming market barriers and promoting deep renovation of buildings

RIA ☒ IA ☒ CSA ☑

Specific Challenge

In order to achieve the EU 2020 energy efficiency objectives, the renovation rate needs to increase from the present level of 1.2% per annum to at least 2-3% (with a specific target for the public sector of 3%) and the energy performance of renovations needs to improve. Both the Energy Performance in Buildings Directive (EPBD) and the Energy Efficiency Directive (EED) contain several provisions in this respect. The environmental sustainability of renovation process but more importantly, the health and wellbeing of the occupants are also relevant. This might lead to consideration of aspects partially covered by different pieces of EU legislation such as REACH, the Water Framework Directive[39], the Construction Products Regulation[40], etc.

Many barriers, which are not necessarily technological, hamper the implementation of these provisions. For example: diversity and fragmentation within the building value chain; inefficient and complex renovation processes; a lack of deep renovation packages; low development and uptake of financial packages or incentives (e.g. grants, credits); unclear energy or environmental requirements in renovation grants or procurement processes; low progress in performance guarantees. There is therefore, a need to overcome these regulatory and non-regulatory barriers to facilitate the renovation of existing building stocks.

Scope

The focus of submitted proposals should be aiming at overcoming market barriers to deep renovation within the value chain. Any building type may be included (public or private, residential or non-residential).

Renovations can take place at one point in time or be staged in a step-by-step approach, but in any case they should strive to achieve "deep renovation" (at least 60% energy savings compared to pre-renovation levels) or aim towards Nearly Zero Energy Buildings (NZEB) performance. Proposals might consider integration of voluntary certification schemes along with energy performance certificate, including elements of indoor quality classification for buildings.

Proposals should address at least two of the following options (list not exhaustive):

- Support to consumers or end-users
- Support the implementation of renovation road maps resulting from the EED/EPBD
- Address the gap between designed and actual energy performance; support reliable energy performance standards, quality of certification and labelling schemes, etc.
- Increase the number of deep renovations by means of :
  - Solutions that offer affordable deep renovation to a large number of individual consumers (e.g. owners or end-users) and/or
  - Targeting large groups of building units in order to take advantage of opportunities for simplification and cost reduction and the potential for further replication.
- Support the use of existing financial mechanisms, instruments and innovative business models to address market failures, in particular split incentives.

The proposals should build on previous experience, including the outcome of Intelligent Energy Europe projects.

Synergies may be considered with activities initiated under the topic LCE-17-2017.

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.

Expected Impact

Depending on the options chosen to address in the Scope, proposals are expected to demonstrate the impacts listed below in the participant countries (wherever possible, using quantified indicators and targets):

- Increased rate of renovation in the targeted area or sector (local, regional or national; public or private; residential; non-residential);

[39] 2000/60/EC (EU Water Framework Directive) http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

[40] Construction Products Regulation (EU 305/2011)
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:088:0005:0043:EN:PDF

- Increased number of individual deep renovations (exceeding 60% energy savings compared to pre-renovation levels);
- Energy savings and renewable energy triggered through deep renovations;
- Increased compliance rate in deep renovations;
- Improved environmental sustainability of deep renovation solutions.

EE-12-2017: Integration of Demand Response in Energy Management Systems while ensuring interoperability through Public Private Partnership (EeB PPP)

RIA ☒ IA ☑ CSA ☒

Specific Challenge

The control, automation and monitoring tools that can be integrated into buildings are becoming more and more sophisticated. In order to guarantee energy efficient operation, building service systems need to deliver adequate control and monitoring of building energy parameters. It is essential to develop and demonstrate interoperable energy automation, control and monitoring tools for efficient heating, domestic hot water, ventilation, cooling, lighting, shading, storage, energy generation, and other building systems while ensuring a high quality indoor environment. This includes the investigation of demand response and energy management of individual customers as well.

The challenge is to integrate demand response enabling elements into Energy Management Systems and thus create 'building – energy system interaction' towards optimising, at building level, energy consumption, production and storage considering the availability and price of energy supplied via the grid. A specific challenge is that Energy Management Systems and smart home devices are often not interoperable but are linked to a certain brand, technology and/or standard. Therefore full interoperability between grids, systems and products for seamless integration of all required components in building energy management systems is crucial.

Scope

At the building and building unit level (residential or non-residential) the focus should be on optimisation, integration and demonstration of cost effective and interoperable solutions, including testing of new technologies and systems in real life situations.

The proposed solutions shall be demonstrated for buildings which incorporate intelligent Energy Management Systems and new technologies (smart home devices). They should ensure interoperability, evolving and adapting to the operational environment (self-learning), including indoor and outdoor conditions, the availability of energy from local RES generation, the availability and price of energy from grids and local energy storage capacities. Also the possibility of clustering individual demand response services, self-generation and storage at district level should be considered. Such solutions should be effective and resilient, ensuring low operational and maintenance costs and could include functions for predictive maintenance. Solutions should be compatible and appropriately integrated with smart grids via open standards, taking into account existing standards as well as standards under development. The proposed activities should clearly involve and engage building occupants, helping them to become an interactive part of the demand response solution, as well as better managing their energy demand. Proposals should involve energy suppliers (DSOs) and industrial technology suppliers.

The topic EUB-02-2017 ("Utilities: energy management at home and in buildings") in Part 5.i Information and Communication Technologies of the Work Programme is also relevant and addresses similar challenges.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 and 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 will be implemented under the PPP on Energy-efficient Buildings. The activities are expected to be implemented at Technology Readiness Level (TRL) 6-8 (please see part G of the General Annexes).

Expected Impact

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

- Facilitate the deployment of solutions that would improve demand response in buildings.
- Real time optimisation of energy demand and supply integrating demand-response into intelligent building energy management systems and/or other systems.
- High replicability across the EU.
- Energy cost savings through integrated home automation solutions.

- Higher indoor environmental quality and adaptability to external conditions, leading to improved comfort and living standards, while optimising energy consumption.

11. Smart, green and integrated transport

ART-01-2017: ICT infrastructure to enable the transition towards road transport automation

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Building on the rapid development of ICT technologies, cooperative ITS and more accurate and reliable satellite navigation and positioning, automated road transport will enable driving strategies which are safe, sustainable and efficient on the level of the whole transport system. There are still many ICT-related challenges to overcome, in particular those related to the connectivity required for advanced levels of road vehicle automation and the architecture of such a connected ICT infrastructure.

Scope

The focus will be on the development, testing and real-life validation of ICT infrastructure architectures, integrating state-of-the-art ICT technologies, systems and functions to enable the transition towards road vehicle automation (up to automation levels 3[41] and 4[42]). Proposals should bring together actors from automotive, IT and telecommunication industries as necessary to address one or several of the following areas:

—Functional and technical requirements for the required connectivity (V2V and V2I) for large-scale deployment of vehicle automation levels 3 and 4, by analysing the use cases for the deployment of stable and reliable connectivity over commercial telecom networks and over dedicated ITS spectrum. It is envisaged that both types of connectivity are needed for the deployment of large-scale automation. Proposers should address cyber-security aspects in depth.

—In relation to connectivity: architecture, functional and technical requirements for data generation, processing, storage and retrieval in the context of large-scale deployment of automation levels 3 and 4. Decision making processes needing data to operate vehicles and/or infrastructure should be distinguished from the provision of infotainment services and from other third party services. Regarding business models based on innovative, cross-sector use of data, proposers should address and analyse preconditions which might require public authority intervention. Proposers should address cyber-security aspects in depth.

—Tamper-proof in-vehicle platforms for automated vehicles building on and advancing the principles of cyber security for automated vehicles.

—Dynamic and accurate localisation and mapping, using cloud-based spatial data for highly automated driving (including sourcing, processing and information maintenance); accurate mapping and precise localisation based on European GNSS, using fully the capacity of vehicle connectivity and sensors and map data feedback loops; security of information enabling automated transport systems.

The Commission considers that proposals requesting a contribution from the EU of between EUR 5 to 15 million each would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Actions will address the ICT-infrastructure related challenges to enable the transition towards advanced levels of road vehicle automation.

As described in the specific challenge above, actions are expected to contribute to improved evidence-based knowledge of required ICT-infrastructure architectures. Actions are expected to demonstrate how issues such as analysis of costs (investment, operations and maintenance) and requirements for interoperability, latency, throughput, congestion strategies, data verification and data integrity are considered.

Actions are expected to demonstrate how they will provide concrete, evidence-based input feeding into standardisation processes (notably supporting interoperability and cyber security) and policy decisions (e.g. for spectrum policy).

[41] Level 3 – Conditional Automation – "the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, with the expectation that the human driver will respond appropriately to a request to intervene", according to the SAE International's standard J3016.

[42] Level 4 – High Automation – "the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene", according to the SAE International's standard J3016.

Considerable progress will be made regarding real time control systems for automated driving.

Actions will contribute to more reliable processing of information for automated transport based on data fusion algorithms to combine V2V and V2X information with on-board sensor information.

Actions will contribute to opening up a services market, as well as advancing public interest applications based on data captured from automation processes concerning e.g. the driver, the vehicle and the journeys made.

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

SC5-04-2017: Towards a robust and comprehensive greenhouse gas verification system

RIA ☑ **IA** ☒ **CSA** ☒

Specific Challenge

According the IPCC's 5th Assessment Report, atmospheric concentrations of CO_2, CH_4 and N_2O have increased to levels unprecedented in at least the last 800 000 years. CO2 alone has increased by 40% since pre-industrial times, primarily from fossil fuel emissions and also from net land use change emissions. Trust in any international agreement under UNFCCC aimed at limiting global warming will depend on our ability to make accurate estimates of greenhouse gas (GHG) emissions as well as provision of mitigation services allowing robust reporting and verification against independent data and analyses.

However, a better understanding of the carbon and nitrogen cycle in the earth-climate system remains one of the key knowledge gaps. It is therefore essential that we increase our capability to identify more accurately the stocks and fluxes of these important greenhouse gases and at the same time develop methods and technologies that will enable us within the next five to ten years to accurately estimate and also verify CO_2, CH_4 and N_2O emissions from key sources.

Scope

Actions should quantify more accurately the stocks and fluxes of CO_2, CH_4, and N_2O in Europe at both regional and continental scales through improved descriptions of key processes and feedbacks, state-of-the art methodologies, models and tools and by exploiting observations from a wide range of monitoring networks (in-situ and satellite). Special attention should be given to independent verification of data reported in countries' greenhouse gas inventories and to the improvement of the methods/approaches currently used for estimating greenhouse gas emissions (e.g. national inventories, tracer transport inversion using atmospheric and oceanic measurements, land-use measurements and models). Proposals should aim to develop widely accepted and scientifically robust methodologies in order to decrease to acceptable levels uncertainties associated with emission estimates and better identify human-induced emissions. The development and improvement of methodologies should also address the need for versatility of application, for example for the tracking of land-based mitigation activities and provision of results relevant to current and potential future land-based GHG accounting systems. Furthermore, issues such as data standards, transfer of information and tools, and replicability of methodologies and tools outside Europe (mainly in developing countries) should also be addressed.

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:

- facilitating the development of an operationalised greenhouse gas monitoring, reporting and independent verification system;
- improving the ability to monitor and verify greenhouse gas emissions under an international climate agreement by significantly decreasing current uncertainties associated with greenhouse gas emission estimations;
- supporting EU climate policies by providing reliable information on greenhouse gases in Europe over appropriate spatial and temporal scales;
- providing input (such as data, models, methods) to key international programs and assessments (Global Carbon Project, IPCC, Future Earth).

SC5-13-2016-2017: New solutions for sustainable production of raw materials

RIA ☑ IA ☒ CSA ☒

Specific Challenge

The EU is highly dependent on raw materials that are crucial for a strong European industrial base, an essential building block of the EU's growth and competitiveness. Securing the sustainable access to raw materials, including metals, industrial minerals and construction raw materials, and particularly Critical Raw Materials (CRM), for the EU economy is of high importance. However, the EU is confronted with a number of technological challenges along the entire raw materials production value chain of primary and secondary raw materials. There is also a need for clean and sustainable raw materials production solutions to avoid environmental damage.

This specific challenge is identified in the Priority Area 'Technologies for primary and secondary raw materials' production of the European Innovation Partnership (EIP) on Raw Materials.

Scope

All proposals should develop sustainable systemic solutions through industrially- and user-driven multidisciplinary consortia covering the relevant value chain of non-energy non-agricultural raw materials.

Assessment of the related environmental and safety risks and a plan to communicate the added value of the proposal to the local communities and society for improving public acceptance and trust should be addressed by all the proposals. Participation of civil society[43] from the start of exploration until after-mining activities in a process of co-design, co-development and co-implementation is strongly encouraged.

Projects should include a work-package 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 EU's strategy for international co-operation in research and innovation (COM(2012)497) international co-operation is encouraged.

Proposals should develop solutions validated in lab or in industrially relevant environment, finishing at the level of Technology Readiness Levels (TRL) 4-5.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 million and 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.

Proposals shall address **only one** of the following issues:

a) Sustainable selective low impact mining (2016): Proposals should develop new sustainable selective low impact technological solutions for mining of small mineral deposits (including those with chemically complex ore-forming phases) on the land. The proposals have to clearly show integration of mining solutions with the processing and/or metallurgy steps in order to justify economic viability of the overall process. Proposals should include the participation of technology oriented SMEs, as far as possible.

b) New technologies for the enhanced recovery of by-products (2016): Proposals should evaluate the potential by-products existing in primary or secondary raw materials (usually accompanying the major constituents at low concentrations) and should develop energy-, material- and cost-efficient new mineral processing and/or metallurgical technologies and processes to increase the selectivity and the recovery rates of valuable by-products, particularly Critical Raw Materials. The importance of the targeted sources of by-products for the EU economy has to be duly demonstrated in the proposal.

c) New sensitive exploration technologies (2017): Proposals should develop new and more sensitive environmentally sound exploration technologies and solutions (such as remote sensing technologies, innovative multi-method approaches to reprocess existing or new geophysical data) able to identify targets for detailed exploration on the land with lower costs, leading to finding new deposits and to re-assessing the mineral potential for the EU. Any of the metallic, industrial and/or construction minerals could be targeted. The importance of the targeted raw materials for the EU economy has to be duly demonstrated in the proposal. Proposals should include the participation of technology oriented SMEs, as far as possible. Sea exploration is not targeted by this call.

Expected Impact

Projects are expected to justify and provide evidence that they lead to:

a)

- achieving the objectives of the EIP on Raw Materials, particularly in terms of ensuring the sustainable supply of raw materials to the EU and improving supply conditions within the EU;
- pushing the EU to the forefront in the area of sustainable mining technologies and solutions through

[43] See the paragraph on engaging society in the introduction to this Work Programme

generated know-how (planned patents, publications in high impact journals[44] and joint public-private publications etc.);

- unlocking substantial reserves of new or currently unexploited resources within the EU;
- improving the economic viability of small industrial mining operations;
- improving in the longer term the competitiveness of and creation of new jobs in mining and/or equipment manufacturing industries;
- safeguarding environmental stability and improving the health and safety performance of the operations;
- improving the awareness, acceptance and trust of society in a sustainable raw materials production in the EU;

b)

- achieving the objectives of the EIP on Raw Materials, particularly in terms of ensuring the sustainable supply of raw materials to the EU and improving supply conditions within the EU;
- pushing the EU to the forefront and improving the competitiveness and creation of new jobs in processing, refining, equipment manufacturing and downstream industries through generated know how (planned patents, publications in high impact journals and joint public-private publications etc.);
- increased process selectivity, broader range and higher recovery rates of valuable, particularly Critical Raw Materials;
- unlocking substantial reserves of new or today unexploited resources within the EU;
- increased economic performance in terms of higher material-, energy- and cost-efficiency and flexibility in minerals processing, metallurgical or recycling processes;
- improving the environmental performance of the operations, including a reduction in waste and emissions generation and a better recovery of resources from generated waste;
- improving the health and safety performance of the operations;
- improving the awareness, acceptance and trust of society in a sustainable raw materials production in the EU;

c)

- achieving the objectives of the EIP on Raw Materials, particularly in terms of ensuring the sustainable supply of raw materials to the EU and improving supply conditions within the EU;
- pushing the EU to the forefront in the area of sustainable exploration 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;
- reducing the exploration costs for the industry through new cost-effective exploration technologies, while safe-guarding environmental stability;
- in 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;
- improving the awareness, acceptance and trust of society in a sustainable raw materials production in the EU.

SC5-14-2016-2017: Raw materials Innovation actions

RIA ☒ **IA** ☑ **CSA** ☒

Specific Challenge

The EU is highly dependent on raw materials that are crucial for a strong European industrial base, an essential building block of the EU's growth and competitiveness. Securing the sustainable access to raw materials, including metals, industrial minerals and construction raw materials, and particularly Critical Raw Materials (CRM), for the EU economy is of high importance.

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

[44] High impact journals are defined to be the top 10% (in terms of Scimago Journal Ranking (SJR) index) of all journals within a given scientific category (www.scimagojr.com).

This specific challenge is addressing development of the "innovative pilot actions"[45] which is one of the major targets of the European Innovation Partnership (EIP) on Raw Materials.

Scope

The main objective is to develop innovative pilots demonstrating clean and sustainable production of non-energy non-agricultural raw materials in the EU from primary and/or secondary sources.

All proposals should cover all the following points:

- justify relevance of selected pilot demonstrations, finishing at Technology Readiness Levels (TRL) 6-8, in different locations within the EU (and also outside if there is a clear added value for the EU economy, industry and society);
- facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain;
- include an outline of the initial exploitation and business plans (with indicated CAPEX, OPEX, IRR and NPV[46]) with clarified management of Intellectual Property Rights, and commitment to the first exploitation;
- consider standardisation aspects when relevant;
- assess health, safety and environmental risks and their management for all proposed actions to avoid environmental damage and maintain overall ecological stability;
- include a plan to communicate the added value of the proposal to the local communities and society for improving public acceptance and trust should be addressed by all the proposals. Participation of civil society from the start of exploration until after-closure activities in a process of co-design, co-development and co-implementation is strongly encouraged.

Wherever possible, proposers could actively seek synergies, including possibilities for funding, with relevant national/regional research and innovation programmes.

Within the projects funded, additional or follow-up funding should be sought, be it private or public, including from relevant regional/national schemes under the European Structural and Investment Funds (ESIF), in particular under the European Regional Development Fund (ERDF), or other relevant funds such as the Instrument for Pre-accession Assistance (IPA II). To achieve this, projects could seek contact with ERDF/IPA managing authorities and with the authorities who developed the Research and Innovation Smart Specialisation Strategies (RIS3). The responsible regional/national authorities could then take an interest in the projects and their expected results. They could engage in the use and deployment of the novel solutions resulting from projects e.g. through pre-commercial public procurement or public procurement for innovative solutions. The project proposals could already indicate which interested regions/countries or other partners have been pre-identified for contact during the project. Please note, however, that reference to such additional or follow-up funding will not lead automatically to a higher score in the evaluation of the proposal.

Projects should include a work-package 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 EU's strategy for international co-operation in research and innovation (COM(2012)497) international cooperation is encouraged.

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.

Proposals shall address **only one** of the following issues:

a) Intelligent mining on land (2016): Proposals should develop and demonstrate new intelligent mining systems to avoid exposure of workers in dangerous operations, to increase efficiency and profitability, and to minimise environmental impacts of the mining operations. Any of the metallic, industrials and/or construction minerals could be targeted. The importance of the targeted raw materials for the EU economy has to be duly demonstrated in the proposal.

b) Processing of lower grade and/or complex primary and/or secondary raw materials in the most sustainable ways (2017): Proposals should demonstrate new systems integrating relevant processing and refining technologies for better recovery of minerals and metals from low grade and/or complex ores, industrial or mining wastes at increased efficiency in terms of better yield and process selectivity. The importance of the targeted raw materials and their sources for the EU has to be demonstrated in the proposal. The solution proposed should be flexible enough to adapt to different ore grades and should be supported by efficient and robust process control.

[45] https://ec.europa.eu/eip/raw-materials/en/content/strategic-implementation-plan-sip-0#Targets

[46] Capital expenditures (CAPEX), operational expenditure (OPEX), internal rate of return (IRR), and net present value (NPV)

c) Sustainable metallurgical processes (2017): Proposals should develop innovative metallurgical systems integrating pyro-, hydro-, bio-, and/or electro-metallurgical and/or electrochemical technologies, in order to enhance the production efficiency, metal recovery and selectivity from primary and/or secondary raw materials.

Expected Impact

Projects are expected to justify and provide evidence that they:

a)

- contribute to achieving the targets of the EIP on Raw Materials, particularly in terms of innovative pilot actions on mining for innovative production of raw materials;
- have a market potential and the competitive technology advantage that will be gained through the pilot leading to expanding the EU business and to be implemented across the EU after the project is finished;
- push the EU to the forefront in the area of mining technologies and solutions through generated know how (planned patents, publications in high impact journals and joint public-private publications etc.);
- lead to unlocking substantial reserves of new or today unexploited resources within the EU.
- create added value and new jobs in raw materials producing, equipment manufacturing, information and communication technologies and/or downstream industries;
- lead to improving the health and safety performance of the operations;
- avoid environmental damage and maintain overall ecological stability;
- improve awareness, acceptance and trust of society in a sustainable raw materials production in the EU;

b)

- contribute to achieving the targets of the EIP on Raw Materials, particularly in terms of innovative pilot actions on processing and/or recycling for innovative production of raw materials;
- improve economic viability and market potential that will be gained through the pilot, leading to expanding the business across the EU after the project is finished;
- create added value and new jobs in raw materials producing, equipment manufacturing and/or downstream industries;
- optimise raw materials recovery (increased yield and selectivity) from low grade and/or complex and variable primary and/or secondary resources;
- push the EU to the forefront in the area of raw materials processing technologies and solutions through generated know how (planned patents, publications in high impact journals and joint public-private publications etc.);
- lead to unlocking substantial reserves by giving economic viability to new or today unexploited resources within the EU;
- improve the environmental performance, including reduction in waste generation and a better recovery of resources from generated waste;
- improve the health and safety performance of the operations; improve the awareness, acceptance and trust of society in a sustainable raw materials production in the EU;

c)

- contribute to achieving the targets of the EIP on Raw Materials, particularly in terms of innovative pilot actions for innovative production of raw materials;
- improve economic viability and market potential that will be gained through the pilot, leading to expanding the business across the EU after the project is finished;
- optimise metal production (increased yield and selectivity) from primary and/or secondary resources, while keeping competitive process performance in terms of resource and energy efficiency;
- push the EU to the forefront in the area of metals processing and refining technologies and solutions through generated know how (planned patents, publications in high impact journals and joint public-private publications etc.);
- create added value and new jobs in metallurgy, equipment manufacturing and/or downstream industries;
- improve the environmental (control of emissions, residues, effluents), health and safety performance of the operations;
- improve the awareness, acceptance and trust of society in a sustainable raw materials production in the EU.

SC5-16-2016-2017: Raw materials international co-operation

RIA ☒ IA ☒ CSA ☑

Specific Challenge

Many countries are facing similar challenges in the field of mineral raw materials as the EU, including dependence on supply of raw material from international markets, shortage of knowledge on raw materials and their flows for decision making by authorities, industry, financial sector etc. Understanding of the global nature of raw materials value chains and ensuring sustainable supply of primary and secondary raw materials for the EU requires knowledge of materials flows at a global level and relevant skills. At present, there is a shortage of specialists in the EU in some areas related to primary and secondary raw materials production and raw materials markets. This is a challenge that needs to be addressed at the EU level together with the relevant countries around the world having expertise in the field. In addition, the global nature of raw materials value chains requires common approach and solutions at a global level in order to ensure fair and unrestricted access to raw materials worldwide. There is therefore a need for a more active involvement of the EU in relevant initiatives and closer collaboration with competent international organisations in the field of raw materials.

Scope

Proposals should address **one** of the following:

a) Demand-supply forecast and raw materials flows at global level (2016): Proposals should develop a common methodology to mineral raw materials flows at global level which could be agreed and used at international level. As a pilot case, focus should be on critical raw materials and in particular the ones used in low-carbon technologies. The methodology should incorporate models on demand-supply forecast in order to allow for dynamic analysis of global materials flows. Proposals should provide recommendations and feed into future policy developments.

In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international co-operation is required with the US and Japan in the field of Materials Flow Analysis. Where appropriate, synergies with the relevant EU Member States initiatives are to be explored and fostered.

Proposals should build on the outcomes of the Study on Data Inventory for a Raw Material System Analysis and on related studies performed by the International Resource Panel.

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.

b) Advancing the idea of a World Forum on Raw Materials (2016): With a view to contributing to the fair and unrestricted access to raw materials worldwide, this action should cover all the following points:

- develop an EU-based platform of international key experts and stakeholders that would advance the idea of a World Forum on Raw Materials and enhance the international cooperation among G20 Member countries as well as the other third countries active in the mining and other raw materials sectors.
- foster sharing of experience with a view to increasing understanding of all aspects of trade in raw materials and strategies to leverage natural resources for wider growth and development in close co-operation with the OECD to contribute to the OECD policy dialogue.
- where appropriate explore and foster synergies with the relevant EU Member States initiatives;
- identify common needs and threats, and develop and promote on international fora recommendations on possible actions to consolidate the efforts of the countries involved towards a more joint and coherent approach towards raw materials policy and investment;
- involve relevant organisations, in particular OECD, International Study Groups, CONNEX, the Intergovernmental Forum on Mining, UNEP Resource Panel, in the planned activities.

In line with the strategy for EU international co-operation in research and innovation (COM(2012)497), international co-operation is required, in particular with G20 Member countries as well as the other third countries active in the mining and other raw materials sectors, and international organisations.

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.

c) International network of raw materials training centres (2017): Proposals should create a self-sustainable long-term lasting international network of training centres for professionals. The proposals should involve educational and research institutions in the EU and the leading counterparts in third countries, based on specific country expertise in the primary and secondary raw materials sectors. The network should map skills and knowledge in the EU and the third countries, identify key knowledge gaps and emerging needs, develop roadmap for improving skills and knowledge, as well as establish common training programmes in the raw materials sectors.

In line with the EU's strategy for international co-operation in research and innovation (COM(2012)497), international collaboration is required. Where appropriate, synergies with the relevant EU Member States initiatives are to be explored and fostered.

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

The project is expected to contribute to:

a)

- implementation of the Raw Materials Initiative[47] and achieving the objectives of the EIP on Raw Materials, in particular in terms of establishing and maintaining strong and sustainable relationships with the countries concerned, in particular with Japan and US;
- better informed decision-making by authorities and companies at the EU and global levels;
- better understanding of global raw materials flows and market trends.

b)

- implementation of the Raw Materials Initiative and achieving the objectives of the EIP on Raw Materials, in particular in terms of establishing and maintaining strong and sustainable relationships with the relevant international organisations and countries.
- fair and unrestricted access to raw materials worldwide;
- economic stability in the raw materials supply at a global level;
- better informed decision-making at EU and global levels.

c)

- implementation of the Raw Materials Initiative and achieving the objectives of the EIP on Raw Materials, in particular in terms of establishing and maintaining strong and sustainable relationships with the leading training institutions in the relevant countries;
- increasing the EU competence and expertise in the field of the primary and secondary raw materials;
- improved availability of qualified and skilled workforce leading to higher competitiveness of the EU raw materials industry;
- enhancing the possibility for new cross-sectorial innovations.

SC5-18-2017: Novel in-situ observation systems

RIA ☑ **IA** ☒ **CSA** ☒

Specific Challenge

A more systematic observation of the Earth system is required at a resolution and accuracy that cannot always be provided through remote sensing technologies. There is therefore a need to extend and improve the in-situ component of the Global Earth Observation System of Systems (GEOSS) and of the EU Copernicus programme in order to collect the relevant data necessary to cover observation gaps, calibrate and validate remote-sensing data and deliver Earth Observation services, including monitoring variables, for policy makers, local users and citizens.

However, components of existing in-situ observing and monitoring systems are too often bulky, expensive and power hungry, which hinders their wide-scale deployment for continuous environmental monitoring. The challenge here is to explore and test new technological solutions that would lower the costs of acquiring, deploying and maintaining monitoring and observing stations which would contribute to filling the in-situ observational gaps of Earth observation systems. This issue is especially acute in less developed countries where in-situ Earth observation capacities have deteriorated.

Scope

Actions should develop new, in-situ Earth observation systems, taking advantage of new technology and the latest developments in sensor science so that measurements can be performed using low energy sensors and communication systems, requiring less demanding maintenance. Actions should focus on the transfer and adaptation of new technologies into operational systems, enabling a real breakthrough in the efficiency of deploying and maintaining new in-situ observing systems in a cost-effective way. The research and innovation

[47] http://ec.europa.eu/growth/sectors/raw-materials/policy-strategy/index_en.htm

activities under this topic may take into account concepts such as citizens' observatories, disposable sensors, and the use of unmanned platforms. The project should take into account as much as possible relevant research outcomes from programmes of the European Research Council, the Leadership in Enabling and Industrial Technologies and the European Metrology Research Programme[48].

Prominent criteria for the selection of the projects will be fulfilling agreed European and international standards regarding the quality of the measurements, and the interoperability for data exchange with other existing monitoring and observing platforms and with user applications. Proposals should establish formal links, where appropriate, with the GEO Global Initiatives (e.g. GEOGLAM, GEOBON, GFOI, GMOS, AFRIGEOSS, BLUE PLANET) and with the relevant Copernicus services so that the new monitoring and observing platforms fulfil well-identified needs under these two major initiatives. Test phases enabling proof-of-concept of the observation and monitoring platforms in real conditions should be organised during the course of the project. Participation of SMEs in project consortia is encouraged in order to facilitate the development of innovative and operational systems.

Projects should foresee activities to cluster with other projects financed under this topic and – if possible – also under other parts of Horizon 2020.

The Commission considers that proposals requesting a contribution from the EU of between EUR 4 million and 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

The project results are expected to contribute to:

- improved in-situ components of the GEOSS and Copernicus programmes;
- cost-effectiveness of the new systems when compared to previous ones;
- new opportunities and market development of the European Earth observation commercial sector and for downstream users;
- measurable added value for the Copernicus and/or GEOSS initiatives;
- the provision of information necessary to ensure food, water and energy security, to cope with the scarcity of natural resources, to develop mitigation and adaptation solutions to climate change, and to make communities more resilient to natural hazards.

13. Europe in a changing world – inclusive, innovative and reflective Societies

CULT-COOP-09-2017: European cultural heritage, access and analysis for a richer interpretation of the past.

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Collections in archives, museums, and at cultural heritage sites contain a wealth of digital texts, images, audio-visual content and 3D representations of objects or scenes as well as other information such as multispectral or thermal imaging revealing the actual state of conservation, which are largely inaccessible to both computers and humans. In addition, human beings as members of their societies can be regarded as natural archives entail information about the complex semantic and conceptual knowledge organizing a society in its cultural settings and stored in non-verbal practices and rites as well as in language.

Humans can easily extract meaning from individual digital assets but are quickly overwhelmed by the sheer number of items which are usually spatially and/or temporally disconnected and of different digital quality. New technologies can be a valuable instrument to process large amounts of data in order to identify new correlations and interpretations and extract new meaning from our cultural and intellectual heritage. To close, or at least narrow, the "semantic gap" would present a major step forward in digital humanities and other sciences related to European heritage, memory, identity and cultural interaction. Likewise, it is of immediate relevance to find new ways of accessing the complex information embodied in culture-related human 'natural archives'. In addition, the increase and growing complexity of digital cultural material raises new challenges as regards its preservation over time, an essential condition for re-use and study.

[48] http://www.emrponline.eu/

Scope

In order to better understand and inform the present by richer interpretations of the past, actions should create affordable and efficient digital access, documentary methods analysis and preservation services for cultural resources. This should be achieved by tackling issues such as automatic contextualisation and identification of content and by developing analytical tools, including methods for automatically finding content which is semantically similar to a given item, or content which is related to a given high-level concept. This aspect also calls for fundamental work related to the philosophy of meta-data designs especially of language-based data that should be in close coherence with the architecture and typology of human conceptual systems. Actions should also develop innovative tools and methods to extract meaning from digital artefacts (including video recordings, audio recordings, digital images, text, multispectral and thermal information and 3D representations of objects or scenes) considering also the spatio-temporal dimension and the quality of the digital content in order to allow the study and preservation of European heritage. The work must fundamentally address the issue of data quality and interoperability.

Work will be performed in close collaboration with Humanities and Social Sciences researchers.

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. This does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

New ways of taking into account the state of the art in computer science and big data management, of searching European digital content which used to be inaccessible, buried among huge amounts of data and not sufficiently tagged with adequate metadata.

Improve the understanding of the rich diversity of European cultural heritage and create added value for the society by providing humanities researchers, journalists, policy makers and the interested public with new ways of finding answers to their questions about European cultural heritage and history.

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

CIP-01-2016-2017: Prevention, detection, response and mitigation of the combination of physical and cyber threats to the critical infrastructure of Europe.

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Disruptions in the operation of our countries' infrastructure may put at risk the functioning of our societies and their economies. Such disruptions may result from many kinds of hazards and physical and/or cyber-attacks on installations and systems. Recent events demonstrate the increased interconnection among the impact of hazards, of the two kinds of attacks and, conversely, the usefulness for operators to combine cyber and physical security-solutions to protect installations of the critical infrastructure of Europe: A comprehensive, yet installation-specific approach is needed to secure the integrity of existing or future, public or private, connected and interdependent installations. Since the global financial crisis has imposed unprecedented budgetary restrictions on both the public and private sectors, new security solutions must be more efficient and cost-effective than the ones currently available.

Scope

Proposals should focus on one of the following critical infrastructures: Water Systems, Energy Infrastructure (power plants and distribution), Transport Infrastructure and means of transportation, Communication Infrastructure, Health Services, Financial Services.

Proposals should cover: prevention, detection, response, and in case of failure, mitigation of consequences (including novel installation designs) over the life span of the infrastructure, with a view to achieving the security and resilience of all functions performed by the installations, and of neighbouring populations and the environment. They should not only address in details all aspects of both physical (e.g. bombing, plane or drone overflights and crashes, spreading of fires, floods, seismic activity, space radiations, etc.) and cyber threats and incidents, but also systemic security management issues and the combinations of physical and cyber threats and incidents, their interconnections, and their cascading effects. Innovative methods should be proposed for sharing information with the public in the vicinity of the installations, and the protection of rescue teams, security teams and monitoring teams.

Only the installations not covered in 2016 will remain eligible in 2017. A list of topics that remain eligible in 2017 will be published in due time in the section "Topic Conditions & Documents" for this topic on the Participant Portal.

The participation of SMEs is strongly encouraged.

In line with the EU's strategy for international cooperation in research and innovation[49] international cooperation is encouraged, and in particular with international research partners involved in ongoing discussions and workshops, with the European Commission. Legal entities established in countries not listed in General Annex A and international organisations will be eligible for funding only when the Commission deems participation of the entity essential for carrying out the action.

The outcome of the proposal is expected to lead to development up to Technology Readiness Level (TRL) 7; please see part G of the General Annexes.

Indicative budget: The Commission considers that proposals requesting a contribution from the EU of € 8million would allow this topic to be addressed appropriately. Nonetheless this does not preclude the submission and selection of proposals requesting other amounts.

A maximum of one project will be selected per critical infrastructure listed in the “Scope” section of this topic over the 2016-2017 period.

Expected Impact

Short term:

- State-of-the-art analysis of physical/cyber detection technologies and risk scenarios, in the context of a specific critical infrastructure.
- Analysis of both physical and cyber vulnerabilities of a specific critical infrastructure, including the combination of both real situation awareness and cyber situation awareness within the environment of the infrastructure.

Medium term

- Innovative (novel or improved), integrated, and incremental solutions to prevent, detect, respond and mitigate physical and cyber threats to a specific Critical Infrastructure.
- Innovative approaches to monitoring the environment, to protecting and communicating with the inhabitants in the vicinity of the critical infrastructure.
- In situ demonstrations of efficient and cost-effective solutions.
- Security risk management plans integrating systemic and both physical and cyber aspects.
- Tools, concepts, and technologies for combatting both physical and cyber threats to a specific critical infrastructure.
- Where relevant, test beds for industrial automation and control system for critical infrastructure in Europe, to measure the performance of critical infrastructure systems, when equipped with cyber and physical security protective measures, against prevailing standards and guidelines
- Test results and validation of models of a specific critical infrastructure against physical and cyber threats.
- Establishment and dissemination throughout the relevant user communities of specific models for information sharing on incidents, threats and vulnerabilities with respect to both physical and cyber threats.

Long term

- Convergence of safety and security standards, and the pre-establishment of certification mechanisms.

Contributions to relevant sectorial frameworks or regulatory initiatives.

SEC-10-FCT-2017: Integration of detection capabilities and data fusion with utility providers’ networks

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Research undertaken in recent years has proposed innovative approaches for the detection of precursors of explosives, drugs, and more generally speaking substances threatening the security of the citizens. Such approaches often require the installation of networks of sensors throughout urban areas. Utility networks, which are well developed in such areas, could be both sources of information through the analysis of the substance that they

[49] COM(2012)497

transport/provide (e.g. energy consumption, characteristics of used waters) or of their environment (e.g. quality of air, etc.). They can constitute networked (mobile) platforms for sensors, but this potential remains largely untapped.

Scope

Proposals should address the deployment of detection systems in large and medium cities, in existing networks, or a combination of such networks, for instance for the detection of explosive precursors and illegal chemicals (drugs). Proposals shall address sewage networks and quality of air monitoring networks, and may address other networks. The experiment should last a significant period of time (at least two years).

Proposals should also provide for a mobile platform equipped to ascertain the composition and location of suspicious measurements, once data have been provided by the networked detection systems.

Proposals should provide for the prototype of a system controlling the detection systems and capable of fusing data provided by a variety of such networks, and of interfacing with other networks, pay particular attention to ethical issues raised when using such systems, and address the sustainability of such systems.

Whereas activities will have an exclusive focus on civil applications, coordination with the activities of the European Defence Agency (EDA) may be considered with possible synergies being established with projects funded by the EDA programmes. The complementarity of such synergies should be described comprehensively. On-going cooperation should be taken into account.

Proposers for this topic should look for an enhanced SME participation.

The outcome of the proposal is expected to lead to development up to Technology Readiness Level (TRL) 7 to 8 for the sensors deployed; 6 for the control and information system, and the mobile platform; please see part G of the General Annexes.

Indicative budget: The Commission considers that proposals requesting a contribution from the EU of € 8million would allow for this topic to be addressed appropriately. Nonetheless this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Short term:

- Real-life demonstrations of the combination of systems detecting precursors of explosives, and drugs, installed on at least two utility networks, and making use of a prototype of information systems fusing the data provided by these networks;
- Better understanding of the effectiveness of the combination of technologies used to detect and locate a bomb factory or a drug lab/drug consumption/traffic;

Medium/Long term:

- Provision of a higher level of information/intelligence to those involved in counter-terrorist and countering drugs activities (e.g. Law Enforcement Agencies, Security & Intelligence Agencies, and Government Laboratories)

SEC-15-BES–2017: Risk-based screening at border crossing

RIA ☒	IA ☑	CSA ☒

Specific Challenge

The concept of 'borders' has changed in recent times. The purpose and function of borders have been, and remain, to delineate and demarcate one sovereignty from another. However, borders must also allow for the smooth movement of people and goods.

Maintaining the current level of checks is becoming increasingly expensive given the ever growing volumes of people and goods on the move, and increasingly more disruptive of flows. It would remain sustainable if thorough checks could be limited to fewer individual goods and people pre-selected further to a preliminary (and non-disruptive) risk-based screening of the flows.

Scope

Proposals should take account of the four-tier access control model developed in the EU: measures undertaken in, or jointly with third countries or service providers (e.g. those managing Advance Passenger Information or Passenger Name Record systems); cooperation with neighbouring countries; border control and counter-smuggling measures; control measures within the area of free movement in order to prevent illegal immigration and cross-border crime inside the Schengen area.

Innovative, international alert systems can be developed further to more co-operative law enforcement and investigative efforts. Building upon lessons learned and field experience is essential.

The combination of a variety of arrays of sensors, new operational methods, and improved data management techniques can support appropriate law enforcement responses and enable better, transnational, interagency access to reliable and secure situational intelligence and information, on a real-time and cost-effective basis.

Collaboration with IATA, the air transport industry and other partners and international stakeholders in other fields of transport safety (e.g. maritime, rail) may lead to the development of new solutions.

Particular attention should be paid to personal data protection and to other ethical concerns that may arise from the development of risk-based screening at borders.

The outcome of the proposal is expected to lead to development up to Technology Readiness Level (TRL) 7; please see part G of the General Annexes.

Indicative budget: The Commission considers that proposals requesting a contribution from the EU of € 8million would allow for this topic to be addressed appropriately. Nonetheless this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Short/Medium term:

- Enhanced situational awareness for border control practitioners, enabling the timely and proper identification of potentially dangerous people and goods, and preventing smuggling and human trafficking;
- Improved risk-management coordination and cooperation between border control (passport/persons), customs (baggage/goods) and security in transport (pre-boarding security checks on persons and baggage);

Long term:

- Improved solutions for remote detection of abnormal behaviours;
- Improved and people-respectful border automated screening systems through close cooperation with actions resulting from SEC-18-BES–2017: Acceptance of "no gate crossing point solutions".

More effective use of intelligence to reduce risks at borders

SEC-16-BES–2017: Through-foliage detection, including in the outermost regions of the EU

RIA ☑	IA ☒	CSA ☒

Specific Challenge

Member States' authorities are carrying out activities all along the European border, and have started to share operational and situational information. But several regions at the borders of the European Union are covered with forests, and face extreme temperature conditions. Detecting, locating, tracking or identifying persons and vehicles crossing the border in forested regions is extremely difficult given that technologies for surveillance through harsh unstructured environments are currently not effective. The increasing risk of irregular flows and immigration across the border with, for instance, Turkey, Ukraine, Belarus, Russia or Brazil makes the issue even more acute than in the past.

Scope

Systems should be developed that combine or improve surveillance technologies and techniques and arrays of sensors of different sorts capable to provide higher quality detection capabilities and imaging via the integration of different techniques, to achieve wide- and small-area through foliage detection, despite the canopy density, in a real operational context. They could build on airborne, satellite-based, and/or on ground based platforms.

Solutions should be tested and validated in terms of capabilities to control effectively the land border covered by a vegetation layer, in all weather conditions.

Pre-competitive research may be needed to address various stages of development, from sensor design, to the analysis and design of system configuration and to the integration and validation by (public) authorities for target detection, identification and recognition.

Overlap with the work being undertaken by border surveillance authorities in the context of the EWISA[50] project should be avoided, whilst compatibility with previous results from FP7 or H2020 projects is encouraged. Ethical and societal acceptance needs to be properly addressed.

[50] http://cordis.europa.eu/project/rcn/192052_en.html

Whereas activities will have an exclusive focus on civil applications, coordination with the activities of the European Defence Agency (EDA) may be considered with possible synergies being established with projects funded by the EDA programmes. The complementarity of such synergies should be described comprehensively. On-going cooperation should be taken into account.

The outcome of the proposal is expected to lead to development up to Technology Readiness Level (TRL) 5 or 6; please see part G of the General Annexes.

Indicative budget: The Commission considers that proposals requesting a contribution from the EU of € 8million would allow for this topic to be addressed appropriately. Nonetheless this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact

Short term:

- Improved border surveillance and search-and-rescue capabilities, especially in forested regions;

Medium term;

- Validated through-foliage detection technologies, in terms of fitness for purpose, low rate of false alarms, practicability, mobility, and cost effectiveness.

Long term:

- Demonstrated through-foliage detection technologies in the context of realistic operational scenarios, in extreme weather conditions, to be implemented in collaboration with the relevant border surveillance authorities and in regions where the Frontex Agency indicates that important illegal border crossing and smuggling may be taking place.

17. Cross-cutting activities (Focus Areas)

PILOTS-03-2017: Pilot Lines for Manufacturing of Nanotextured surfaces with mechanically enhanced properties

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Nanostructured coatings or nanotextured surfaces provide improved scratch and abrasion resistance, super hardness and mechanical resistance that rivals diamond in performance, improved wear resistance and corrosion inhibition, bio-compatibility, control of reflectivity, sensing ability, self-cleaning surfaces improving many products such as technical textiles and papers, structural elements for machinery, construction elements, transportation, etc.

Nano-enhanced functional surfaces have huge potential in different sectors, including packaging, marine, water treatment, electronics, building and construction, automotive, transport, energy and other applications including textile, leather and industrial engineering.

The involved technologies to manufacture these surfaces or coatings are currently at a lower TRL level, and call for up-scaling, demonstration and validation in large scale pilot installations in operational environments, before industrial manufacturing can take place.

Scope

The proposed pilot lines should address the development, upscaling and demonstration in relevant industrial environments of reliable manufacturing processes to obtain nanostructured surfaces with mechanically enhanced properties.

They should use existing pilot lines as a starting point for development, incorporating new materials and methods and/or instrumentation with real time characterization for measurement, analysis and monitoring at the nanoscale to characterise relevant materials process properties;

The aim is to increase the level of robustness and repeatability of such industrial processes; to optimise and evaluate the increased performances of the production lines in terms of productivity and cost-effectiveness; and finally to assess the functionality and performance of the new materials/products.

Proposals should address the complete research-development-innovation cycle and obstacles remaining for industrial application, and involve a number of relevant materials producers and users, also considering the needs of SMEs.

Technology transfer should be prepared through technology services at affordable costs, facilitating the collaborating with EU SME and large industries, and the rapid deployment and commercialisation of the new technology.

Examples of possible developments include:

- Upgrade existing production methods, extending current production capabilities of mass production injection moulding, or additive technologies such as Roll-2-Roll- and sheet-2-sheet printing, into the sub-100 nm regime.
- Enhancing key properties of promising lab scale nano-enabled surfaces and upscale their production up to pilot level. Different technologies for nano-enabled surface production may be considered.
- Applying such surfaces in sectors (more than one is preferred) where they may have strong social and economic impact.

Non-technological aspects key for the marketing of such products (e.g. standardization, regulatory issues, user acceptance, HSE aspects, LCA) need to be considered.

Activities are expected to focus on Technology Readiness Levels 4 to 6, and target Technology Readiness Level 7. This topic addresses cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 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

The action is expected to lead to a direct economic impact on the economy of the manufacturing industry as well as society, resulting from issues such as increased performance and durability of wear-intensive industrial components, reduction of infrastructure maintenance costs, and reduction of operational costs due to energy savings.

Functional nanotextured surfaces and nano structured coatings have a huge potential for many sectors, and embedded nanostructured functionalities in coatings and surfaces can alleviate problems from ice, pollutant, UV, fire, heat, marine life, wear, friction and corrosion. These factors cost global industry billions in maintenance, loss and downtime each year. For example, direct corrosion costs account for 3-4% of a country's GDP worldwide. The same for wear costs. Energy losses due to friction in mechanical contacts reaches more than 10% of the GDP of a developed country. More sustainable production as well as products can also be expected, including an environmental impact, from using eco-friendly nanocoatings instead of traditional lubricants for example.

Integration of state-of-the-art nanotechnology in the traditional production of coatings or surfaces will give a market advantage and enhance the competitiveness of European industry.

The new functionalities achieved will have important impact on many sectors, including packaging, marine, water treatment, electronics, building and construction, automotive, energy, textile, leather and industrial engineering.

Enhanced manufacturing capacities in Europe and/or enhanced market opportunities for European enterprises. These impacts should be addressed in particular in the outline of the business case and exploitation strategy to be submitted with the proposal. The expected content of this outline is further detailed in the LEIT introduction, section 6.

The impact should be presented at three levels:

1. Impact on the consortium materials producers and users, and other involved industries, demonstrated in the form of reduced costs and full consideration of environmental and safety legislation.

2. Other existing or new materials manufacturers, describing the expected impact from further integration of the nano-enabled multifunctional materials into practical large-scale applications with producers outside the consortium,

3. Global impact in form of direct or derived benefits from competitive advantage of the new materials and products.

The impact will also be improved by a contribution to training and knowledge dissemination for building an educated workforce.

Overall the action is expected to help driving the demand in Europe as well as support the penetration of new markets worldwide. This should include clear benefits to manufacturers, including SMEs, and new entrants into the market may be expected.

PILOTS-04-2017: Pilot Lines for 3D printed and/or injection moulded polymeric or ceramic microfluidic MEMS

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Microfluidics devices were initially based on non-polymeric materials like silicon or glass, manufactured in facilities developed for the semiconductor industry. New fabrication techniques that are completely based on polymer/plastic materials can lead to reducing fabrication costs and optimise time, including rapid prototyping methods for a new range of products.

A new generation of 3D micro and nano structured and/or injection moulded polymeric or ceramic microfluidic MEMS products are targeted. Applications may include MEMS for nozzles or filters, sensor applications, lab-on-chip systems, printed biochemical materials, soft substrates etc., and open for new applications, including disposables where production cost need to be kept to a minimum. The adoption of environment friendly material solutions may also be explored (e.g. biodegradable materials, materials from renewable resources, reusable/recyclable materials).

While typical features for the mentioned applications may be larger than leading edge semiconductor processes, the required feature sizes are nonetheless significantly smaller than what is available with current standard printing and injection moulding techniques i.e. micro- and nano-fabrication capabilities are required.

Scope

The proposed pilot lines should address the development, upscaling and demonstration in relevant industrial environments.

They should use existing pilot lines as a starting point for development, incorporating new materials and methods and/or instrumentation with real time characterization for measurement, analysis and monitoring at the nanoscale to characterise relevant materials, process properties and product features.

The aim is to increase the level of robustness and repeatability of such industrial processes; to optimise and evaluate the increased performance of production lines in terms of productivity and cost-effectiveness; and finally to assess the functionality and performance of the new materials/products.

Proposals should address the complete research-development-innovation cycle and obstacles remaining for industrial application, and involve a number of relevant materials producers and users, also considering the needs of SMEs.

Non-technological aspects key for the marketing of such products (e.g. standardization, regulatory issues, user acceptance, HSE aspects, LCA) need to be considered.

Applications may fall within areas such as:

- 3D micro and nano printed and/or injection moulded biological applications (including instrument on a chip, bio-medical/bio-physical sensors, Lab-on-chip, organ-on-a-chip, bio-compatible or toxic scaffolds, active influence of cell growth & differentiation).
- 3D micro and nano printed and/or injection moulded polymeric or ceramic microfluidic MEMS for nozzles or filters, sensor applications, and multi-use chip (including also injection molded nanostructures in polymers).
- In-line process control technologies as well as characterization methods needs to be included in order to meet recognised quality, environmental and safety standards and legislations.

The increased performances of the production lines in terms of productivity and cost-effectiveness should be demonstrated together with the relative improved functionality and performance of the resulting products.

SME needs should be catered for, e.g. through a coordinated network of pilot line, test and validation services, in order to prepare for management decisions to progress to the next step of new technology deployment, i.e. installation of industrial pilot lines and enter the commercialization stage.

Activities are expected to focus on Technology Readiness Levels 4 to 6, and target Technology Readiness Level 7. This topic addresses cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 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

The action should allow for a new generation of MEMS products.

The scaled up production lines for 3D micro and nano printing and/or injection moulding in combination with the use of polymers and new micro- and nano-fabrication capabilities is expected to increase cost-effectiveness and robustness of the process and resulting products.

Direct benefit to the involved industries should be demonstrated in the form of reduced costs and full consideration of environmental and safety legislation.

Enhanced manufacturing capacities in Europe and/or enhanced market opportunities for European enterprises. These impacts should be addressed in particular in the outline of the business case and exploitation strategy to be submitted with the proposal. The expected content of this outline is further detailed in the LEIT introduction, section 6.

Impact should be presented at three levels:

1. Impact on the consortium materials producers and users, and other involved industries, demonstrated in the form of reduced costs and full consideration of environmental and safety legislation;

2. Other existing or new materials manufacturers, describing the expected impact from further integration of the nano-enabled multifunctional materials into practical large-scale applications with producers outside the consortium;

3. Global impact in form of direct or derived benefits from competitive advantage of the new materials in products.

The impact will also be improved by a contribution to training and knowledge dissemination for building an educated workforce.

Overall the action is expected to help driving the demand in Europe as well as support the penetration of new markets worldwide, also considering the contributions to an improved quality of life from the resulting products (e.g. lab-on-chip, filters and sensors for medical or other applications), ultimately contributing to a significant growth of quality jobs.

This should include clear benefits to manufacturers, including SMEs, and new entrants into the market should be expected.

PILOTS-05-2017: Paper-based electronics

RIA ☑	IA ☒	CSA ☒

Specific Challenge

On one hand the lifetime of electronics is becoming shorter, now approaching an average in the range of months; this evolution generates technological challenges and poses a growing ecological problem. On the other hand, paper is ubiquitous in everyday life and it is one of the cheapest materials in our society. It is renewable, portable, flexible and in addition cellulose, its main component, is the Earth's major biopolymer and has an essential economic importance in Europe, which is responsible for 30% of the world's total production. Paper Electronics represents a new concept which combines the use of paper as a functional part of electronic components or devices. Typical applications include packaging, graphics, novel diagnostic systems and hygiene products for indicating product safety or freshness, support logistics, health-care and safety for example.

Paper-based electronics shows promising technical, economic, and environmental advantages which will allow new recyclable electronics devices like paper displays, smart labels, smart packaging, bio-and medical applications, PoC devices, RFID tags, disposable electrochemical sensors among others. Paper-based electronics represents a promising source of innovation and growth for sectors such as packaging industry which develops smart solutions able to interact with the end users or classic paper publishing industry which are facing challenges from electronic books and journals, healthcare industry which intensify the development of quantitative biosensing, microfluidic and lab-on-chip devices.

Scope

The proposal should address the physical, chemical and engineering challenges linked with the use of paper as substrate as well as active components of the electronic devices: it includes the development on new technologies for paper manufacturing (fiber enhancement, porosity, fillers, etc) and converting, new paper coatings (organic, inorganic or hybrid), paper surface characteristics and functionalization (nanocellulose functionalization, plasma or gas treatments, bio and chemical modifications for instance) but also heterogeneous integration of high-added value electronic components on paper and introduction of new materials (conductors, semiconductors, insulators, electrochromic, batteries electrodes). The proposal should develop high-precision, cost efficient, and high output printing or other manufacturing technologies on large area (inkjet, screen printing amongst others, and sheet-to-sheet or roll-to-roll processes). The proposal should also address recyclability and eco-design aspects.

The implementation of this topic is intended to start at TRL 3 and target TRL 5.

This topic addresses cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 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

- To develop a new disruptive and sustainable paper-based platforms for electronics that not only integrate discrete devices but also use the cellulose as an electronic material for insulators, electrolytes, conductors, and semiconductors;
- To use the same paper substrate that supports the electronics to also drive a bioplatform or a display, process source video data, or provide the power source through an embedded chemical battery;
- Reduce the environmental impact of electronics;
- Consolidate paper making industries and wood-harvesting industries;
- In long term, the developed technologies should pave the way for active, full color, video-rate reflective displays that perform well in high-light conditions, achieving performance equivalent to classical electronics (i.e. for display devices, a contrast ratio from 10:1, reflectivity of over 80%, full color, etc.);
- Creation of new markets and new business opportunities for the European industry fulfilling or anticipating consumer needs in this area.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

FOF-06-2017: New product functionalities through advanced surface manufacturing processes for mass production

RIA ☑	IA ☒	CSA ☒

Specific Challenge

As a response to increasing competition in global markets, many industrial sectors (e.g. automotive, aerospace, tooling or packaging) aim at improving their product performances through surface functionalisation. As the products are increasingly complex in terms of scale (from nano to macro) and shape, processes need to deliver efficiently, ensuring an uncompromised quality together with high versatility and controlled costs. One way to reach this goal is to differentiate between a product body and its surface, where specific properties can be tailored. Furthermore, the required functionalities may be achieved with little or no addition of new raw material. For example, modifications in the surface geometry or even microstructure induced by texturing processes enable to improve the performance of those products by providing them with dedicated functionalities such as tailored friction, antibacterial properties, aesthetic issues or self-cleaning capabilities, among others.

In this context, substantial research is needed for exploring innovative approaches aimed at producing high added-value functional surfaces by a superficial modification of the substrate. Special attention should be paid to the cost efficiency of the novel surface manufacturing processes and to the development of technologies that are adaptable and up-scalable to real scale conditions and to their implementation into mass production conditions. Finally, environmental aspects of the processes should also be addressed.

Scope

The proposal should address surface-modifying methods which do not alter the chemical composition of the surface or add an extra layer of a different material, for example: micro-machining, texturing, photon-based technologies, laser, mechanical treatments, etc. These methods should be used to create new manufacturing processes that can be applied on mass production lines. Due to the need for cost-effective technologies, these processes should be easy to integrate within the existing manufacturing plants and cost-effectiveness should be demonstrated. The research activities should be multi-disciplinary and address all of the following issues:

- Development of cost-efficient, up-scalable and adaptable surface processing techniques that introduce micro- or nano-scale modifications at the surface level of the part providing it with specific properties or capabilities.
- Design and implementation of specific methods and systems that enable highly efficient up-scaling of the developed processing techniques from laboratory scale to real scale, with a specific objective to apply the processes for mass production.
- Implementation of modelling tools to support selection of the processing parameters that lead to the targeted surface modifications.
- Solutions which are economically viable, environmentally friendly and easy to transfer to other fields than the demonstrated fields of application.

- In-process inspection and monitoring possibilities to ensure that the final results remain within the quality requirements.

The projects are expected to cover applied research but also demonstration activities, such as testing a prototype in a simulated operational environment. The ability of the demonstration activities to validate a technology's high level of readiness will be reflected in the evaluation.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

This topic is particularly suitable for SMEs.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 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

The developed innovative product functionalities should lead to a remarkable impact for both producers and users, in the following terms:

- Cost increase pertaining to those functionalities integrated into products should be below 10% with respect to the cost of conventional products .
- The improvement in the product performance should be above 20% in the targeted functionalities such as: surface friction (increase or decrease), wear resistance, surface energy, corrosion and thermal resistance, hardness, self-cleaning properties, conductivity, anti-fouling, catalytic properties, etc. Besides, the improvement can also consist in obtaining tailored optical properties including for aesthetic or functional purposes.
- Strengthened global position of European manufacturing industry through the intensive implementation of innovative and unconventional technologies along the European manufacturing value chain.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

FOF-07-2017: Integration of unconventional technologies for multi-material processing into manufacturing systems

RIA ☑	IA ☒	CSA ☒

Specific Challenge

The competitiveness of European manufacturing depends on producing differentiated and high added value products in an efficient and sustainable manner, with reduced production costs, increased product quality and minimised time to market. Multi-material products have the advantage of putting the right material in the right place to satisfy all the expected requirements, which is particularly relevant when high cost or critical materials are involved. The aim of this topic is to integrate unconventional manufacturing technologies within a specific set (water jet, ultrasonic and micro-wave electron beam welding and/or electro discharge machining, laser and photopolymerisation) into a manufacturing system to make multi-material products composed of high cost or critical materials with a prolonged service life. These innovative manufacturing concepts and technologies can help European industry to face the challenge of improving resource efficiency and sustainability.

The integration of the above-mentioned unconventional manufacturing technologies into the process chain may be complemented with processes such as thermal treatment, in-process inspection and control, stress-relieving, micro-structural improvements, machining and joining. Successful integration will help to achieve a breakthrough in innovative manufacturing approaches for multi-material products. The major challenge lies in reinforcing the integration of these unconventional processes into manufacturing systems for multi-material products and subsequently implementing them throughout the European manufacturing sector, as well as ensuring that the disassembly of the materials is possible to enable re-use and recycling.

Scope

The proposal should use one or more of the following unconventional manufacturing technologies (water jet, ultrasonic and micro-wave electron beam welding and/or electro discharge machining, laser and photopolymerisation) to create new manufacturing systems for multi-material products. To tackle this major challenge successfully, research will need to cover all of the following areas:

- innovative process chains for high cost or critical multi-material products based on unconventional technologies, integrated if appropriate with more conventional manufacturing techniques such as machining and joining;
- manufacturing processes capable of generating the features and geometries required for multi-material

products as well as integrating additional improvements such as thermal treatment, stress relieving, surface hardening, corrosion resistance or micro-structural improvements;

- new flexible machinery concepts and components to allow the integration of unconventional technologies and processes into industrial manufacturing systems able to handle a range of material combinations and products;
- in-process inspection and control to ensure quality requirements within the innovative process chains.

Activities are expected to focus on Technology Readiness Levels 4 to 6. This topic addresses cross-KET activities.

This topic is particularly suitable for SMEs.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 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

The developed new technologies should lead to a remarkable impact in the following terms:

- Reduction of at least 10% in the production time through the integration of operations and the reduction of idling time between manufacturing steps.
- Reduction of at least 15% in the production cost through process integration and improved manufacturing quality.
- Resource efficiency improved by reducing the use of raw materials and energy consumption by at least 10%.
- Strengthened global position of European manufacturing industry through the intensive implementation of innovative and unconventional technologies along the European manufacturing value chain.
- Low capital investment solutions available for SME uptake.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

FOF-08-2017: In-line measurement and control for micro-/nano-enabled high-volume manufacturing for enhanced reliability

RIA ☒	IA ☑	CSA ☒

Specific Challenge

Rapid developments in micro-/nano-technologies require complex business models that respond to volatile markets in demand for faster product delivery with an unprecedented yield and quality. High-volume manufacturing is not spared from these requirements, and will in fact need to demonstrate a productivity improvement compared to lab-scale process development and low-volume manufacturing in order to remain commercially competitive.

The process scaling needs to include system-level architectures for metrology and control. This includes data acquisition and control at the levels of the process, the physical handling and the component validation. The in-line metrology and inspection for micro-/nano-production play an important role, together with a common reference system and approach across process chain. The evolution of the control system on the factory floor will also need to show various levels of distributed control in order to cover both batch-to-batch and run-to-run variations with real-time parameter prediction and feedback.

Practical industry solutions for reference metrology at these small dimensions are not readily available. However, whilst efforts are made towards producing reference materials, reliable and fast measurements that allow for control both at the process level and at the higher level of product vehicle or line, are needed. This will enable predictive management of batches, improved quality and speed control, and machine learning enabling fully autonomous control at the level of the process tool.

Scope

Proposals should include a systems-level strategy for integrating measurement and control throughout the production line for micro-/(nano-)enabled high volume manufacturing. To address this challenge the proposal will need to cover all of the following areas:

- Measurement techniques that target highly integrated and functional products at the micro- (and nano-)scale.
- Measurement and data acquisition which are non-destructive, i.e. no waste material at the measurement steps, and allow for high throughput scenarios in their respective industrial settings.
- Traceability in the measurements back to reference samples (e.g. calibrated standard artefacts and products).

Direct contributions to related standards may be a part of the proposal.

- Approaches to control at the different levels of factory integration, including process variation, product/component reliability, waste optimisation, yield/output improvements and predictive/preventive corrections to the entire line.

Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL6.

This topic addresses cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU 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

The developed new technologies should lead to a significant impact in the following terms:

- Improvement in existing manufacturing processes through implementation of system-wide control systems, demonstrating better resource efficiency, yield and productivity of a wide variety of components and final products.
- Improvement in technical knowledge on the in-line metrology for micro-/(nano-)sized components in a high-volume manufacturing setting.
- Accelerated uptake by industry of in-line measurements and related control systems that allow for traceability in terms of physical dimensions, functionality and reliability of micro-/nano-sized components.
- Contribution to standardisation in the field of reference materials targeting micro-/(nano-) technology and factory integration.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

FOF-09-2017: Novel design and predictive maintenance technologies for increased operating life of production systems

RIA ☒	IA ☑	CSA ☒

Specific Challenge

The elevated complexity and costs of production assets combined with the requirements for high-quality manufactured products necessitate novel design and reliability-based maintenance approaches that are able to provide the required levels of availability, maintainability, quality, safety while considering the system as a whole and throughout the production lifecycle.

Analysis of operational parameters and in-service behaviour, self-learning features and condition prediction mechanisms could contribute to improve smart predictive maintenance systems capable to integrate information from many different sources and of various types, in order to more accurately estimate the process performances and the remaining useful life. That will lead to a more efficient management, reconfiguration and re-use of assets and resources, avoiding false alarms and unforeseen failures which lower operators' confidence in such systems.

Scope

The aim would be to design optimal maintainability solutions into production systems to improve operating life at maximised performance and reduce costs by carrying out maintenance activities at the most optimised time before failure occurs, thus minimising the degree of intervention required and maximising the system availability.

More trustworthy predictive maintenance and cause-and-effect analysis techniques should be developed to aggregate and interpret data captured from production systems and effectively share the massive amount of information between users. Measurements of a range of parameters at the level of components, machines and production systems should be carried out to provide data for building trend reference models for prediction of equipment condition, to improve physically-based models and to synchronise maintenance with production planning and logistics options. The dependability of the techniques would be demonstrated for a range of components and machines.

While the focus will be on demonstrating the design approaches and maintenance technologies, R&D activities supporting the integration and scale-up are expected as well.

Demonstration activities should address all of the following areas:

- Methodologies and tools for improved maintainability and increased operating life of production systems.
- Methodologies and tools to schedule maintenance activities together with production activities.

- Predictive maintenance solutions, combined with integrated quality-maintenance methods and tools, as well as failure modes, effects, and criticality analysis (FMECA) techniques, that effectively share information among different data sources in a secure way. Exploitation of networks of Smart Objects Technologies is an option.
- Versatility, in order to make solutions transferable to different industrial sectors.
- The project must include two complex demonstrators in real industrial settings to represent a clear added value.

In order to ensure the industrial relevance and impact of the demonstration effort, the active participation of industrial partners, including SMEs, represents an added value to the activities.

Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL6.

This topic addresses cross-KET activities.

This topic is particularly suitable for SMEs, as well as for international cooperation.

The Commission considers that proposals requesting a contribution from the EU 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

The developed new technologies should lead to a significant impact in the following terms:

- 10% increased in-service efficiency through reduced failure rates, downtime due to repair, unplanned plant/production system outages and extension of component life.
- More widespread adoption of predictive maintenance as a result of the demonstration of more accurate, secure and trustworthy techniques at component, machine and system level
- Increased accident mitigation capability.

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

FOF-10-2017: New technologies and life cycle management for reconfigurable and reusable customised products

RIA ☒	IA ☑	CSA ☒

Specific Challenge

New customised products will be increasingly incorporating, in a seamless fashion, intelligence and smart functionalities through advanced materials and embedded components. The integration of highly differentiated materials and components is a key requisite for flexible manufacturing of individualised consumer/customised products. On the other hand, enhanced integration of sophisticated ICT-based components and of advanced materials implies a rapid product obsolescence rate, and can thus introduce further pollution risks if reuse of products and/or components is not improved. Therefore, reconfiguration and reuse of products, and related services, need to be developed.

Scope

To face sustainability and flexibility challenges customised products need to be conceived, designed and manufactured in a modular way, and their single components have to be developed so as to be interoperable with one another during the product/service lifetime, so as to be exchangeable and updateable whenever necessary. This influences both the hard and soft requirements and calls for new production technologies that enable the fast manufacturing, assembly and configuration of complex products, as well as the products updatability and disassembly for re-use and end of life management.

In particular, consumer goods manufacturers should be able easily and effectively to integrate products and components which can be independently designed, produced and used in order to make diverse final personalised products in different production systems.

All involved actors in the product life cycle, from manufacturers of basic products components to retailers and vendors up to the final customers, should be provided with the needed hard and soft tools to reassemble and/or reconfigure the product or its components.

Research activities should address all of the following areas:

- Methodologies, engineering and tools for the fast reconfiguration and re-use of personalised products and their components
- New production techniques allowing for a fast manufacturing, assembly and configuration of complex

personalised products

- Innovative methods and technologies for personalised products updatability, disassembly for reuse and end of life management of the products as well as their different components
- Methodologies and tools for the development of assembly, configuration, disassembly and reconfiguration services along the whole consumer/customised products value chain and along its overall life cycle also including the aftersale stage.

The proposals are expected to include use-case demonstrations aiming at the rapid deployment of the new modularity, reconfiguration and re-use of personalised consumer/customised products and life cycle management. All relevant value-chain stakeholders are expected to participate, including relevant Social Sciences and Humanities (SSH) practitioners.

The resulting personalised products are expected to satisfy the final consumer needs at an individual level and consequently to facilitate daily life (particularly concerning elderly, disabled or other target groups with special needs) or improve workers and sportsmen safety and health.

Activities are expected to focus on Technology Readiness Levels 5 to 7 and to be centred around TRL6.

This topic addresses cross-KET activities.

This topic is particularly suitable for SMEs.

This topic is particularly suitable for collaboration at international level, especially regarding the involvement of multiple actors in complex value chains on a global scale for consumer/customised goods.

The Commission considers that proposals requesting a contribution from the EU 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

The developed new technologies should lead to a significant impact in terms of:

- Reduction of time to market of new personalised products/services by 30% through a modular product/service design and manufacturing approach
- Cost reduction of the manufacturing of personalised products by 25% by decreasing lead times in product-services development and configuration
- Reduction of environmental impact by more than 50% due to modular reusable components and final products
- Savings of overall products/services life cycle costs by 30% as a consequence of the reusability and re-adaptability of the components of the personalised products
- Wide adoption of the technologies developed leading to increasingly flexible manufacturing of customised products

Proposals should include a business case and exploitation strategy, as outlined in the Introduction to the LEIT part of this Work Programme.

Euratom

NFRP 1: Continually improving safety and reliability of Generation II and III reactors

RIA ☑ IA ☒ CSA ☒

Specific Challenge

A number of current Generation II reactors should continue operating for a few decades and Generation III should still be in operation one century from now. The objective of this action is to complement, where needed, earlier investment in research regarding the safety and reliability of Generation II and III reactors, with particular attention to the new requirements of the amended Nuclear Safety Directive (Council Directive 2014/87/Euratom of 8 July 2014 amending the Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations).

Scope

Safety and reliability improvements are to be sought in a number of areas, with due consideration to the NUGENIA roadmap. The action should address the remaining technology gaps and encompass experiments as well as numerical simulations. It should focus on the integrity of structural components in ageing reactors, the knowledge

basis for lifetime management of the reactor islands and the management of severe accidents. This can involve *inter alia*: probabilistic safety assessment, uncertainty analyses, the identification and understanding of deterioration mechanisms, the assessment of the need for and feasibility of retrofitted safety systems, the development of tools to establish safety cases for Long Term Operation, study of the prevention of hydrogen production, the improved modelling of reactor behaviour, the methodology of seismic risk assessment, the evaluation of accident-tolerant fuel, the improved assessment of fire risks and the safety demonstration of digital I&C equipment and their practical implementation. All aspects of meltdown, as a key issue of Generation-II and -III reactors, are also considered to be in scope. Results obtained as part of this action should be made public. In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), international cooperation is encouraged.

The Commission considers that proposals requesting a contribution from Euratom of between EUR 2 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. Proposals for topics NFRP 1 to 5 will be ranked in a single ranking list.

Expected Impact

This action will help industrial stakeholders to develop efficient solutions in response to the new requirements of the amended Nuclear Safety Directive. It will result in reinforcement of the safety features of the Generation-II and -III EU nuclear reactor fleet. This should improve the market profile of EU-based reactor designs and strengthen the competitiveness of the EU nuclear sector through promoting an excellent level of safety in response to market requirements and trends.

NFRP 13: Fission/fusion cross-cutting research in the area of multi-scale materials modelling

RIA ☑	IA ☒	CSA ☒

Specific Challenge

As the fusion programme progresses towards the ultimate goal of electricity generation, there are increasing opportunities for synergies in a wide range of areas that are common with fission. The present action is to encourage closer integration of research efforts between fission and fusion research communities in the domain of multi-scale modelling in research on material properties and the development of new materials.

Scope

Ferritic-martensitic (F/M) steel is a promising material for use in both fusion and fission installations. Multi-scale modelling is expected to be an efficient and effective tool in the development of a complete description and in-depth understanding of phenomena in these steels. In this context, the predictive capability of models is of paramount importance and should be aimed at supporting the elaboration of design rules. Proposed modelling approaches would need to be supported by robust validation means, including where necessary testing of environmental degradation and appropriate irradiation campaigns ranging from neutrons to ions. Contributions to benchmarking, the development of codes and standards as well as to small specimen test technology is also encouraged. It is essential for proposals to demonstrate substantial benefit for both fission and fusion, to include actors from both communities (specifically EUROfusion and EERA Joint Programme on Nuclear Materials), and to complement the existing research efforts in both domains.

The Commission considers that proposals requesting a contribution from Euratom of between EUR 3 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. Proposals for topics NFRP 13 and 14 will be ranked in a single ranking list.

Expected Impact

This action will help the cross-fertilisation in nuclear materials research between the two main fields of activity represented by fission and fusion and will result in a better general understanding and critical mass in the discipline as a whole. In turn, it will help overcome bottlenecks that are limiting developments in fission and fusion, including in technology areas with safety relevance.

Annex 1. List and link to Work Programmes H2020, 2016-17

Work Programmes 2016-17

http://ec.europa.eu/research/participants/portal/desktop/en/funding/reference_docs.html

1. Introduction 2016-17
2. Future and Emerging Technologies (FETs) 2016-17
3. Marie Sklodowska-Curie actions (MSCA) 2016-17
4. Research infrastructures (including e-Infrastructures) 2016-17
5. Introduction to Leadership in enabling and industrial technologies (LEITs) 2016-17
5i. Information and communication technologies (ICT) 2016-17
5ii. Nanotechnologies, advanced materials, advanced manufacturing and processing, biotechnology 2016-17
5iii. Space 2016-17
6. Access to risk finance 2016-17
7. Innovation in SMEs 2016-17
8. Health, demographic change and wellbeing 2016-17
9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy 2016-17
10. Secure, clean and efficient energy 2016-17
11. Smart, green and integrated transport 2016-17
12. Climate action, environment, resource efficiency and raw materials 2016-17
13. Europe in a changing world - inclusive, innovative and reflective societies 2016-17
14. Secure societies - protecting freedom and security of Europe and its citizens 2016-17
15. Spreading excellence and widening participation 2016-17
16. Science with and for society 2016-17
17. Cross-cutting activities (Focus Areas) 2016-17
18. Fast Track to Innovation Pilot 2016-17
19. Dissemination, Exploitation and Evaluation 2016-17

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

		TYPE OF ACTION	BUDGET 2016 (M EUR)	BUDGET SHARED WITH CALLS:	BUDGET 2017 (M EUR)	BUDGET SHARED WITH CALLS:	DEADLINE single step	DEADLINE 1st step	DEADLINE 2nd step
4. Research infrastructures (including e-Infrastructures) 2016-17									
INFRADEV-01-2017	Design Studies	RIA			20,00		29/03/2017		
INFRADEV-02-2016	Preparatory Phase of ESFRI projects	CSA	40,00				22/06/2016		
INFRADEV-03-2016-2017	Individual support to ESFRI and other world-class research infrastructures	CSA	30,00		40,00		30/03/2016		
INFRAIA-01-2016-2017	Integrating Activities for Advanced Communities	RIA	88,00		72,00		30/03/2016		
INFRAIA-02-2017	Integrating Activities for Starting Communities	RIA			40,00			30/03/2016	29/03/2017
INFRAINNOV-01-2017	Fostering co-innovation for future detection and imaging technologies	RIA			20,00		29/03/2017		
INFRAINNOV-02-2016	Support to Technological Infrastructures	CSA	10,00				30/03/2016		
5i. Information and communication technologies (ICT) 2016-17									
ICT-02-2016	Thin, Organic and Large Area Electronics	RIA	12,00				12/04/2016		
ICT-02-2016	Thin, Organic and Large Area Electronics	IA	8,00				12/04/2016		
ICT-03-2016	SSI - Smart System Integration	RIA	17,00				12/04/2016		
ICT-03-2016	SSI - Smart System Integration	CSA	1,50				12/04/2016		
ICT-07-2017	5G PPP Research and Validation of critical technologies and systems	RIA			100,00		08/11/2016		
ICT-07-2017	5G PPP Research and Validation of critical technologies and systems	CSA			3,00		08/11/2016		
ICT-08-2017	5G PPP Convergent Technologies	IA			40,00		08/11/2016		
ICT-08-2017	5G PPP Convergent Technologies	RIA			5,00		08/11/2016		
ICT-09-2017	Networking research beyond 5G	RIA			18,00		08/11/2016		
ICT-29-2016	Photonics KET 2016	RIA	40,00				12/04/2016		
ICT-29-2016	Photonics KET 2016	IA	23,00				12/04/2016		
ICT-29-2016	Photonics KET 2016	CSA	3,00				12/04/2016		
ICT-30-2017	Photonics KET 2017	RIA			41,00		25/04/2017		
ICT-30-2017	Photonics KET 2017	IA			43,00		25/04/2017		
ICT-30-2017	Photonics KET 2017	CSA			3,00		25/04/2017		
ICT-31-2017	Micro- and nanoelectronics technologies	RIA			19,00		25/04/2017		
ICT-31-2017	Micro- and nanoelectronics technologies	IA			3,00		25/04/2017		

		TYPE OF ACTION	BUDGET 2016 (M EUR)	BUDGET SHARED WITH CALLS:	BUDGET 2017 (M EUR)	BUDGET SHARED WITH CALLS:	DEADLINE single step	DEADLINE 1st step	DEADLINE 2nd step
5ii. Nanotechnologies, advanced materials, advanced manufacturing and processing, biotechnology 2016-17									
EEB-05-2017	Development of near zero energy building renovation	IA			54,00	EEB-5, EEB-6, EEB-7, EEB-8	19/01/2017		
EEB-07-2017	Integration of energy harvesting at building and district level	IA			54,00	EEB-5, EEB-6, EEB-7, EEB-8	19/01/2017		
NMBP-03-2016	Innovative and sustainable mateRIAls solutions for the substitution of critical raw mateRIAls in the electric power system	RIA	78,08	NMBP-1, 2, 3, 23, 26				08/12/2015	24/05/2016
NMBP-04-2017	Architectured /Advanced mateRIAl concepts for intelligent bulk mateRIAl structures	RIA			114,19	NMBP-4, 5, 6, 7, 22, 25, 28, 29, 35		27/10/2016	04/05/2017
NMBP-05-2017	Advanced mateRIAls and innovative design for improved functionality and aesthetics in high added value consumer goods	IA			114,19	NMBP-4, 5, 6, 7, 22, 25, 28, 29, 35		27/10/2016	04/05/2017
NMBP-07-2017	Systems of mateRIAls characterisation for model, product and process optimisation	RIA			114,19	NMBP-4, 5, 6, 7, 22, 25, 28, 29, 35		27/10/2016	04/05/2017
NMBP-13-2017	Cross-cutting KETs for diagnosticssss at the point-of-care	RIA			15,00		19/01/2017		
NMBP-15-2017	Nanotechnologies for imaging cellular transplants and regenerative processes in vivo	RIA			40,00	NMBP-12, 14, 15		27/10/2016	04/05/2017
NMBP-16-2017	Mobilising the European nano-biomedical ecosystem	CSA			5,20	NMBP-8, 16, 31, 34	19/01/2017		
NMBP-17-2016	Advanced materials solutions and architectures for high efficiency solar energy harvesting	IA	32,00	NMBP-17, 18				08/12/2015	24/05/2016
NMBP-21-2016	ERA-NET on manufacturing technologies supporting industry and particularly SMEs in the global competition	ERA-NET-COFUND	30,00	BIOTEC-01, NMBP-11, NMBP-21			21/01/2016		
NMBP-26-2016	Analytical techniques and tools in support of nanomateRIAl risk assessment	RIA	78,08	NMBP-1, 2, 3, 23, 26				08/12/2015	24/05/2016
NMBP-29-2017	Advanced and realistic models and assays for nanomateRIAl hazard assessment	RIA			114,19	NMBP-4, 5, 6, 7, 22, 25, 28, 29, 35		27/10/2016	04/05/2017
NMBP-36-2016	Policy support for Industry 2020 in the circular economy	CSA	10,70	BIOTEC-04, NMBP-24, 27, 30, 31, 32, 33, 36			21/01/2016		

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5iii. Space 2016-17									
COMPET-1-2016	Technologies for European non-dependence and competitiveness	RIA	14,85				03/03/2016		
COMPET-2-2016	Maturing satellite communication technologies	RIA	7,00				03/03/2016		
COMPET-4-2016	SRC - Space Robotics Technologies	RIA	18,00				03/03/2016		
COMPET-5-2016	Scientific Instrumentation	RIA	3,00				03/03/2016		
GALILEO-3-2017	EGNSS professional applications	IA			8,00			01/03/2017	
COMPET-1-2017	Technologies for European non-dependence and competitiveness	RIA			15,00			01/03/2017	
COMPET-2-2017	Competitiveness in Earth observation mission technologies	RIA			7,00			01/03/2017	
COMPET-3-2017	High speed data chain	RIA			10,00			01/03/2017	
COMPET-7-2017	Technology transfer and business generators	CSA			1,00			01/03/2017	
7. Innovation in SMEs 2016-17									
SMEInst-01-2016-2017	Open Disruptive Innovation Scheme	SME Instrument	60,00		66,00		STEP 2 03/02/16 14/04/16 15/06/16 13/10/16 STEP 1 24/02/16 03/05/16 07/09/16 09/11/16	STEP 2 18/01/17 06/04/17 01/06/17 18/10/16 STEP 1 15/02/17 03/05/17 06/09/17 08/11/17	
SMEInst-02-2016-2017	Accelerating the uptake of nanotechnologies advanced materials or advanced manufacturing and processing technologies by SMEs	SME Instrument	31,83		35,32				
SMEInst-04-2016-2017	Engaging SMEs in space research and development	SME Instrument	11,37		12,60				
SMEInst-05-2016-2017	Supporting innovative SMEs in the healthcare biotechnology sector	SME Instrument	35,00		45,00				
SMEInst-06-2016-2017	Accelerating market introduction of ICT solutions for Health, Well-Being and Ageing Well	SME Instrument	18,00		12,50				
SMEInst-09-2016-2017	Stimulating the innovation potential of SMEs for a low carbon and efficient energy system	SME Instrument	46,00		50,00				
SMEInst-10-2016-2017	Small business innovation research for Transport and Smart Cities Mobility	SME Instrument	57,57		61,23				
SMEInst-11-2016-2017	Boosting the potential of small businesses in the areas of climate action, environment, resource efficiency and raw materials	SME Instrument	25,00		27,50				
SMEInst-13-2016-2017	Engaging SMEs in security research and development	SME Instrument	15,37		14,67				
INNOSUP-01-2016-2017	Cluster facilitated projects for new industrial value chains	IA	15,00					06/04/2016	08/09/2016
INNOSUP-03-2017	Technology services to accelerate the uptake of advanced manufacturing technologies for clean production by manufacturing SMEs	CSA			4,90		28/03/2017		

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8. Health, demographic change and wellbeing 2016-17									
SC1-PM-05–2016	The European Human Biomonitoring Initiative	COFUND-EJP	50,00				13/04/2016		
SC1-PM-06–2016	Vaccine development for malaria and/or neglected infectious diseases	RIA	40,00				13/04/2016		
SC1-PM-08–2017	New therapies for rare diseases	RIA			60,00			04/10/2016	11/04/2017
SC1-PM-09–2016	New therapies for chronic diseases	RIA	60,00				13/04/2016		
SC1-PM-10–2017	Comparing the effectiveness of existing healthcare interventions in the adult population	RIA			40,00			04/10/2016	11/04/2017
SC1-PM-16–2017	In-silico trials for developing and assessing biomedical products	RIA			19,00		14/03/2017		
SC1-PM-17–2017	Personalised computer models and in-silico systems for well-being	RIA			19,00		14/03/2017		
SC1-HCO-01-2016	Valorisation of FP7 Health and H2020 SC1 research results	CSA	2,00				13/04/2016		
SC1-HCO-02-2016	Standardisation of pre-analytical and analytical procedures for in vitro diagnostics in personalised medicine	CSA	2,00				13/04/2016		
9. Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy 2016-17									
SFS-05-2017	Robotics Advances for Precision Farming	RIA			7,00		14/02/2017		
SFS-13-2017	Validation of diagnostic tools for animal and plant health	IA			6,00		14/02/2017		
SFS-22-2017	Smart fisheries technologies for an efficient, compliant and environmentally friendly fishing sector	IA			6,00		14/02/2017		
BG-04-2017	Multi-use of the oceans marine space, offshore and near-shore: Enabling technologies	IA			8,00		14/02/2017		
BG-05-2016	ERA-NET Cofund on marine technologies	ERA-NET-COFUND	10,00				17/02/2016		
BG-07-2017	Blue green innovation for clean coasts and seas	IA			12,00		14/02/2017		
BG-09-2016	An integrated Arctic observation system	RIA	30,00	BG-09 and BG-10			17/02/2016		
BG-10-2016	Impact of Arctic changes on the weather and climate of the Northern Hemisphere	RIA	30,00	BG-09 and BG-10			17/02/2016		
BG-12-2016	Towards an integrated Mediterranean Sea Observing System	RIA	8,00					17/02/2016	13/09/2016
BG-13-2016	Support to the BLUEMED Initiative: Coordination of marine and maritime research and innovation activities in the Mediterranean	CSA	3,00				17/02/2016		
RUR-04-2016	Water farms – improving farming and its impact on the supply of drinking water	RIA	5,00					17/02/2016	13/09/2016

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10. Secure, clean and efficient energy 2016-17									
EE-10-2016	Supporting accelerated and cost-effective deep renovation of buildings through Public Private Partnership (EeB PPP)	IA	16,00	EE-10-2016 and EE-17-2016-2017			21/01/2016		
EE-11-2016-2017	Overcoming market barriers and promoting deep renovation of buildings	CSA	30,00	EE6, EE9, EE11, EE13, EE14, EE16, EE24, EE25			15/09/2016		
EE-11-2016-2017	Overcoming market barriers and promoting deep renovation of buildings	CSA			47,00	EE2, EE6, EE9, EE11, EE14, EE15, EE16, EE18, EE19, EE23, EE24	07/06/2017		
EE-12-2017	Integration of Demand Response in Energy Management Systems while ensuring interoperability through Public Private Partnership (EeB PPP)	IA			16,00	EE12, EE17-2017	19/01/2017		
11. Smart, green and integrated transport 2016-17									
MG-1.1-2016	Reducing energy consumption and environmental impact of avIAtion	RIA	40,00					20/01/2016	29/09/2016
ART-01-2017	ICT infrastructure to enable the transition towards road transport automation	IA			50,00	ART-1, ART-3, ART-7		26/01/2017	27/09/2017
ART-02-2016	Automation pilots for passenger cars	IA	48,00	ART-2, ART-4				20/01/2016	29/09/2016
ART-05-2016	Road infrastructure to support the transition to automation and the coexistence of conventional and automated vehicles on the same network	RIA	13,00					20/01/2016	29/09/2016
12. Climate action, environment, resource efficiency and raw materials 2016-17									
SC5-04-2017	Towards a robust and comprehensive greenhouse gas verification system	RIA			43,00	SC5-1, SC5-2, SC5-4, SC5-6	07/03/2017		
SC5-13-2016-2017	New solutions for sustainable production of raw mateRIAls	RIA	26,00				08/03/2016		
SC5-13-2016-2017		RIA			10,00		07/03/2017		
SC5-14-2016-2017	Raw materials Innovation actions	IA			56,00			07/03/2017	05/09/2017
SC5-16-2016-2017	Raw materials international co-operation	CSA			9,50	SC5-15 and SC5-16	07/03/2017		
SC5-18-2017	Novel in-situ observation systems	RIA			15,00		07/03/2017		

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13. Europe in a changing world - inclusive, innovative and reflective societies 2016-17									
ENG-GLOBALLY-09-2016	Centres/Networks of European research and innovation	CSA	10,00				14/04/2016		
CULT-COOP-08-2016	Virtual museums and socIAl platform on European digital heritage, memory, identity and cultural interaction	RIA	10,00				04/02/2016		
CULT-COOP-08-2016	Virtual museums and socIAl platform on European digital heritage, memory, identity and cultural interaction	CSA	1,00				04/02/2016		
CULT-COOP-09-2017	European cultural heritage, access and analysis for a richer interpretation of the past	RIA			9,00		02/02/2017		
14. Secure societies - protecting freedom and security of Europe and its citizens 2016-17									
CIP-01-2016-2017	Prevention, detection, response and mitigation of the combination of physical and cyber threats to the critical infrastructure of Europe	IA	20,00				25/08/2016		
CIP-01-2016-2017	Prevention, detection, response and mitigation of the combination of physical and cyber threats to the critical infrastructure of Europe	IA			20,00		24/08/2017		
SEC-01-DRS-2016	Integrated tools for response planning and scenario building	IA	8,00				25/08/2016		
SEC-03-DRS-2016	Validation of biological toxins measurements after an incident: Development of tools and procedures for quality control	IA	8,00				25/08/2016		
SEC-10-FCT-2017	Integration of detection capabilities and data fusion with utility providers' networks	IA			16,00		24/08/2017		
SEC-14-BES–2016	Towards reducing the cost of technologies in land border security applications	RIA	10,00				25/08/2016		
SEC-15-BES–2017	Risk-based screening at border crossing	IA			8,00		24/08/2017		
SEC-16-BES–2017	Through-follAge detection, including in the outermost regions of the EU	RIA			8,00		24/08/2017		
SEC-20-BES-2016	Border Security: autonomous systems and control systems	IA	24,00	SEC-19, SEC-20			25/08/2016		
DS-01-2016	Assurance and Certification for Trustworthy and Secure ICT systems, services and components	RIA	13,50				12/04/2016		
DS-01-2016	Assurance and Certification for Trustworthy and Secure ICT systems, services and components	IA	9,00				12/04/2016		
DS-01-2016	Assurance and Certification for Trustworthy and Secure ICT systems, services and components	CSA	1,00				12/04/2016		

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17. Cross-cutting activities (Focus Areas) 2016-17									
PILOTS-01-2016	Pilot lines for manufacturing of mateRIAls with customized thermal/electrical conductivity properties	IA	32,00	PILOTS 01-02				08/12/2015	24/05/2016
PILOTS-02-2016	Pilot Line Manufacturing of Nanostructured Antimicrobial Surfaces using Advanced Nanosurface Functionalization Technologies	IA	32,00	PILOTS 01-02				08/12/2015	24/05/2016
PILOTS-03-2017	Pilot Lines for Manufacturing of Nanotextured surfaces with mechanically enhanced properties	IA			48,00	PILOTS 3, 4, 5		27/10/2016	04/05/2017
PILOTS-04-2017	Pilot Lines for 3D printed and/or injection moulded polymeric or ceramic microfluidic MEMS	IA			48,00	PILOTS 3, 4, 5		27/10/2016	04/05/2017
PILOTS-05-2017	Paper-based electronics	RIA			48,00	PILOTS 3, 4, 5		27/10/2016	04/05/2017
FOF-01-2016	Novel hybrid approaches for additive and subtractive manufacturing machines	RIA	77,00	FOF 01-02-03-04-05			21/06/2016		
FOF-02-2016	Machinery and robot systems in dynamic shop floor environments using novel embedded cognitive functions	IA	77,00	FOF 01-02-03-04-05			21/06/2016		
FOF-03-2016	Zero-defect strategies at system level for multi-stage manufacturing in production lines	IA	77,00	FOF 01-02-03-04-05			21/06/2016		
FOF-04-2016	Continuous adaptation of work environments with changing levels of automation in evolving production systems	RIA	77,00	FOF 01-02-03-04-05			21/06/2016		
FOF-05-2016	Support for the further development of Additive Manufacturing technologies in Europe	CSA	77,00	FOF 01-02-03-04-05			21/06/2016		
FOF-06-2017	New product functionalities through advanced surface manufacturing processes for mass production	RIA			85,00	FOF 06-07-08-09-10	19/012017		
FOF-07-2017	Integration of unconventional technologies for multi-mateRIAl processing into manufacturing systems	RIA			85,00	FOF 06-07-08-09-10	19/012017		
FOF-08-2017	In-line measurement and control for micro-/nano-enabled high-volume manufacturing for enhanced relIAbility	IA			85,00	FOF 06-07-08-09-10	19/012017		
FOF-09-2017	Novel design and predictive maintenance technologies for increased operating life of production systems	IA			85,00	FOF 06-07-08-09-10	19/012017		
FOF-10-2017	New technologies and life cycle management for reconfigurable and reusable customised products	IA			85,00	FOF 06-07-08-09-10	19/012017		
FOF-13-2016	Photonics Laser-based production	IA	15,00				21/06/2016		
SPIRE-01-2016	Systematic approaches for resource-efficient water management systems in process industries	IA	74,00	SPIRE 01-02-03-04-05-06			21/01/2016		

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18. Fast Track to Innovation Pilot 2016-17									
FTIPilot-01-2016	Fast Track to Innovation Pilot	IA	100,00				15/03/2016 01/06/2016 25/10/2016		
Euratom									
NFRP 1	Continually improving safety and relIAbility of Generation-II and -III reactors	RIA	47,74	NFRP 1-, NFRP -2, NFRP -3, NFRP 4, NFRP 5			05/10/2016		
NFRP 1	Continually improving safety and rellability of Generation-II and -III reactors	RIA			7,71	NFRP 1-, NFRP -2, NFRP -3, NFRP 4, NFRP 5			
NFRP 13	Fission/fusion cross-cutting research in the area of multi-scale materials modelling	RIA			8,00	NFRP 13, NFRP 14	05/10/2016		

This document has been prepared under the Project EuroPHO21 (H2020-ICT-2014-1, 643995) by Teresa Molina-Jiménez with the cooperation of Estrella Fernández-Sánchez, Roberto Ocaña, Juan Hervás and Santiago Simón.