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Annex 6

Horizon 2020

Work Programme 2018-2020

5.i. Information and Communication Technologies

Important notice on the Horizon 2020 Work Programme

This Work Programme covers 2018, 2019 and 2020. The parts that relate to 2019 and 2020 are provided at this stage on an indicative basis. Such Work Programme parts will be decided during 2018 and/or 2019.

(European Commission Decision C(2017)7124 of 27 October 2017)

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Introduction

Digital technologies underpin innovation and competitiveness across private and public sectors and enable scientific progress in all disciplines. The topics addressed in this Work Programme part cover the ICT technology in a comprehensive way, from technologies for Digitising European Industry, HPC, Big Data and Cloud, 5G and Next Generation Internet. Pursuing the change initiated under Work Programme 2016-2017, activities will continue to promote more innovation-orientation to ensure that the EU industry remains strong in the core technologies that are at the roots of future value chains.

Firstly, this WP will support core ICT industries through roadmap-based Public Private Partnerships (PPPs). The work will contribute to maintaining and developing the technology leading edge in key areas such as electronics, photonics, embedded systems, computing, robotics, big data or network technologies and systems, in which the EU has and should keep major strengths. The ECSEL Joint Undertaking on electronic components and systems and the contractual PPPs will continue to be cornerstones for this strategy.

Secondly, support to the Focus Area Digitising and transforming European industry and services will be provided through Innovation hubs and cross-sectorial and integrated digital platforms and large-scale pilots for experimentation and co-creation with users.

All available demand-side instruments and accompanying measures will continue to be exploited in order to reinforce the involvement of end users, support digital entrepreneurship, strengthen support to start-ups and SMEs and as a result more effectively embed innovation in LEIT-ICT.

Security also remains a key transversal goal through a dedicated set of activities as well as a pervasive consideration for security issues throughout ICT research and innovation areas.

The international dimension of ICT activities is reinforced through joint calls with Japan and South Korea on a set of specific topics, dedicated twining activities on 5G with China and Taiwan, as well as additional support actions towards improved cooperation with the US on 5G and Next Generation Internet.

Finally, the STARTS activity promotes silo-breaking collaboration between researchers, industry and artists to have European innovation profit from the out of the box thinking of artists. In particular, STARTS encourages projects to consider including dedicated artistic practices, for instance, for exploration of technological limits via art installations, developing unexpected uses of technology, testing of unusual technical solutions, and for working on social acceptance.

Geolocation and earth observation data are playing an important role in digitisation. Wherever relevant, applicants are strongly encouraged to leverage data provided by the European satellite navigation systems Galileo and EGNOS, as well as the European Earth Observation programme Copernicus.

Interim Evaluation

This work programme takes into consideration and addresses the main findings of the Horizon 2020 Interim Evaluation. In particular, this Work Programme has a simpler and more coherent structure, in line with clear political priorities in the digital area. This will help increase impact and makes it easier to navigate for proposers. This is consistent with the Interim Evaluation's recommendation to 'simplify the work programme'. The work programme also reinforces international cooperation with Japan, South Korea, China, Taiwan and the US, a clear recommendation from the interim evaluation which noted a decrease in international participation as compared to FP7. This should help improve on the opening of the programme. This Work Programme responds to the need to deliver on the targets for sustainable development (in particular goal 9) through building resilient infrastructures, promote inclusive and sustainable industrialization and foster innovation.

Open research data

Grant beneficiaries under this work programme part will engage in research data sharing by default, as stipulated under Article 29.3 of the Horizon 2020 Model Grant Agreement (including the creation of a Data Management Plan). Participants may however opt out of these arrangements, both before and after the signature of the grant agreement. More information can be found under General Annex L of the work programme

Contribution to focus area(s)

Focus Area 'Digitising and transforming European industry and services' (DT): EUR 461.00 million

Focus Area 'Boosting the effectiveness of the Security Union' (SU): EUR 152.00 million

Call - Information and Communication Technologies[1]

H2020-ICT-2018-2020

Technologies for Digitising European Industry

The Digitising European Industry[2] initiative aims to establish next generation digital platforms and re-build the underlying digital supply chain on which all economic sectors are dependent. The initiative should enable all sector and application areas to adapt, transform and benefit from digitisation, notably by allowing also smaller players to capture value. Digital Platforms are becoming a key factor in one sector after another, enabling new types of services and applications, altering business models and creating new marketplaces. Actions under this heading will provide extensive support to key DEI components in Photonics, Robotics, Manufacturing technologies and Cyber-Physical Systems. Support to Micro-electronics, in particular for higher TRLs, will continue through the ECSEL Joint Undertaking. In addition, innovation hubs and platforms, two key DEI objectives, will be supported through a Focus Area on Digitisation and Transformation of the EU industry, implemented in cooperation with other programme parts.

Progress in technologies such as photonics, micro- and nanoelectronics, smart systems and robotics is changing the way we design, produce, commercialise and generate value from products and related services. Recent studies[3] estimate that digitisation of products and services will add more than 110 B€ of revenue for industry per year in Europe in the next 5 years. Close to a third of the growth of the overall industrial output in Europe is already due to the uptake of digital technologies.[4] The challenge ahead is for the European industry to seize fully and swiftly these opportunities. This is essential to ensure Europe's mid and long term competitiveness with implications for overall welfare. The purpose of the topics proposed under this heading is to ensure European industry is supported in further developing the building blocks of the digital transformation

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1 It is expected that this call will continue in 2020.
Drawing on the success of actions of previous work programmes leveraging cascading grants to enable agility and reach out to new or key actors in the innovation chain (such as SMEs and mid-caps) not necessarily involved in standard EU R&I projects, part of the budget allocated to several actions of the Next Generation Internet topics will be dedicated to the support of experiments and smaller projects funded through financial support to third parties (in accordance with article 137 of the Financial Regulation). While their size will be small in comparison with standard Horizon 2020 actions, in line with article 23 (7) of the Rules for Participation the budget to be allocated per third party may exceed the default maximum amount foreseen in the Financial Regulation. Specific limits corresponding to the specific objectives to be addressed, and to the consequent expected scale and duration of the activities to be carried out by third parties are provided for the topics ICT-24-2018-2019, ICT-25-2018-2020, ICT-26-2018-2020, ICT-29-2018, and ICT-30-2019-2020.

2 http://bit.ly/DigIndEU

3 PwC, opportunities and Challenges of the industrial internet (2015), and Boston Consulting Group: the future of productivity and growth in manufacturing industries (2015)

4 Estimates by LIFE + series of studies 2016.

Proposals are invited against the following topic(s):

ICT-01-2019: Computing technologies and engineering methods for cyber-physical systems of systems

Specific Challenge: Cyber-physical Systems of Systems (CPSoS), like transport networks or large manufacturing facilities, interact with and are controlled by a considerable number of distributed and networked computing elements and human users. These complex and physically-entangled systems of systems are of crucial importance for the quality of life of the citizens and for the European economy. At system level the challenge is to bring a step change to the engineering techniques supporting the design-operation continuum of dynamic CPSoS and to exploit emerging technologies such as augmented reality and artificial intelligence. At computing level the challenge is to develop radically new solutions overcoming the intrinsic limitations of today's computing system architectures and software design practices.

Scope: **a. Research and Innovation Actions**

The focus is on dependable physically-entangled systems for applications in industrial sectors. Work is complementary to the initiative on European low-power microprocessor technologies, which addresses technology for HPC applications, and to the ECSEL programme, which addresses computing for CPSoS at higher TRL.

Computing software and systems design for physically-entangled systems supporting the creation of reliable, robust and energy-aware solutions for autonomous and safety-critical systems. The issues of energy efficiency, testability, trust and cyber-security should be considered, as well as the support of different levels of criticality on the same computing platform where needed.

Models, tools and methods for design-operations continuum of dependable CPSoS supporting the complete lifecycle of Cyber-Physical Systems of Systems (CPSoS), from requirements capture to design, test, operation and decommissioning. Projects shall focus on autonomic solutions capable of guaranteeing the overall reliability and security even when the components or subsystems are not fully reliable and unforeseen conditions emerge in the course of operation.

Projects will target TRLs 2-5, and will deliver a working prototype tested in at least two different use cases, demonstrating improvement over the state of the art in industrial and professional domains. The Commission considers that proposals requesting a contribution from the EU of between EUR 3 and 5 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. In each area at least four proposals will be funded.

b. Coordination and Support Activities

The objective is to structure, connect and cross-fertilise the European academic and industrial research and innovation communities in Embedded Computing and Cyber-Physical Systems.

The action should implement technology watch, facilitate take-up of technologies in real-world use cases and support know-how transfer. Activities will include constituency building, clustering of related projects, liaison with related programmes such as ECSEL and EUREKA, impact analysis, communication of project results, pre-normative activities and road-mapping for future research and innovation. One proposal will be funded.

Expected Impact: Proposals should address one or more of the following impact criteria, providing metrics to measure success where appropriate:

- Availability of innovative technologies supporting compute-intensive applications in industrial and professional domains, demonstrating significant and measurable improvement over the state of the art.
- Availability of engineering practices and tools for CPSoS, resulting in a demonstrable improvement in quality and cost of development and operation for large SoS.
- Increased synergies and collaboration between industrial and academic communities; dissemination of high-quality roadmap for future research and innovation activities in the relevant areas.

Type of Action: Research and Innovation action, Coordination and support action

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

ICT-02-2018: Flexible and Wearable Electronics

Specific Challenge: Flexible and Wearable Electronics combines new and traditional materials with large-area processes to fabricate lightweight, flexible, printed and multi-functional electronic products. The challenge is to tap open opportunities in existing and emerging markets by pushing technology barriers further and demonstrating innovative use in sectors that could benefit from such innovations.

Scope: To fully exploit the potential of Flexible and Wearable Electronics and overcome barriers of manufacturability, challenges need to be addressed in materials, processes for large-area fabrication and quality control, integration technologies, and demonstrating innovative and sustainable products for professionals and consumers. This topic will support advances in device technology and related manufacturing processes.

Proposals can address one or more of the following topics:

Enhancing manufacturability: Addressing advances in combined organic and printed electronics and large area deposition technologies resulting in multi-functional components; and/or equipment and processes for large-scale fabrication, mass-customisation and characterisation as well as textile compatibility, whenever relevant.

Integration technologies: It addresses the development of new concepts for the integration of transducers, energy and data storage elements, logic, displays and light sources, as well as new interconnection technologies.

Device demonstration: Prototype validation in specific applications of flexible and wearable electronics. Consideration to be given to the integration of electronic devices in connected wearable and portable settings (e.g. textiles, flexible or stretchable substrates), interconnection, compatibility with low-cost manufacturing, efficient energy scavenging and storage, functional performance, and durability/reliability. Privacy and security, liability and free flow of data as well as recyclability and waste management should be considered where relevant.

It is expected that projects addressing manufacturability would demonstrate production capability in a laboratory environment (TRL 4).

For integration and device demonstration, it is expected that technologies are validated in laboratory or relevant environments (TRL 4-5), and that industrial exploitation is clearly identified.

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

To complete this effort and strengthen the value chain, from materials to devices, a jointly funded topic with NMBP [5] will support projects spanning from material improvement (electrical performance, processibility, stability and lifetime during device operation), to prototyping of advanced large area electronic products - TRL 3 to TRL 5. This topic will be implemented through Innovation Actions (see topic DT-NMBP-18-2019 Materials, manufacturing processes and devices for organic and large area electronics (IA)).

Expected Impact: Proposals should address some of the following impact criteria and provide metrics to measure and monitor progress:

- Technology leaps related to improved performance (functionalities, autonomy, reliability, manufacturability and cost…) and contributing to European leadership in large area, flexible and wearable electronics .
- The emergence of new products based on the combination of printed and large area processed electronics.
- Increased R&D cooperation in technology device development and related manufacturing processes.
- Developing further manufacturing capabilities in Europe.

[5] Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology. Part of LEIT (Leadership in Enabling and Industrial Technologies) in Horizon 2020.

- Creating new opportunities for digitisation in other sectors and including new actors in the ecosystems (designers, artists…),
- Increased industrial investments in flexible and wearable electronics.

Type of Action: Research and Innovation action

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

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

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

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

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

Actions must address one or more of the following technologies.

1. **Indium Phosphide (2018 call):** providing open access to photonics integrated circuits based on Indium Phosphide, going beyond multi-project wafers and offering generic solutions for a wide class of applications.
2. **Silicon Photonics (2018 call):** providing open access to photonics integrated circuits based on Silicon Photonics, going beyond multi-project wafers and offering generic solutions for a wide class of applications.

3. **Next generation free-form optics (2019 call):** maturing a technology platform and providing access to optics with free-form shapes and exceptional surface finish, exploiting new optical materials and/or combining and integrating diffractive/refractive/reflective optical components, to obtain improved performances and capabilities.

4. **Advanced optical medical device technologies for medical diagnostics (2019 call):** maturing a technology platform and providing access to novel, reliable, robust optical based devices for in-vivo and/or in-vitro medical diagnosis.

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

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

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

Type of Action: Innovation action

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

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

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

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

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

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

Scope: The focus is on the following themes:

a) Innovation Actions

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

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

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

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

b) Research and Innovation Actions

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

ii. **Tailored Laser Beams for Laser-based Manufacturing**: new methods and schemes of beam shaping providing the optimal energy delivery on the work piece with a high spatial and temporal resolution. Proposals may include also the related monitoring and

closed loop control aspects. The developed system should be demonstrated with a relevant industrial application.

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

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

a) Innovation Actions

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

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

iii. Enabling Europe to maintain and build on its leading position in innovative lighting solutions by making lighting part of the Internet of Things and unlocking new application domains.

b) Research and Innovation Actions

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

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

Type of Action: Innovation action, Research and Innovation action

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

ICT-05-2019: Application driven Photonics components

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

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

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

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

Scope: The focus is on the following themes:

Innovation Actions

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

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

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

Research and Innovation Actions

i. **Photonics System on Chip/ System in Package for optical interconnect applications:** Actions should address advanced techniques for the intimate combination of photonic integrated circuit technology with other enabling circuits, devices and mother boards to realise major advances in the capability, performance and complexity of photonic

system-on-chip and system-in-package components targeting photonic interconnect applications in the network, datacentre and consumer communication space. A holistic approach from design through to test is required. The targeted component technologies need to have demonstrable performance advantages in terms of speed, energy efficiency, cost and reliability and fit in the system and network architecture roadmaps of vendors.

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

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

Coordination and Support Actions

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

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

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

Innovation Actions

i. Strengthened Europe industrial competitiveness in the biophotonics related market.

ii. Increased competitiveness of the European production industry and significant contribution to the digitization of European industry.

Research and Innovation Actions

i. A massive deployment of Photonic Integrated Circuit (PIC)-based optical transceivers in data center environments thanks to the drastically reduced cost.

ii. Increased European competiveness in the biophotonic areas and more effective medical interventions and treatments.

Coordination and Support Actions

i. More and better prepared professionals in the photonics sector.

Type of Action: Research and Innovation action, Innovation action, Coordination and support action

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

ICT-06-2019: Unconventional Nanoelectronics

Specific Challenge: The challenge is to maintain Europe's position at the forefront of advanced nanoelectronic technologies developments. This is essential to ensure strategic electronic design and manufacturing capability in Europe avoiding critical dependencies from other regions. Advanced nanoelectronics technologies enable innovative solutions to industrial and societal challenges.

Scope: Projects will aim at demonstrating the viability of new approaches to computing components. The focus should be on demonstrating new concepts at transistor or circuit level which bring the potential of highly improved performance for generic or specific applications. This can be based on materials, computing unit architecture (transistor or beyond) as well as at circuit level. Still the focus is on devices and components, as well as related processing technologies.

The concept validation should be addressed in a controlled environment at a limited scale (laboratory, research line) amenable to transfer to larger scale developments in industrial environments (pilot lines, etc.).

Innovative concepts include, but are not limited to, the design, processing and integration of devices based on new approaches, e.g. spintronics, neuromorphic, resulting in computing devices and circuits. Proposals are expected to prove the industrial relevance of the intended approach.

The scope of the call covers Research & Innovation Actions on

- Energy-efficient computation devices beyond the current CMOS paradigm. These can address steep slope devices, quantum bits implemented in solid-state, spintronic-based devices, single electron devices, nanomechanical switches, etc.

- Energy-efficient computation circuit architectures. These can be based on the devices above but approaches based on neuromorphic computing or other hardware implementation are relevant.

- Specific technological developments may include (i) promising approaches for 3D stacks, both sequential and monolithic to address challenges of compactness, heat dissipation, reduced interconnect length, and (ii) development of cryogenic electronics to support advances in applications to computing (superconducting, quantum computing) or constraints faced in space. The aim is the demonstration of functionality at circuit level by integrating the adequate functional blocks.

- Design for advanced nanoelectronics technologies. Focus will be on design-technology solutions for energy efficiency, high reliability and robustness. All above topics can be addressed as well as the issues related to improving the devices and circuits in the advanced technology nodes.

The proposed demonstrations are expected to be validated in laboratory (TRL 4).

Proposal are also expected to specify the road to industrialisation and establish links to applications likely to benefit from the development.

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

- Identify applications likely to benefit from the intended approach with indication of key parameters (power, energy-efficiency, size, frequency, and cost) and quantitative targets to be achieved (figures of merit).

- Contribute to the mid-term viability of the European Nanoelectronics industry ensuring that new technologies with high potential for computing emerge in time to be taken up by industry.

- Sustain the technological integration requirements by focussing on challenging 3D integration issues as well as for electronics at cryogenic temperature.

- Contribute to the European industry capability to design advanced circuits for its needs.

Type of Action: Research and Innovation action

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

ICT-07-2018: Electronic Smart Systems (ESS)

Specific Challenge: The challenge is to develop and validate a new generation of cost-effective ESS technologies integrating hardware technologies across multiple fields eg, multi-modal sensing, actuating, advanced processing, and secure wireless transmission (to network or local infrastructures). Access to advanced electronics technologies by SMEs and academia is a complementary challenge supporting digitisation of industry.

Scope: **Research and Innovation Actions**

It is expected that proposals focus on only one of the two areas underneath (a or b).

a) Technological breakthroughs for future ESS leading to further miniaturisation, new functionalities, improved power consumption, autonomy, adaptation and reliability, and secure operation in real environments:

- Development and integration of micro- and nano- sensor and actuator systems in ESS, including sensors exploiting emerging paradigms (e.g. 2D and 1D nanomaterials, spintronics) for ultra-high sensitivity and low power, and MEMS/NEMS-based sensors,

- Demonstrating ESS that brings intelligence and real-time reconfiguration if required to the IoT edge with integration of sensor systems, processors, computing and networking elements with improved energy efficiency and sustainability,

- Advancing comprehensive design, integration and packaging technologies.

It is expected that, while proposed ESS technologies are to be validated via demonstrators operating in laboratory environments (TRL 4), industrial exploitation and application perspectives are clearly identified.

b) Advances in bio-electronics smart systems: Enhancement of the technical capabilities of bio-electronics and connected Bio-electronics and Micro-Nano-Bio Systems through cost-effective miniaturisation, manufacturing and demonstration, leading to high performance in specificity/sensitivity, reliability, time to results and manufacturability. This includes modular approaches with integration of standard components and interfaces as well as platforms where material, IT, communications and sensing/analysis modules are interchangeable. Portability, wearability, biocompatibility, and operation in remote and low resource settings should be considered. Needs of users, both men and women, markets and business cases should be clearly addressed.

Projects should start from experimentally proven concepts and deliver prototype(s) validated in relevant environments (TRL 5).

Issues related to security, safety, privacy, standardisation, interoperability, certification, life cycle, regulation compliance and ethics are to be considered where appropriate (for a and b).

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

Innovation Actions

c) Innovation Action on Access[6] to Nanoelectronics and Electronics Smart Systems: In the context of Digital Innovation Hubs (DIH) the goal is to support electronic components, sensors, smart devices and systems, including advanced nanoelectronics and integrated smart systems (e.g. Micro-Nano BioSystems). Focus is on (i) access to advanced design and manufacturing for academia, research institutes and SMEs, and (ii) Rapid prototyping production for SMEs and deployment to market. This service also includes activities such as technical support and training.

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

Coordination and Support Actions

d) Support Action on Electronics

- Reinforced collaboration & cross-fertilisation between projects and representatives of the Electronics areas addressed, namely (i) Nanoelectronics, (ii) Electronics Smart Systems and (iii) Flexible and Wearable Electronics;

- Increased outreach of these actions across Europe, their industrial perspective;

- Establishing of International cooperation in the field;

- Monitoring of technology advances and developments in the field and analysing the European ecosystems (available research infrastructures, competence centres, education, public procurement...) to determine the strengths and possible gaps.

- Elaborating technology and application roadmaps that identify new opportunities for users and suppliers.

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

Expected Impact: Proposals should address some of the following impact criteria and provide metrics to measure and monitor progress:

- European Technology leadership in ESS and bio-electronics systems performances (functionalities, size, reliability, manufacturability, cost…)

[6] Including EuroPractice-type actions

- Improving ESS manufacturing capabilities in Europe,
- Increasing ESS and bio-electronics systems Market penetration in emerging digital economy sectors,
- Creating new opportunities for digitisation in traditional sectors and improving user acceptance
- Attract a substantial number of new users, from industry (in particular SMEs and mid-caps) and academia, to advanced technologies.
- Increased industrial investments and open innovation marketplace for ESS and bio-electronics technologies.
- Increased cooperation and synergy across electronic technology areas, promoting joint, multi-disciplinary initiatives.
- Stimulating the involvement of industry in longer term research and innovation activities.

Type of Action: Innovation action, Research and Innovation action, Coordination and support action

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

ICT-08-2019: Security and resilience for collaborative manufacturing environments

Specific Challenge: As addressed in the multi-annual roadmap[7] of the FoF cPPP, physically-entangled systems used in manufacturing environments have some specific requirements in terms of reliability and security, which are now challenged by the need for manufacturing facilities to be digitally connected with external partners in the value chain. While free flow of data is a primary requirement for digitisation of industry, it poses significant challenges in terms of data security, which cannot be solved easily because the factory of the future must exchange digital information with the outside world just like raw materials and components. There is a need to develop practically usable solutions which can guarantee an adequate level of security without limiting the capability to exchange data and information both on the manufacturing floor and beyond the factory.

Scope: Proposals need to develop tools and services guaranteeing an adequate level of data security for digital collaboration between manufacturing environments and value chains. Solutions need to be practically usable in real manufacturing facilities, taking into account the operational requirements needed for factory usage in real-world conditions, including reliability and resilience. Issues of threat detection and implementation of countermeasures should be addressed, as well as evolution and real-time response when needed. Semi-

[7] See roadmap document "Factories 4.0 and Beyond" on http://www.effra.eu/

autonomous or fully autonomous solutions, requiring little or no local supervision are encouraged.

Proposals will target TRL 5 to 7, and will include at least one use case which will demonstrate measurable and significant improvements over state of the art tools and methods under real-world conditions. The Commission considers that proposals requesting a contribution from the EU of between EUR 4 and 6 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Take-up by industry of practically usable solutions which guarantee significantly increased cyber-security levels in daily operations for manufacturing facilities and other actors in the value chains.

Type of Action: Research and Innovation action

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

ICT-09-2019-2020: Robotics in Application Areas[8]

Specific Challenge: While robots originated in large-scale mass manufacturing, they are now spreading to more and more application areas. In these new settings, robots are often faced with new technical and non-technical challenges. The purpose of this topic is to address such issues in a modular and open way, and reduce the barriers that prevent a more widespread adoption of robots. Four Priority Areas (PAs) are targeted: healthcare, inspection and maintenance of infrastructure, agri-food, and agile production.

User needs, ethical, legal, societal and economic aspects should be addressed in order to raise awareness and take-up by citizens and businesses. Privacy and cybersecurity issues, including security by design and data integrity should also be addressed, where appropriate.

Scope: **a) Research and Innovation boosting promising robotics applications**

Innovative approaches to hard research problems in relation to applications of robotics in promising new areas are particularly encouraged. Proposals are expected to enable substantially improved solutions to challenging technical issues, with a view of take-up in applications with high socio-economic impact. Driven by application needs, the work can start from research at low TRL, but proposals are expected to validate their results in realistic environments in order to demonstrate the potential for take-up in the selected application(s).

The call is open to all robotics-related research topics and to all new application areas. Excluded are the four priority areas which are already covered elsewhere in this work programme: healthcare, inspection and maintenance of infrastructure, agri-food and agile

[8] It is expected that this topic will continue in 2020.

production. Proposals will be expected to plan efforts to connect and cooperate with the DIHs, Platforms and other relevant activities of this work programme, as appropriate.

The Commission considers that proposals requesting a contribution from the EU between €3 million and €5 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

b) Innovation Actions - Robotics for infrastructure inspection and maintenance

Establish large-scale pilots capable of demonstrating the use of robotics at scale in actual or highly realistic operating environments; showcase advanced prototype applications built around platforms operating in real or near-real environments and demonstrate high levels of socio-economic impact.

Through large-scale pilots, proposals are expected to make a significant step forward in platform development in the area of infrastructure inspection and maintenance. Starting from suitable reference architectures, platform interfaces are defined, tested via piloting, and supported via ecosystem building preparing their roll-out, and are being evolved over time into standards.

Each proposal is expected to establish large scale pilots. They are expected to: consider utilising existing infrastructure and links to other European, national or private funding-sources; identify the long-term sustainability of the pilot; develop scalable technical solutions capable of meeting performance targets; develop metrics and performance measures for the pilot; engage relevant industry stakeholders, including SMEs, in the provision and operation of the pilot. Proposals will be expected to dedicate resources to disseminate best practice and coordinate access to platforms and demonstrators, in particular in connecting with the Robotics DIHs and Core Technologies actions and other relevant activities, in H2020 and beyond.

Pilots are expected to address both technical and non-technical issues, such as socio-economic impact, novel business models, legal and regulatory, ethical and cyber-security issues and connections to Big Data and IoT.

The Commission considers that proposals requesting a contribution from the EU between €7 million and €9 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

c) Robotics Competitions

Competitions aims at reducing technical and commercial risks by allowing commercial and technical performance data to be gathered and assessed. They provide a real or near-real operating environment for long-term trials and the testing of deployment strategies.

Proposals (CSA) should address the delivery of challenge-led, robotics competitions focusing on the four application areas prioritised: Healthcare, Infrastructure Inspection and Maintenance, Agri-Food, and Agile Production. Besides the technological objectives,

proposals are also expected to stimulate public engagement and engage with the Robotics DIHs. Proposals should address all aspects of running competitions as public events**,** and engage with the media and public. Proposals should seek to mobilise external partners in sponsoring and setting up the competitions.

Expected Impact: a)

- Strengthening European excellence in Robotics S&T
- Boosting the use of robotics in promising application areas
- Opening up new markets for robotics
- Lowering barriers in the deployment of robotics-based solutions.

b)

- Demonstration of the potential for robotics to impact at scale in the chosen application areas prioritised in this call (infrastructure inspection and maintenance).
- Reduction of technical and commercial risk in the deployment of services based on robotic actors within the selected application area.
- Greater understanding from the application stakeholders of the potential for deploying robotics.
- Demonstration of platforms operating over extended time periods in near realistic environments and promotion of their use.
- Develop the eco-system around the prioritised application areas to stimulate deployment.
- Contribution to the development of open, industry-led or de facto standards

c)

- Greater public exposure to actual robotics capability.
- Greater engagement with competitions from commercial organisations in the four prioritised application areas: Healthcare, Infrastructure Inspection and Maintenance, Agri-Food and Agile Production.

Type of Action: Coordination and support action, Research and Innovation action, Innovation action

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

ICT-10-2019-2020: Robotics Core Technology[9]

Specific Challenge: Autonomy in robotic systems is built on a combination of four core technologies:

AI and Cognition: AI provides tools to make systems cognitive. Cognition equips robots with the ability to interact with people and environments, to learn and to categorise, to make decisions and to derive knowledge.

Cognitive Mechatronics: Mechatronic systems where sensing and actuation are closely coupled with cognitive systems are expected to deliver improved control, motion, interaction, adaptation and learning, and safer systems.

Socially cooperative human-robot interaction: Cooperative human-robot interaction is critical in many work environments from collaborative support, e.g. passing tools to a worker, to the design of exo-skeletons able to provide motion that is sympathetic to the user.

Model-based design and configuration tools: Deploying robotics at scale in application areas where tasks need to be defined by the user requires easy-to-use configuration tools. Embedding and sharing of knowledge between tools is essential, as is standardisation across the interfaces to connect systems and modules (taking into account cybersecurity issues, including security by design and data integrity).

Scope: Proposals should address one of the four core technologies and target the development of core technology modules (modular, open and non-proprietary) and tool kits for use in deployable system platforms that meet the requirements of applications in the following four prioritised application areas: Healthcare, Infrastructure Inspection and Maintenance, Agri-Food and Agile Production. Proposals will be required to dedicate resource for connecting with the DIH actions arising from DT-04-2018.

The Commission considers that proposals requesting a contribution from the EU of between €5 million and €10 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Improved technical capability in each of the core technologies over the current state of the art.
- A greater range of applications in the prioritised application areas that can be demonstrated at TRL 3 and above.
- The lowering of technical barriers within the prioritised applications areas.

Type of Action: Research and Innovation action

[9] It is expected that this topic will continue in 2020.

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

European Data Infrastructure: HPC, Big Data and Cloud technologies

The European Cloud Initiative calls for the creation of a leading-class European Data Infrastructure (EDI) as an essential component to exploit the data revolution in Europe and contribute to global growth. The aim of the activities under this heading is to enable the creation of a world-class High Performance Computing (HPC)/Big Data (BD) ecosystem based on European leadership in HPC, Cloud and Big Data technologies. This ecosystem will strengthen the European technology supply in these areas and will provide innovative, usable and competitive solutions that satisfy the demands of users of the European Data Infrastructure.

A synergetic approach to support the creation of a European Data Infrastructure and a European Data Economy is promoted, complementing the relevant activities in the e-Infrastructures and FET work programmes 2018-2020.

The Copernicus Data and Information Access Services (DIAS) will contribute to EDI by making Copernicus' huge amount of data available within an efficient computing environment.

ICT-11-2018-2019: HPC and Big Data enabled Large-scale Test-beds and Applications

Specific Challenge: The Internet of Things and the convergence of HPC, Big Data and Cloud computing technologies are enabling the emergence of a wide range of innovations. Building industrial large-scale application test-beds that integrate such technologies and that make best use of currently available HPC and data infrastructures will accelerate the pace of digitization and the innovation potential in Europe's key industry sectors (for example, healthcare, manufacturing, energy, finance & insurance, agri-food, space and security).

Scope: a) **Innovation Actions (2018 call - deadline in April 2018)** targeting the development of large-scale HPC-enabled industrial pilot test-beds supporting big data applications and services by combining and/or adapting existing relevant technologies (HPC / BD / cloud) in order to handle and optimize the specific features of processing very large data sets. The industrial pilot test-beds should handle massive amounts of diverse types of big data coming from a multitude of players and sources and clearly demonstrate how they will generate innovation and large value creation. The proposal shall describe the data assets available to the test-beds and, as appropriate, the standards it intends to use to enable interoperability. Pilot test-beds should also aim to provide, via the cloud, simple secure access and secure service provisioning of highly demanding data use cases for companies and especially SMEs.

b) **Innovation Actions (2018 call - deadline in November 2018)** targeting the development of large-scale IoT/Cloud-enabled industrial pilot test-beds for big data applications by combining and taking advantage of relevant technologies (Big Data, IoT, cloud and edge

computing, etc.). The aim is to develop industrial pilot test-beds addressing data flows from a very large number of distributed sources (such as sensors or IoT applications/infrastructures and/or involving remote data storage/processing locations) and clearly demonstrate how they will generate innovation and large value creation from such data assets. The industrial pilot test-beds shall also address the relevant networking connectivity and large-scale data collection, management and interoperability issues. The data assets available to the test-beds should be described in the proposal. Pilot test-beds should also aim to provide, via the cloud, simple secure access and secure service provisioning of highly demanding data use cases for companies and especially SMEs.

a) is called in the 2018 call with a deadline in April 2018. b) is called in the 2018 call with a deadline in November 2018.

For all subtopics a), b) above:

Proposals should be led by and show strong industrial commitment. They should explain how the proposed activities will be industrialized and have impact on the competitiveness and leadership of European industry. They should target a wide participation and/or applicability and use of the targeted industrial pilot test-bed by industrial members/users from different countries and regions. They should also define quantifiable outputs and impact Key Performance Indicators, in particular related to the "Expected Impact" of the topic.

The Commission considers that proposals requesting a contribution from the EU between EUR 12 and 13 million for subtopic a), and EUR 15 and 18 million EUR for subtopic b) would allow these areas to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Proposals could seek synergies and co-financing from relevant national / regional research and innovation programmes, including European Structural and Investment Funds (ESIF) addressing pre-identified smart specialisation priorities at regional / national level. Proposals combining different sources of financing should include a concrete financial plan detailing the use of these funding sources for the different parts of their activities.

All grants under both subtopics will be subject to Article 30.3 of the grant agreement (Commission right to object to transfers or licensing).

Expected Impact: Proposals should address the following impact criteria, **providing metrics to measure success** where appropriate:

- Demonstrated increase of innovation and productivity in the main target sector of the Large Scale Pilot Action;
- Increase of market share of Big Data technology providers if implemented commercially within the main target sector of the Large Scale Pilot Action;

- Effective integration of HPC/BD/Cloud/IoT technologies in the main target sector(s) of the Large Scale Action, resulting into integrated value chains and efficient business processes of the participating organizations;

- Widening the use of and facilitating the access to advanced HPC, big data and cloud infrastructures stimulating the emergence of the data economy in Europe;

- Stimulating additional private and public target investments in HPC and Big Data technologies from industry, Member States and Associated Countries, and other sources, as referred to in the contractual arrangements of the HPC and/or the Big Data Value Public Private Partnerships.

Type of Action: Innovation action

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

ICT-12-2018-2020: Big Data technologies and extreme-scale analytics[10]

Specific Challenge: Rapidly increasing volumes of diverse data from distributed sources create challenges for extracting valuable knowledge and commercial value from data. This calls for novel methods, approaches and engineering paradigms in analytics and data management. As the success will require not only efficient data processing/management but also sufficient computing capacity and connectivity, a coordinated action with all related areas (e.g. analytics, software engineering, HPC, Cloud technologies, IoT) is necessary and will contribute to a European leadership in these areas.

Scope: a) **Research and Innovation Actions** developing new big data analytics methodologies and engineering solutions addressing industrial and/or societal challenges. Proposals may cover (but are not limited to): architectures for collecting and managing vast amounts of data; system engineering/tools to contribute to the co-design of secure federated/distributed systems (to involve all stakeholders/technology areas); new methods for extreme-scale analytics, deep analysis, precise predictions and decision making support; novel visualization techniques; standardized interconnection methods for efficient sharing of heterogeneous data pools, seamlessly using distributed tools and services.

The data assets should be available to the project and described in the proposal. The Commission considers that proposals requesting a contribution from the EU of between EUR 3 and 6 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

b) **One CSA** to ensure coordination between the different existing activities in HPC/BD/Cloud technologies, including Public-Private Partnerships, digital innovation hubs,

[10] It is expected that this topic will continue in 2020.

and relevant national and regional initiatives, in particular the European Network of National Big Data Centres of Excellence[11].

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

All grants under this topic will be subject to Article 30.3 of the grant agreement (Commission right to object to transfers or licensing).

Expected Impact: a)

- Increased productivity and quality of system design and software development thanks to better architectures and tools for complex federated/distributed systems handling extremely large volumes and streams of data;
- Demonstrated, significant increase of speed of data throughput and access, as measured against relevant, industry-validated benchmarks;
- Demonstrated adoption of results of the extreme-scale analysis and prediction in decision-making (in industry and/or society)

b)

- Effective cooperation of the participating initiatives and platforms as measured by the jointly participating members/users, countries/regions/cities and projects, and the organisation of common events and joint initiatives, resulting in an increased prevalence of data value chains and related technologies (HPC/BD/Cloud/IoT) in the national and regional strategies.

Type of Action: Research and Innovation action, Coordination and support action

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

ICT-13-2018-2019: Supporting the emergence of data markets and the data economy

Specific Challenge: The lack of trusted and secure platforms and privacy-aware analytics methods for secure sharing of personal data and proprietary/commercial/industrial data hampers the creation of a data market and data economy by limiting data sharing mostly to open data. This need strongly emerges from recent evidence from stakeholders, both for personal data platforms[12] and for industrial data platforms.[13,14,15] The lack of ICT and Data

[11] http://i-know.tugraz.at/european-network/

[12] See a Commission paper on "Personal information management services – Current state of service offers and challenges" analysing feedback from public consultation

[13] See "Industrial Data Platforms – Key Enablers of Industry Digitization", IDC study report 28/7/2016

skills seriously limits the capacity of Europe to respond to the digitisation challenge of industry. Specific attention needs to be put in involving SMEs and give them access to data and technology. IT standardisation faces new challenges as technologies converge and federated systems arise, creating new gaps in interoperability.

All grants under this topic will be subject to Article 30.3 of the grant agreement (Commission right to object to transfers or licensing).

Scope: a) Innovation Actions for setting up and operating platforms for secure and controlled sharing of "closed data" (proprietary and/or personal data). The actions should address the necessary technical, organisational, legal and commercial aspects of data sharing/brokerage/trading, and build on existing computing platforms. Proposals shall address one or both of the following sub-topics:

- *Personal data platforms* shall ensure respect of prevailing legislation and allow data subjects and data owners to remain in control of their data and its subsequent use. Solutions should preserve utility for data analysis and allow for the management of privacy / utility trade-offs, metadata privacy, including query privacy. Solutions should also develop privacy metrics that are easy to understand for data subjects and contribute to the economic value of data by allowing privacy-preserving integration of independently developed data sources.

- *Industrial data platforms* shall enable and facilitate trusted and secure sharing and trading of proprietary/commercial data assets with automated and robust controls on compliance (including automated contracting) of legal rights and fair remuneration of data owners.

The actions are required to link to and bring in industrial data providers (not necessarily as consortium members) that will populate the platforms. Conditions of use and practical arrangements of data sharing should be regulated.

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

b) Research and Innovation Actions to advance the state of the art in the scalability and computational efficiency of methods for securing desired levels of privacy of personal data and/or confidentiality of commercial data, particularly when they are combined from multiple owners. Proposals shall also analyse and address, as appropriate, privacy/confidentiality threat models and/or incentive models for the sharing of data assets.

c) **CSA** proposals are invited to cover both of the following tasks:

14 See "Report on the alignment of priorities and programmes and mobilisation of investments towards platform/standardisation initiatives" DEI Working Group 2 "Strengthening Leadership in Digital Technologies and in Digital Industrial Platforms across Value Chains in all Sectors of the Economy", to be published in April 2017.

15 See European Commission Staff working document accompanying the communication "Building the European Data Economy", published in January 2017.

- Support the emergence of a data economy by ensuring SME inclusion, entrepreneurial support and trust-building, address the data skills gap. The CSA action shall liaise with and complement related initiatives[16], and shall support and work in collaboration with the platforms under ICT-13 a).

- In line with the Communication on ICT Standardisation Priorities for the Digital Single Market[17], promote standardization, interoperability and policy support in the field of data and federated/networked computing systems.

One CSA will be funded. The Commission considers that proposals requesting a contribution from the EU of 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) and b)

- Personal data protection is improved, and compliance with the General Data Protection Regulation (and other relevant legislation) is made easier for economic operators
- Citizens' trust is improved as privacy-aware transparency and control features are increasingly streamlined across data platforms and Big Data applications.
- Better value-creation from personal and proprietary/industrial data.
- 20% annual increase in the number of data provider organisations in the personal and industrial data platforms
- 30% annual increase in the number of data user/buyer organisations using industrial data platforms
- 50% annual increase in number of users (data subjects) in the personal data platforms
- 20% annual increase in volume of business (turnover) channelled through the platforms

c)

- Demonstrated success stories among clients as a result of the services offered by the CSA and at least 50 clients (e.g. start-ups, SMEs) served annually in partner finding, matchmaking, venture capital raising, training, coaching etc.
- Improved standardisation and interoperability especially in the context of cross-sector applications and technology convergence (data, Cloud, IoT, connectivity a.o.)

[16] Such as the European Data Science Academy (EDSA), the network of European Centres of Excellence in Big Data, the BDVe project.

[17] https://ec.europa.eu/digital-single-market/en/news/communication-ict-standardisation-priorities-digital-single-market

Type of Action: Research and Innovation action, Coordination and support action, Innovation action

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

ICT-14-2019: Co-designing Extreme Scale Demonstrators (EsD)

Specific Challenge: To demonstrate in operational environments the successful integration of technology building blocks developed in previous R&I actions into world-class Extreme Scale Demonstrators. The challenges of power efficiency, resiliency and scalability of these systems require a strong co-design approach driven by ambitious applications involving technology suppliers, system integrators, supercomputing infrastructure providers and user communities, as well as ambitious HPC and extreme-data application owners or providers.

Scope: Proposals are expected to address the research, co-design, integration, validation and experimentation of extreme scale computing systems driven by a set of ambitious extreme data and HPC applications. EsDs should have the potential of being commercialised, operating in mode close to service delivery to users, and should integrate to a large extent technologies developed in projects funded by FP7, Horizon 2020 or other R&D actions in Europe. In particular, proposals will demonstrate how the building blocks developed in the FETHPC projects and other relevant actions supported in Horizon 2020 (e.g. the LEIT-ICT low-power microprocessor technologies) are integrated and leveraged in the EsDs (e.g. architectural work, software and parallel programming environments, etc.). EsDs are expected to demonstrate scalability up to exascale-class levels with specific design points and performance/power targets (e.g., design point target of 500 Petaflops to 1 Exaflop).

Each proposal should follow a 2-phase approach: Phase A consisting of development, integration and testing of a HW/SW system with a sufficient size to enable evaluation and validation of the design and that is fully usable by the end of this phase; and Phase B dedicated to deployment, use for relevant applications and validation in operational environments for real users. It is critical that the EsDs achieve well specified performance/power targets in both phases using a representative set of ambitious applications. These applications will address Big Data and extreme scale computing challenges combining fast response times, and advanced Big Data analytics and High-Performance Computing techniques.

The Commission considers that proposals requesting a contribution from the EU of between EUR 20 and 40 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Wherever appropriate, actions should seek synergies and co-financing from relevant national / regional research and innovation programmes in line with already existing smart specialisation priorities.

All grants under this topic will be subject to Article 30.3 of the grant agreement (Commission right to object to transfers or licensing).

Expected Impact:

- Strengthening the competitiveness and leadership of European industry & science, in particular of the European technology supply
- Proof-of-principle for pre-exascale machines addressing strategic HPC and Big-Data applications
- New operational environments and capacity available for users with extreme-data application requirements
- Contribution to the realisation of the ETP4HPC Strategic Research Agenda
- Maximising the impact and leveraging the results of European R&D projects (in particular FETHPC and related LEIT-ICT actions) into operational extreme scale demonstrators

Type of Action: Research and Innovation action

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

ICT-15-2019-2020: Cloud Computing[18]

Specific Challenge: Develop competitive cloud solutions based on advanced cloud platforms and services and cloud-based software and data applications, as well as the opportunities brought by considering the edge devices capacities. Such solutions should also address stringent security, data protection, performance, resilience and energy-efficiency requirements to respond to the future digitisation needs of industry and the public sector. Addressing these challenges will also be part of and contribute to the technological ambitions for the Next Generation Internet (NGI) and the Internet of Things (IoT).

Scope: *a) Research and Innovation Actions (RIA)*

Proposals will address at least one the following areas:

i. New modelling techniques and mechanisms are needed to compose and coordinate resources across heterogeneous clouds, including micro local clouds, private enterprise clouds, aggregated and hybrid cloud models facilitating interoperability and data portability between cloud service providers. Techniques that guarantee privacy, security, identity are essential.

[18] It is expected that this topic will continue in 2020.

ii. Edge computing (fog computing) technologies that integrate the limited memory, storage and computation of fog nodes that are closer to where data are generated into the cloud architecture and allow to make intelligent decisions when to move computation from the edge to the cloud, while taking into account the network capabilities as well as the security and/or sensitivity of data.

iii. New management strategies aimed to design and develop an efficient, coordinated, robust, secure and service agnostic management of the set of resources brought by combining cloud, IoT, Big Data and fog computing. Solutions for consistent resources categorization, abstraction and monitoring are fundamental. Proposed solutions should also envision the development of novel collaborative (sharing) scenarios and innovative service execution approaches that allow the dynamic allocation of cloud services to improve performance, and to facilitate automatic discovery and composition of cloud services at IaaS, PaaS and SaaS levels (Infrastructure, Platform and Software as a Service). The provision and its user-friendly combination, usage and orchestration of such services should particularly look at SMEs and public sector users.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 and 5 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

b) Coordination and Support Actions (CSA)

Proposals in this action will address the following:

- Facilitate awareness of stakeholders in research and policy matters related to Cloud Computing.
- Coordinate stakeholders in Cloud Computing and act as support to R&D programmes/activities by disseminating project results and organising scientific and policy events, developing research and innovation roadmaps, and addressing pre-standardisation initiatives.

Expected Impact: *a) Research and Innovation Actions (RIA)*

i. Contribute to the development of an ecosystem that will respond to the future digitisation needs of industry and the public sector;

ii. Assist the development of new cloud-based services and infrastructures in Europe and foster an industrial capability in the cloud computing sector;

iii. Create new opportunities to encourage European-based providers, in particular SMEs, to develop and offer cloud-based services based on the most advanced technologies;

iv. Leverage research and innovation projects to support the development and deployment of innovative cloud-based services and next generation applications, for the public and private sectors (including standardisation and applications for Big-Data and other sector-specific applications).

b) Coordination and Support Actions (CSA)

- Creation of a sustainable European forum of stakeholders representing the Cloud Computing research, industry and users.

Type of Action: Coordination and support action, Research and Innovation action

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

ICT-16-2018: Software Technologies

Specific Challenge: New advances in ICT technology influence the way software is developed. Software is increasingly becoming a pervasive and enabling technology and the impact of software defined infrastructures in the software development & management processes will span across multiple technology domains (e.g HPC, IoT, Big Data, Cloud, Artificial Intelligence). There is a need for novel and generic software engineering methods and tools that are applicable across different domains and that are complemented by domain-specific software related activities such as those proposed in the past and current H2020 ICT-LEIT Work Programmes.

Future software technologies need to address the transition from modern development processes towards a new paradigm which treats software, data, computing and communication resources as abstract elements. This will enable data to flow freely over heterogeneous infrastructures in a scalable, distributed and human-understandable fashion. To this end, the degree of abstraction in all these elements must be increased without losing controllability or correctness. The challenge would be to support the full software lifecycle in adopting this new paradigm.

In this fast evolving landscape, there is a need for increased software development productivity which can be fulfilled through the exploitation of reusable code and software components from existing code bases (either as open source software or proprietary software shared among closed ecosystems).

Scope: a) **Integrated programming models & techniques for exploiting the potential of virtualised and software defined infrastructures**: (Research and Innovation Actions)

Proposals will address at least one of the following areas:

- Code and resources (data, computing and networking) abstraction: Advances in how to abstract code and data beyond simple semantic annotations that are expressive, machine-readable and carrying out additional information about execution requirements, network topologies, data sources, etc. The concepts must allow (de)composition and transformation of all aspects involved in the code, including (de)composition of non-functional properties, conversion to different target platforms, restructuring and reinterpretation of data.

- Advanced software systems development: Methods for describing software, data and requirements that are necessary to advance software application development for software defined infrastructures. Such methods should enable flexible (de)composition and interoperability of software and data at run-time, thereby adhering to relevant operational constraints and business requirements. To enable development of such complex structures of code and data, programming models must become more abstract and easier to use, following the principles of human thinking, rather than conventional algorithms.

The proposals should demonstrate the applicability and viability of the proposed solution across multiple application domains.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 and 5 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

b) Software ecosystems exploiting the potential of existing code bases. (Innovation Actions)

Proposals in this action will address the following area:

- Development platforms and techniques for code re-usability, providing the necessary mechanisms for ensuring software quality (development, verification, validation and/or qualification tools), supporting software reusability (storing, tracking, searching and analysing software artefacts) and sustainable community building. Attention should be given in the handling of cross-platform dependencies and in the quality management of software built from diverse components.

The Commission considers that proposals requesting a contribution from the EU of between EUR 3 and 5 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

c) Coordination and Support Actions

Proposals in this action will address one of the following areas:

- Implement support actions which will help H2020 projects in the area of software technologies to establish their software ecosystems, transform their initial software development results into exploitable and viable solutions, showcase best practices of code reusability, facilitate community building and promote reuse of the code by new initiatives.

- Coordinate stakeholders in Software Technologies and act as support to R&D programmes/activities by disseminating project results and organising scientific and policy events, developing research and innovation roadmaps.

The Commission considers that proposals requesting a contribution from the EU between EUR 400.000 to 600.000 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 (RIA)

- Increased capacity of the European software industry to exploit the capabilities of software-defined infrastructures at middleware and application layer.
- Expand research and innovation potential in software technologies while overcoming fragmentation in the European supply base, optimizing investments and use of resources to yield multi-domain software-based products and related software services.

b) Innovation Actions (IA)

- Expand innovation potential in software technologies while overcoming fragmentation in the European supply base, optimizing investments and use of resources to yield reusable software-based products and related software services.

c) Coordination and Support Actions (CSA)

- Creation of a sustainable European forum of stakeholders representing the Software research, industry and end users.

Type of Action: Coordination and support action, Innovation action, Research and Innovation action

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

5G

5G cPPP phases 1 and 2 have supported R&I on technologies and architectures for 5G. Phase 3 targets their validation in a system context and for multiple use cases, with performances well beyond those of early 5G trials planned over the 2018-20 period with "non standalone" 5G implementations, and supporting innovative "vertical" use cases as per the 5G Action Plan adopted by the Commission. It also aims at leveraging 5G technologies towards downstream innovation both at service and product levels, at maintaining a significant long term commitment to prepare for 5G "Long Term Evolution", and at leveraging international cooperation towards industrial consensus on 5G key aspects such as interoperability, architecture, standards, and spectrum.

Activities under this heading are intended to support EU 5G policy as outlined in the context of the 5G Action Plan[19] *whilst implementing the last phase of the 5G cPPP roadmap. They*

[19] *Doc COM(2016) 588: 5G for Europe, an Action Plan*

should significantly contribute to building a first class European industrial supply side for core 5G technologies with global market footprints and notably for network technologies and systems. They will support the emergence of new innovative market players taking advantage of the growing adoption of distributed cloud computing technologies in 5G networks and making possible open innovation at service level. In that context, the work also supports the needed transformation of the telecom industry with a growing part of the activities moving from hardware to software in the context of an increased virtualisation of networks. In the context of the EU standardisation and Spectrum policies, the work contributes to the emergence of global standards and globally harmonised frequency bands for 5G, in view of the important decision milestones planned at the level of global relevant bodies like 3G PP and ITU. This 5G PPP phase also develops the "lead" demand side with support to partnerships with key vertical sectors like automotive, healthcare, energy, media, smart factories in view of developing new connected digital markets contributing to the wider policy objectives of industry digitisation of the Digital Single Market.

Complementary grant agreements will be implemented across projects originating from RIA, IA and CSA implemented under ICT-17-2018, ICT-18-2018, ICT-19-2019, ICT-20-2019 through use of the respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement.

ICT-17-2018: 5G End to End Facility

Specific Challenge: The challenges consist in providing an end to end facility that can i) demonstrate that the key 5G PPP network KPIs can be met; ii) be validated and accessed and used by vertical industries to set up research trials of innovative use cases, to further validate core 5G KPIs in the context of concurrent usages by multiple users.

Scope: The target 5G end to end network facility covers[20] fixed/multi radio access, backhaul, core network, service technologies and architectures targeted for 5G including end to end virtualisation and slicing as key component to support vertical use cases.

The objective is i) to validate the 5G network KPIs through representative network trials, as defined by the 5G PPP; ii) to prepare an extensive validation platform for verticals use cases. The facility allows to validate early versions of the standards and to prepare for later "forward compatible" versions. Such facility may be based on the interworking of several experimental platforms existing in Europe. It requires availability of an openness framework (both legal and technical, e.g. open APIs) enabling "vertical" projects to access and use it. It also requires a methodology to consistently compare technologies where appropriate.

The Commission considers that proposals requesting a contribution from the EU of between EUR 15 and 20 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

[20] Satellites and/or copper solutions are in scope as appropriate for relevant 5G-PPP KPI's.

Expected Impact: - Demonstrated feasibility of 5G PPP KPIs[21] beyond 4G evolution (NB-IoT, 4G LTE-A-PRO), including at least KPIs for capacity, ubiquity, speed, latency, reliability, density of users, location accuracy, energy efficiency, service creation time, network management capex/opex. It requires clear analysis of the state of the art and how 5G goes beyond.

- Demonstration of innovative radio spectrum use and sharing applicable to 5G spectrum use, including - if appropriate - licensed, unlicensed or licensed-shared access.

- Validation of a representative end to end 5G architecture including end to end service provisioning with slicing capabilities and solving slicing issues between core and access.

- Demonstrated impactful contribution to standards. Participation of key European industrial partners with high standardisation impact is desired.

- Availability of 5G facility that may be further used for validation through specific vertical use cases and/or for large scale showcasing events.

Type of Action: Research and Innovation action

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

ICT-18-2018: 5G for cooperative, connected and automated mobility (CCAM)

Specific Challenge: The challenge is to qualify 5G as a core connectivity infrastructure to address vehicle-to-everything (V2X), both from a technological and from a business perspective, for the higher automation levels (4, 5) defined by the automotive industry (SAE) and for new mobility services. Demonstrating the benefits of 5G connectivity should support innovative business models as "revenue generators", opening the door to private investments and to a broader digitisation of the automotive sector. It supports the realisation of the strategic objective of having all major transport paths covered by 5G connectivity in 2025[22] through cross-border trials along roads planned for CCAM deployment ("5G corridors"[23]).

Scope: It covers the applicability of 5G connectivity to "Cooperative, Connected and Automated Mobility" (CCAM) V2X use cases, taking a broad service approach, including and reaching beyond the safety/efficiency use cases of C-ITS. It aims to qualify and quantify from a business perspective the added value of cellular connectivity compared to pure meshed connectivity or to purely disconnected scenarios, and to enable a wide range of services to connected vehicles in support of innovative business models enabled by 5G connectivity (e.g. new mobility scenario, car as cellular relay node). It takes forward cellular connectivity for vehicles, targeting use cases which are difficult or impossible to realise from a technical or

[21] See 5G KPI in the cPPP contractual arrangement at www.5G-PPP.eu

[22] Communication of the Commission "A 5G Action plan for Europe", COM(2016) 588

[23] Corridors as referred to in the "Letter of Intent" signed by 27 EU Member States, see https://ec.europa.eu/digital-single-market/en/cooperative-connected-and-automated-mobility-europe

business viewpoint with existing technology and requiring improved performance of typical parameters such as low latency, reliability, security, location, throughput, security.

Validation of 5G in a broad CCAM context is realised through **cross border** trials along 5G corridors covering significant portions of roads and including the core technological innovation expected from 5G, such as (but not limited to) New Radio, new frequency bands[24], C-RAN, Mobile Edge Computing, network virtualisation, new network architecture, cross domains data flows. Specific requirements of 5G technologies for connected, cooperative and automated driving will be determined. Results of the pilots are used to define options for deployment, taking into account the evolution from earlier cellular technology (e.g. LTE-V2X), and possible co-existence with other technologies (e.g IEEE 802.11p). Cost/complexity assessment of the various technology deployment options is in scope and identifies who has to invest and who will benefit commercially.

The Commission considers that proposals requesting a contribution from the EU of between EUR 12,5 and 25 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: - Validation of 5G technologies and architecture in an "extended CCAM" context, including validation of innovative business models and applicable standards.

- Validated cost/benefit analysis of **cross border** 5G deployment enabling CCAM along 5G corridors potentially including several operator's domains.

- Availability of deployment scenarios and strategies with broad base industry and administration consensus.

- Identification of spectrum and standardisation gaps with impact at the level of standardisation (taking into account related developments at 3G PP RAN Level) and spectrum allocation bodies. Participation of key European industrial partners of both the ICT and the automotive sectors and with high standardisation impact is desired.

Type of Action: Innovation action

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

ICT-19-2019: Advanced 5G validation trials across multiple vertical industries

Specific Challenge: The challenge is to get the European 5G Vision of "5G empowering vertical industries[25]" closer to deployment with innovative digital use cases involving cross industry partnerships. It requires technological and business validation of 5G end to end connectivity and associated management from two perspectives: i) within the set of

[24] 3,5 Ghz band is the target option for V2N applications, though other bands may be considered

[25] 5G PPP White Paper "5G empowering vertical industries, see 5G-PPP.eu.

requirements specific from one application domain; ii) across all sets of heterogeneous requirements stemming from concurrent usages of network resources by different vertical domains.

Scope: **a) Trials** of various scales, depending on the target technology, in view of demonstrating that performance conforming to 5G PPP KPIs requirements are met in the context of specific vertical use cases. Target 5G technologies and architectures should also support specific performance requirements stemming from the considered vertical use case.

In addition, 5G technology and architecture trials are also targeting concurrent usage of resource by multiple verticals, addressing the 3 classes of ITU requirements [26] (eMBB, mMTC, URLLC use cases). In practice, the 5G infrastructure (RAN, back/fronthaul, Core) will be shared among multiple verticals and applications, each asking for independent service guarantees and very different service requirements. Operations of one application in one vertical domain should not affect the performance of other domains/applications. The trials should hence demonstrate that 5G architecture and technologies (notably slicing and virtualisation) enabling multi domain management of resources, beyond the *ETSI NFV Management and Orchestration (MANO)* and with cross domain orchestration capabilities are in line with these concurrent performance requirements.

Trials leverage results of 5G PPP phases 1 and 2 and go beyond the proof of concepts of phase 2.

Vertical use cases may focus on those outlined in the 5G PPP White paper "5G empowering vertical industries" (Automotive, smart factories, energy, media, smart healthcare) though other may be considered (e.g. PPDR[27]). High density location and very high data volumes applications should be covered, as typically encountered with media/content applications in large events.

Trials are preferably implemented over the 5G end to end platforms developed under **ICT-17-2018**, and may contribute to 5G demonstration in the context of large showcasing events.

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

b. Coordination and Support Actions

5G PPP projects under ICT-17-2018, ICT-18-2018, ICT-19-2019, ICT-20-2019 are implemented as a programme through the use of complementary grants. The respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement will be applied. This requires cooperation of the implemented 5G Research and Innovation Actions

[26] See ITU Recommendation M2083

[27] Public Protection and Disaster Relief systems beyond TETRA/TETRAPOL capabilities

(RIA) and Innovation Actions (IA) towards joint leveraging of results. The proposed CSA shall liaise with the 5G RIA and IA actions to exploit synergies for:

- Management and orchestration of 5G PPP project cooperation for horizontal issues of common interests (adherence to KPIs, 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 key international co-operation activities with a proactive strategy to leverage relevant 5G PPP project outcomes in the context of key standard developments and of relevant spectrum related bodies.

- 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 2 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) Advanced Trials**

- Validated core 5G technologies and architectures in the context of specific vertical use cases and deployment scenarios, from high to low density regions.

- Validated core technologies and architecture for differentiated performance requirements originating from eMBB, mMTC, URLL use cases, notably for end to end slicing and virtualisation.

- Viable business models for innovative digital use cases tested and validated across a multiplicity of industrial sectors, including demonstration of required network resource control from the vertical industry business model perspective.

- Impactful contributions towards standardisation bodies, involving vertical actors, for what concerns the second phase of 5G standardisation. Participation of key European industrial partners with high standardisation impact is desired.

- Validation of relevant KPIs[28] with services linked to specific vertical sectors.

[28] See 5G PPP KPI definition in the cPPP Contractual Arrangement, www.5G-PPP.eu

- Europe 5G know how showcasing.

b) **Coordination and Support Actions**

- Organisation of the 5G PPP as a programme with clear links to the 5G Infrastructure Association.

- 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.

Type of Action: Coordination and support action, Research and Innovation action

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

ICT-20-2019-2020: 5G Long Term Evolution[29]

Specific Challenge: Whilst 5G early introduction targets "local" network improvements (e.g. at radio access level), the longer term vision targets the realisation of pervasive mobile virtual services, through a network managing compute, storage and transport connectivity functions[30] in an integrated way. The challenge is to transform the network into a low energy distributed computer, where processes and applications are dynamically created, moved and suppressed, depending on the information flows, customer needs, and where new terminal types in cars, objects, appliances, and new interfaces based on gestures, facial expressions, sound and haptics may be the basis of the interaction between humans and the infosystems.

Scope: Proposals may cover only one strand or cut across several strands.

- Strand 1: Extension of virtualisation technologies and architectures for Network Management to support i) recursive deployments of functional components for multi-tenancy; ii) high device heterogeneity through virtualisation of resource-constrained devices with load reduction approaches and new network control solutions to effectively handle the authentication, naming, addressing, routing and related functions for massive number of terminals; iii) end to end resource self-configuration and management according to service, traffic, channel or mobility conditions; iv) SDN intelligent network interface selection; v) ultra-dense network deployment with massive user generated traffic; vi) unified management of compute, storage and connectivity resources.

[29] It is expected that this topic will continue in 2020.

[30] As defined under the ETSI Standardisation framework for Network Function Virtualisation initiatives (ETSI-NFV)

- Strand 2: Security[31]: hardware, software technologies and architectures, level of abstraction for information sharing enabling tenants workloads to trust the host systems. It enables trusted deployment of critical workloads across infrastructure and for infrastructure owners, differentiated services offers to tenants, whilst also improving their own control of their systems, vulnerabilities and compromises. It covers Trusted Execution Environments (TEEs) secure provisioning and their remote management, with categorisation of sensitive operations supporting trust domain definition and set up, with real -time identification of possible compromises or security breaches.

- Strand 3: Radio network enabling technologies, architectures and advanced signal processing targeting i) differentiated service requirements, including broadcast/multicast and strategies for spectrum sharing and usage optimisation in licensed and unlicensed bands; ii) terminals as moving nodes for coverage or service extension; iii) network assisted self-driving objects with optimised information fusion/processing from maps, sensors, and events communication; iv) simplified access points through distributed computing and optimised function placement; v) ultra low latency services; vi) applicability of mmWave frequency bands to use cases beyond eMBB; vii) usability of novel spectrum at Teraherz frequencies (incl. visible light communications).

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: - Evolution of networks towards OTT like platforms integrating connectivity, storage and computing resources opening for new service models to telecom/ISP providers - (Strand 1).

- Network scalability towards high number of resource constrained devices, multiplicity of service requirements, and new connectivity paradigms (user controlled) – (Strand 1).

- Characterisation and availability of secure and trusted environments for software based virtualised networks, enabling trusted multi-tenancy - (Strand 2).

- Improvements of radio spectrum usage, novel strategies for coverage/service extension, support of novel use cases and mobile edge cloud applications, usability of today unexplored spectrum - (Strand 3).

- Dynamic scalability of network capabilities through availability of managed and enhanced resources - (Strands 1 and 3).

- Network energy consumption reduction, a factor of at least 10 is targeted - (Strands 1 and 3).

Type of Action: Research and Innovation action

[31] This should be covered as part of an integrated Network management system.

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

ICT-21-2018: EU-US Collaboration for advanced wireless platforms

Specific Challenge: Both the EU and the NSF address the challenges of advanced wireless research beyond 5G focusing on game changing technologies for wireless communications, capitalizing on existing testbeds and projects, to reach further connectivity frontiers.

Scope: To establish collaborative transatlantic work on advanced wireless platforms addressing the use of new ranges of frequencies from mmwave bands up to Terahertz bands, massive antenna arrays, new radio and signal processing techniques, optimised new usage of Spectrum and platform or testbeds for experimental research. To develop research roadmaps, workshops, scientific exchanges, development of tools for experimentations, opens source software tools and repositories, prototyping and evaluation, tools for probing and data analytics, emulation, management and cross Atlantic technology trials.

Proposals shall foresee twinning with entities participating in projects funded by USA to exchange knowledge and experience and exploit synergies. In particular twinning with entities participating in projects funded by the NSF under the Programme for Advanced Wireless Research (PAWR) should be addressed. The Commission considers that proposals requesting a contribution from the EU of up to EUR 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Support to advances in Wireless knowledge and reinforced cooperation with the US through common transatlantic experiments linking platforms and testbeds, fostering common scientific roadmap, developing new tools and potential options for standards ahead of worldwide competition for beyond 5G connectivity systems and services.

Bridge EU and US research communities addressing this topic. In the case of US, the target community is the NSF community addressing the new "Programme for Advanced Wireless Research" (PAWR)[32].

Type of Action: Coordination and support action

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

ICT-22-2018: EU-China 5G Collaboration

Specific Challenge: The next phase of 5G activities running during the 2018-20 period is expected to cover, both in EU and in China, technologies and systems demonstrations and

[32] See Programme and budget at https://www.nsf.gov/cise/advancedwireless/

trials. The challenge is hence to demonstrate technologies and system interoperability for a number of core applications of interest in the two regions.

Scope: The scope is to conduct 5G trials addressing two specific scenarios: scenario n°1 - enhanced Mobile Broadband (eMBB) on the 3.5GHz band, which is a priority band in the two regions for early introduction of very high rate services; and scenario n°2 - Internet of Vehicles (IoV) based on LTE-V2X using the 5.9 GHz band for Vehicle-to-Vehicle (V2V) and the 3.5 GHz band for Vehicle-to-Network (V2N). The overall goal is to evaluate in real setup innovative end-to-end 5G systems built on the outcomes of the previous phases of the 5G R&I. More specifically, the optimisation of the band usage in multiple scenarios with different coverage is a key target, so as the validation of the geographic interoperability of the 3.5 and 5.9 GHz bands for these use cases. Both scenarios shall be implemented in both regions (EU and China) through testbeds with interoperability forming the core of the R&I work.

The underlying trials' testing facilities shall implement the latest mature and broadly commonly agreed 5G systems, network architectures and technologies spanning from the core/transport networks, the radio access, up to the service, orchestration, management and security components. The trial facility shall not be restricted to innovative 5G radio access technology, but should include and enable the evolution of 5G networks innovations in network slicing, virtualisation, cross-domain orchestration, in view of supporting resource control from multiple tenants. In EU, trials are preferably implemented over the 5G end-to-end platforms developed under ICT–17-2018.

The 5G trials' infrastructures shall facilitate the testing and validation of innovative applications for each of the defined scenarios, including efficiency solutions in the areas of spectrum usage, energy consumption and costs.

As per cPPP objectives, relevant industries and organisations are expected to have a sizeable share of the proposals participation. Teams including mobile operators, vendors (for both scenarios) and car companies (for scenario n°2 IoV) together with SMEs, academia and research institutes may be considered.

Proposals shall foresee twinning with entities participating in projects funded by China to exchange knowledge and experience and exploit synergies. This topic is calling for bilateral project twinning with the National Science and Technology Major Project (NSTMP) "mirror project" launched by China in 2018. Proposals shall foresee all the mechanisms, including budget provisions, to enable close collaboration with the "5G Major Project" that will be funded by China. The two twining projects (EU/China) will be requested to define and use unified trial specifications, unified trial frequency bands and to share data. Joint deliverables, like joint tests reports, white papers, publications and standard contributions, will also be expected. In addition, the 5G trials' infrastructures shall be deployed in one or more cities in each region (EU/China).

The Commission considers that proposals requesting a contribution from the EU up to EUR 6 million for a period between 24 and 36 months would allow this area to be addressed

appropriately. This does not preclude the submission and selection of proposals with a different budget or duration.

Expected Impact: - Holistic 5G networks implementations based on the latest 5G innovations and evaluated in the two prominent usage scenarios.

- 5G RAN for the specified bands validated in real world environments.

- Global interoperability demonstrations for 5G networks.

- Joint contributions to global 5G standards specifications in relevant organisations (e.g. 3GPP, ITU-R), especially in view of 5G phase 2 standardisation (beyond eMBB), and to harmonized spectrum bands.

- Successful showcasing events with, ideally, joint demonstration across regions.

- New or reinforced cooperation between 5G R&I stakeholders from EU and China, with a focus on private companies (industry, telecom operators, SMEs).

Type of Action: Research and Innovation action

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

ICT-23-2019: EU-Taiwan 5G collaboration

Specific Challenge: This activity, integrated end-to-end network for 5G trials, is to test 5G systems for specific applications and it follows up on the first targeted opening call with Taiwan in which 5G research and demonstration facilities offered by Taiwan towards collaborative 5G research with the EU.

The integrated end-to-end network for 5G trials activity is to utilize the infrastructure of the integrated 5G access/core networks in test beds, in Europe and Taiwan, to verify the requirements of 5G technologies in joint trials for specific applications such as AR/VR for entertainment, V2X communications, utilities, e-Health, drone, factory of the future (though not limited to those) featuring high peak data rates and network density, ultra-low latency, and high reliability.

Scope: The scope is to conduct 5G trials addressing technology and business validation of 5G end-to-end connectivity and associated management from applications in Taiwan that will support the development of mmWave, massive MIMO, new air interfaces, multi-user access and other technologies, aiming to increase the network capacity in an ultra-dense network and to provide access for a massive number of devices.

Proposals are encouraged to consider network virtualization approaches such as SDN/NFV and network slicing to make the best use of the resources for services with a reduction in CAPEX and OPEX.

The targeted 5G technologies and architectures should support the specific performance requirements stemming from the considered vertical use cases. The trials should go beyond proof of concept and leverage the results of related 5G PPP projects and Taiwan's 5G Program.

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

- Validation of core 5G technologies and architectures in the context of specific vertical use cases.
- Leverage cooperation towards industrial consensus between EU and Taiwan on 5G key aspects such as standard, spectrum, architecture and interoperability.
- Accelerate the pre-commercialization trials of the use cases introduced by IMT-2020 (eMBB, mMTC, URLLC).

Type of Action: Research and Innovation action

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

Next Generation Internet (NGI)

A number of technological trends will thoroughly reshape the internet over the next 10-15 years. Europe should drive this technology revolution while contributing to making the future internet more human-centric. An internet for the people, that contributes to a more sustainable and inclusive society.

Increasingly these technological trends influence each other and a programme targeted towards the Next Generation Internet must consider them in a holistic way.

- Future **Interactive Technologies** will allow users to access, process and deliver information in more natural, efficient and less intrusive ways, providing enhanced and personalized experiences;
- Advances in **Artificial Intelligence** are critical to turn information into knowledge and to embed autonomy and intelligence into networks, robots and other connected devices;
- **Internet of Things** technologies and applications are changing the way users, services and applications interact with the real world environment in a trusted way.
- **Future social networks, media and platforms** will transform the way we produce, consume and interact with content, services and objects, within and across users' groups and will become the way our societies operate for communication, exchange, business, creation and knowledge acquisition.

- The Next Generation Internet will be **multilingual** and **inclusive**. Advances in **language technologies** will help eliminate language barriers. NGI technologies will also help to provide a new quality in Digital Learning as smart, open, inclusive and **personalised learning** solutions will be tailored to each individual's needs, competences and abilities.

In addition, cutting across technologies, the **Open Internet Initiative**, based on an agile and flexible programme approach, will focus on research teams, hi-tech start-ups, SMEs and social innovators, and will rapidly explore promising avenues for the Internet of the future.

The topics addressed here form a coherent and integrated package. Coordination and support actions will be called upon to cut across topics and benefit from synergies.

The upcoming 'digital era' and 'hyper-connected society' must be based on principles that are in line with our values like openness, neutrality, cooperation, inclusion, transparency, protection of data and privacy. The topics proposed under this heading will contribute ensuring that, through the Next Generation Internet, the immense potential of artificial intelligence, the connection with the physical world, the interactive technologies and immersive environments, as well as the massive networks of people and machines are used to empower people and contribute to sustainable and inclusive societies. The Next Generation Internet should be an Internet that is dependable and trustable, creating new usage and new business opportunities making Europe a trusted hub globally. It also has to be a source of creativity, directly supporting the cultural and creative industries[33] *and its media sector. It has to be at the heart of the industry 4.0 revolution and the digitization of industry, being an essential driver for the competitiveness of European industry.*

ICT-24-2018-2019: Next Generation Internet - An Open Internet Initiative

Specific Challenge: This initiative aims at developing a more human-centric Internet supporting values of openness, cooperation across borders, decentralisation, inclusiveness and protection of privacy; giving the control back to the users in order to increase trust in the Internet. It should provide more transparent services, more intelligence, greater involvement and participation, leading towards an Internet that is more open, robust and dependable, more interoperable and more supportive of social innovation.

Scope: Involving today's best Internet innovators to address technological opportunities arising from cross-links and advances in various research fields ranging from network infrastructures to platforms, from application domains to social innovation. Beyond research, the scope includes validation and testing of market traction with minimum viable products and services, of new economic, mobility and social models, and involves users and market actors at an early stage. Multi-disciplinary approaches are encouraged when relevant. Eventually this initiative should influence Internet governance and related policies.

a) Research and Innovation Actions

[33] *Cultural and Creative Industries are mainly composed by the following sectors: advertising, architecture, arts, craft, design, fashion, films, music, press, publishing, radio, TV and video games.*

Each Research and Innovation Action (R&I Action) will focus on a given research domain supporting the objective of a human-centric Internet. It will build a European ecosystem of researchers, innovators and technology developers by selecting and providing financial support to the best projects submitted by third parties in a competitive manner.

Through an agile and flexible process, 'R&I Actions' will focus their support on third party projects from outstanding academic research groups, hi-tech startups and SMEs, so that multiple third parties will be funded in parallel contributing to the same research area, using short research cycles targeting the most promising ideas. Each of the selected third parties projects will pursue its own objectives, while the 'R&I Action' will provide the programme logic and vision, the necessary technical support, as well as coaching and mentoring, in order that the collection of third party projects contributes towards a significant advancement and impact in the research domain. The focus will be on advanced research that is linked to relevant use cases and that can be brought quickly to the market; apps and services that innovate without a research component are not covered by this model.

Beneficiaries shall make explicit the intervention logic for their specific research domain, their capacity to attract top Internet talents, to deliver a solid value-adding services package to the third party projects, as well as their expertise and capacity in managing the full life-cycle of the open calls transparently. They should explore synergies with other research and innovation actions, supported at regional, national or European level, to increase the overall impact.

For grants awarded under this topic for Research and Innovation actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied.

For the call closing in 2018 'R&I Actions' in the following three sub-topics will be called for. Proposals should address only one of these sub-topics.

i) Privacy and trust enhancing technologies: as sensors, objects, devices, AI-based algorithms, etc., are incorporated in our digital environment, develop robust and easy to use technologies to help users increase trust and achieve greater control when sharing their personal data, attributes and information.

ii) Decentralized data governance: leveraging on distributed open hardware and software ecosystems based on blockchains, distributed ledger technology, open data and peer-to-peer technologies. Attention should be paid to ethical, legal and privacy issues, as well as to the concepts of autonomy, data sovereignty and ownership, values and regulations.

iii) Discovery and identification technologies: to search and access large heterogeneous data sources, services, objects and sensors, devices, multi-media content, etc. and which may include aspects of numbering; providing contextual querying, personalised information retrieval and increased quality of experience.

'R&I Actions' should encourage, when relevant, open source software and open hardware design, access to data, standardisation activities, access to testing and operational infrastructure as well as an IPR regime ensuring lasting impact and reusability of results.

The Commission considers that proposals requesting a contribution from the EU of 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. As a reference, 80% of the EU funding should be allocated to financial support to the third parties, through projects typically in the EUR 50 000 to 200 000[34] range with duration of 9 to 12 months. Each 'R&I Action' is expected to run several cycles of third party projects, which requires an overall duration of 24 to 36 months.

In the call closing in 2018, at least one proposal will be selected in each of the three sub-topics. Another three sub-topics will be identified for the forthcoming call closing 2019; the new sub-topics will be published by the European Commission in the update to the work programme 2019 that will be done before the call is published.

b) Coordination and Support Actions

Coordination and Support Actions are called for in the following three sub-topics. Proposals should address only one of these sub-topics. At least one proposal will be selected in each of the three sub-topics.

iv) 'Technology Strategy & Policy': will engage leading-edge Internet stakeholders and will identify emerging research trends and policy needs, through a continuous public online consultation, open stakeholder engagement, fora and debates, and data analysis. It should also use the most innovative approaches and technologies, and unconventional ways to maximise involvement of those stakeholders who are new to community programmes and who will actually drive the evolution of the Internet. It should map and cooperate with national/regional initiatives and global activities where relevant. Driven by actors with a solid background and standing in today's NGI community, it aims at sustainability right from the beginning. It will be the intellectual spearhead of the 'Next Generation Internet – An Open Internet Initiative' and will closely engage with the other actions supported in this topic.

These activities could partially be implemented through small prizes; the maximum budget the project can devote to prizes is Euro 300.000. For grants awarded under this sub-topic beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of prizes. The respective options of Article 15.2 and Article 15.3 of the Model Grant Agreement will be applied.

The Commission considers that proposals with a duration of three years and requesting a contribution from the EU of EUR 3 million would allow this specific challenge to be

[34] 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 when this is necessary to achieve the objectives of the action.

addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations or amounts.

v) 'Technology Harvest & Transfer': will support 'R&I Actions' and their third parties in ensuring the best use of the outcomes created by delivering specific exploitation strategies, including follow-up investment opportunities, industry relations, IPR/knowledge transfers, tech-transfer services to digital innovation hubs, mentoring / coaching services and linkage to national IPR exploitation programmes, in a most innovative and effective way. It will also support impact assessment at the level of the 'Next Generation Internet – An Open Internet Initiative' topic.

The 'Technology Harvest & Transfer' action shall start no earlier than 6 months after the start of the first 'R&I Actions' in 2018. The Commission considers that proposals with a duration of three years and requesting a contribution from the EU of EUR 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations or amounts.

vi) 'Outreach Office': will execute the programme communication strategy, branding and marketing activities, including extensive online and social media presence and events, establishing a positive brand image among young researchers, innovators, policy makers and people at large. Centralised, more efficient and professional, it will lead communications towards the outside world but also coach all actions under this topic in effective communications and marketing.

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

Expected Impact: Proposals should provide appropriate metrics for the claimed impacts.

- Shape a more human-centric evolution of the Internet.
- Create a European ecosystem of top researchers, hi-tech startups and SMEs with the capacity to set the course of Internet evolution.
- Generate new business opportunities and new Internet companies with maximum growth and impact chances.
- For sub-topics i, ii and iii: Integrating research and innovation communities; development of common visions and enhanced science – industry collaborations in each of the technology domains.
- For sub-topic iv: European research and innovation leaders driving the debate for a human-centric Internet research and policy strategy.

- For sub-topic v: New Internet applications / services, business models and innovation processes strengthening the position of European ICT industry in the Internet market.

- For sub-topic vi: global visibility in the media of the debate on a human-centric Internet; citizens' priorities influencing the evolution of the Internet.

Type of Action: Research and Innovation action, Coordination and support action

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

ICT-25-2018-2020: Interactive Technologies[35]

Specific Challenge: Interactive technologies such as Augmented (AR) and Virtual Reality (VR) are set to transform the ways in which people communicate, interact and share information on the internet and beyond. This will directly impact a larger number of European industries ranging from the cultural and creative industries, manufacturing, robotic and healthcare to education, entertainment and media, enabling new business opportunities. The challenge is to forge a competitive and sustainable ecosystem of European technology providers in interactive technologies.

Scope: The scope includes: 1/ support a pan-European coordination effort to strengthen the collaboration among the constituency; 2/ increase the European innovation capacity through the development of new authoring tools and the access to a broader community;

a) Interactive Community Building (CSA)

To better coordinate stakeholders the focus should be on:

- elaborating a common research agenda and a technology transfer strategy;

- building a platform to gather and share knowledge, algorithms and tools for the development and use of new interactive technologies. This may include the development of a dedicated open operating system;

- providing broad access and technical support for the platform as well as promoting its existence and establishing links with other existing platforms;

- supporting research and development teams in the integration of their tools into the platform. The task may involve financial support to third parties, in line with the conditions set out in part K of the General Annexes. Maximum 2M€ funding could be dedicated to it, with EUR 50.000 to 100 000[36] per third party.

[35] It is expected that this topic will continue in 2020.

[36] 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 when this is necessary to achieve the objectives of the action.

This action should result in a unique access point for innovators, SMEs and industrial companies interested in taking-up European interactive technologies in their product and services development. The Commission considers that proposals requesting a contribution from the EU of EUR 3 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

b) Future interaction (RIA)

To strengthen European research and industrial capacities the research and innovation actions should focus either on:

- Better exploiting opportunities offered by **multi-user interactions**, researching and developing technologies augmenting human interaction in groups within both professional and private contexts.
- Or developing future interactive systems offering **higher quality experiences**, for instance through systems which are mobile, support additional senses, have higher accuracy or incorporate bio or environmental sensors.

The Commission considers that proposals requesting a contribution from the EU of between EUR 2 and 4 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) Establish a sustainable competitive ecosystem of European technology and solution providers for interactive technologies.

b) Strengthening European research and industrial capacities to develop future interactive devices.

Type of Action: Coordination and support action, Research and Innovation action

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

ICT-26-2018-2020: Artificial Intelligence[37]

Specific Challenge: Artificial Intelligence (AI) is a key technology for the further development of the Internet and all future digital devices and applications. Driven by the wider availability of large amounts of data and increasingly higher performance computing and networking, AI brings additional autonomy to all types of physical and virtual artefacts and opens the door to a wave of innovations and opportunities. It is already transforming important sectors ranging from data analytics and Web platforms up to driverless vehicles and new generation of robots for our homes, hospitals, farms or factories.

[37] It is expected that this topic will continue in 2020.

The challenge is to fully exploit the potential of AI in the economy and society. Building notably on Europe's Scientific and Technology strengths in the field, the supported activities should reinforce industrial competitiveness across all sectors including for SMEs and non-tech industries and help address societal challenges (e.g. ageing, transport). The focus is on R&I areas in AI where collaborative work at European level can make a difference amidst the fierce world-wide competition in the field. The ambition is therefore to make AI technologies and resources available to developers and innovators in all sectors and actively engage with a wide user community, including non-AI experts.

Scope: The ultimate goal is a European AI-on-demand platform mobilising the European AI community to support businesses and sectors in accessing expertise, knowledge, algorithms and tools to successfully apply AI thereby generating market impact.

The platform should:

- serve as a central point to gather and provide access to AI-related knowledge, algorithms and tools;
- support potential users of AI in order to facilitate the integration of AI into applications;
- facilitate the interaction with existing data portals needed for AI algorithms, and resources, such as HPC or cloud computing, and support interoperability.

Research and Innovation Action - Building a European AI on-demand platform

The goal is to develop a European AI ecosystem bringing together the knowledge, algorithms, tools and resources available and making it a compelling solution for users, especially from non-tech sectors. The action should build on and link to existing relevant initiatives, including for instance existing platforms, data repositories, cloud computing, HPC. Proposals will be expected to plan efforts to connect and cooperate with the DIHs, Pilots and other relevant activities of this workprogramme, as appropriate. The action called for is expected to include the following activities:

- Mobilising the European AI community including researchers, businesses and start-ups to provide access to knowledge, algorithms and tools;
- Defining sustainable processes and structures (governance, access, business models, licensing, etc.) as well as developing a suitable software infrastructure (APIs and tools to aggregate existing tools and algorithms and to make them easily deployable in applications, as well as to access data and computing resources);
- Filling important technology gaps through challenge-based and/or user-driven research and innovation efforts. These efforts could have an application or technology focus, covering major domains such as robotics, IoT, CPS, intuitive interfaces, personalised applications, healthcare, manufacturing or agriculture;

- Gathering user requirements: based on representative set of its future users (researchers and industry). In particular, the research and innovation efforts expected from this action will have strong synergies with the platform building (providing user requirements, guiding its development, exploiting its resources, and contributing to its content) but additional efforts might be necessary to ensure that the needs of the various types of potential users of the platforms are represented;

- Putting in place a comprehensive service layer to facilitate the use and uptake of the platform both by end-users and researchers;

- Reaching out to new user domains and boosting the use of the platform. The task may involve financial support to third parties to fund promising projects (selected through open competitive calls) exploiting the resources and services offered by the platform to foster technology transfer of AI-based solutions, in line with the conditions set out in part K of the General Conditions. Maximum 3M€ funding could be dedicated to it, with EUR 50.000 to EUR 200.000 per third party[38];

- Developing a Strategic Research and Innovation Agenda for AI including ELSE (Ethical, Legal, Socio-Economic) aspects, taking into account and building on relevant initiatives and strategies (e.g.: Big Data PPP, Robotics PPP, AIOTI , CPS (CyPhERS), cybersecurity cPPP).

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

Expected Impact:

- Building a sustainable AI-on-demand platform, becoming a reference, mobilising the entire European AI community, and ensuring a leading position for Europe in AI.

- Reinforcing European excellence and leading position worldwide in major research and application domains, especially through the research and innovation efforts to fill important technology gaps.

- Boosting technology transfer of AI, especially towards SMEs and non-technology sectors, and disseminating the economic benefits of AI to a large user base.

Type of Action: Research and Innovation action

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

[38] 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 when this is necessary to achieve the objectives of the action.

ICT-27-2018-2020: Internet of Things[39]

Specific Challenge: Internet of Things (IoT) technologies and applications are bringing fundamental changes to all sectors of activity and are therefore an essential element of the Next Generation Internet. The challenge is to leverage EU technological strength to develop the next generation of IoT devices and systems that build on enhanced sensing/actuating, reasoning capabilities and computational power to the edges, but also new capabilities on the backend, such as artificial intelligence, deep semantic interoperability and novel contractual arrangements like Blockchains.

Scope: **Coordination and Support Actions**

A support action which will support IoT policies under the Digitising European Industry strategy especially in the context of human-centered IoT. In particular, it should analyse and evaluate security and privacy concepts across on-going and new European projects and initiatives in the IoT Focus Area and carry out trend scouting for future research and innovation policy through liaising with academic, industrial and policy stakeholders. The approach should include to build and sustain a vibrant network of IoT technology providers in Europe as well as ensuring the end-user trust in the security concerns as well respect for privacy.

The CSA will analyse and compile trends in IoT research and innovation with the aim to define research roadmap for future IoT related activities. The CSA shall evaluate and take into account emerging business models and shall support consensus building both with suppliers and users across Europe. It shall disseminate and seek support for results from a broad range of stakeholders in the IoT domain and relevant areas of the Next Generation Internet (NGI) initiative.

The Commission considers that proposals requesting a contribution from the EU of **EUR 1.5 million** would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Broad consensus on a strategy on human-centred IoT evolution improving usability and user acceptance, notably through strengthened security, privacy and user trust.
- Identified roadmap that enables taking the right measures to put Europe in the lead for IoT research and innovation through a long-term evolution of IoT platform strategy and through scientific progress enabling novel, future semi-autonomous IoT applications.
- Capacity to create and sustain a vibrant technology cluster involving all stakeholders including industry, technology, and end-users.

Type of Action: Coordination and support action

[39] It is expected that this topic will continue in 2020.

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

ICT-28-2018: Future Hyper-connected Sociality

Specific Challenge: Future social networks, media and platforms will become the way our societies operate for communication, exchange, business, creation, learning and knowledge acquisition. The challenge is to mobilise a positive vision as to the role that Social Media will increasingly play in all these areas, and to overcome today's critical issues about trust and governance through democratic reputation mechanisms, and user experience.

Scope: Analysing and building the foundation of next generation Social Media platforms towards a "Global Social Sphere", based on peer-to-peer/decentralised, community approaches and free/open source principles. This foundation shall enhance the role of prosumers, communities and small businesses, mastering technological barriers, introducing innovative and participatory forms of quality journalism, and using various data in a secure manner. These activities should contribute to overcome the current accumulation of power by central intermediaries often located outside Europe. Proposals are invited for one of the following four subtopics:

Innovation Action

Trustful and Secure Data Ecosystem for Social Media and Media.

a) Content verification - Development of intermediary-free solutions addressing information veracity for Social Media. The solutions to be developed shall contribute to the understanding of information cascades, the spreading of information and the identification of information sources, the openness of algorithms and users' access to and control of their personal data (such as profiles, images, videos, biometrical, geolocation data and local data). Proposals are expected to develop and pilot solutions with a large existing community of citizens, and consortia may include inter alia partners from media, social media, distributed architectures, security and blockchain developers. Linked to this and in order to allow mastering better the complexity for users of Social Media, a Digital Companion interaction component may also be realised. The actions on this subtopic will cooperate for setting-up the basis of an observatory as described in d).

b) Secure Data Ecosystem - Creation of media and social media data business and innovation ecosystem to ensure privacy and secure sharing, as well as fair trade of federated media relevant data produced by media, social media and operators from other industrial sectors across Europe. The involvement of non-media sectors is considered critical to achieve volume and variety of data sets comparable with the ones of leading content aggregators. The action should address the necessary technical, organisational, legal and commercial aspects of

data sharing/brokerage/trading to enable data-driven services. The action must also develop pilots to demonstrate the potential and sustainability of the federated data solution.[40]

Research and Innovation Action

c) Support of new Social Media initiatives, and transition to peer-to-peer federated social networks based on smart decentralised architectures. This should be carried out by multidisciplinary and cross-sectorial consortia (technologist, sociologists, artists,…), including inter alia academic and industry partners focussing on web media, platform and application development. Proposals should include the creation of an open decentralised platform exploiting the added value derived from data aggregation and data analytics, exploring possible applications of blockchain technologies and enabling the development of innovative services and novel forms of distribution of media content. This includes research and innovation on open API, interface design, content production, consumer/prosumer business models including crowd-sourcing models for identification and rewarding of user generated content, open management and portability of profiles, gaming and art aspects. Proposals may also consider aspects of a "Social Networks of Objects", integrating latest European advancements on smart objects, big data, autonomous systems, real-time geolocation[41] and augmented/virtual reality. Proposals should include demonstrations and validation, also leveraging on concepts and technologies addressed elsewhere in the NGI programme.

Coordination and Support Action

d) Support of Social Media ecosystem community building between different Social Media actors such as developers, designers, users of all ages, artists, entrepreneurs, researchers, at European and national level, also linking to important international initiatives. This should include a dynamic app-based tool for community-mapping and an analysis of a future hyper-connected society, considering societal, economic, educational, legal and community-based self-regulation aspects. In addition, the action shall establish with actions on Content Verification under subtopic a) the basis for an observatory on information veracity and best Social Media practices.

The Commission considers that proposals requesting a contribution from the EU of maximum 2,5 MEUR for subtopic a), 5 MEUR for subtopic b) and c) and 1 MEUR for subtopic d) would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

At least one proposal will be selected for subtopics a) and b). Proposals should clearly state which subtopic they address.

Expected Impact:

[40] This action is to be followed up in the Big Data Innovation Hubs, planned for 2020, with a subtopic aiming at incubating ideas for data driven services and tools able to improve the media value chain.

[41] Where use is made of geolocation, data from Galileo and EGNOS should be used wherever relevant.

- Increased trust and improved governance and value for Social Media and Media
- New federated Social Media platforms and innovative media data driven services
- Societal change towards digital literacy and citizen participation

Type of Action: Innovation action, Research and Innovation action, Coordination and support action

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

ICT-29-2018: A multilingual Next Generation Internet

Specific Challenge: The activities under this topic will support technology-enabled multilingualism for an inclusive Digital Single Market. Every European should be able to access content and engage in written and spoken communication activities without language being a barrier. Content and services, such as those provided by public administrations, are not available in multiple languages. Linguistic fragmentation means that many citizens and businesses cannot fully engage in online activities and benefit from online content and services. The sheer volume of content, the diversity of content types and modalities as well as the diversity of languages in Europe makes the effective roll-out and provision of multilingual solutions challenging.

Scope: The actions will address technological challenges (for language resources and interoperable language tools) and support coordination and networking by exploiting excellences and synergies with activities carried out in the Member States and Associated Countries. They will push research results to those who need them and support technology transfer and breakthroughs.

a) Innovation Action: A European Language Grid

The action shall:

i. develop the architecture and components for a public, open and interoperable grid connecting resources and tools, sharing and combining resources to support effective development and deployment of language technologies (software and services) across Europe. It shall provide easy access to basic natural language processing tools and services for European languages. The action shall cater for both consolidation of existing and a seamless inclusion of new resources and tools available for free or/and for a fee, enabling providers to control access rights reflecting their policies. The end-users of the grid shall be closely involved in the process.

ii. coordinate the work of the European Language grid and all actions supported under this topic and address the interoperability issues. It shall identify barriers for deploying multilingual services and establishing language infrastructure at European scale, including any skills gap. The action shall address legal and organisational obstacles, facilitate

coordination between various European, national and regional activities through a structured dialogue and the establishment and exchange of best practices.

iii. pilot the European Language Grid in specific sectors of high commercial and/or societal impact, through small scale demonstrators geared towards an innovative integration of language technologies in specific operating processes/operations. The action shall provide facilities for collaboration, technical and linguistic guidance, access to open-source tools and open language resources (available through the grid), access to venture capital, and promotion and dissemination events. The results of all small scale demonstrators should be made available through the European Language grid under appropriate licensing conditions. The action shall select these small scale demonstrators through the use of financial support to third parties. Up to 30% of the EU funding of the action should be allocated to the financial support of these third parties, typically of the size of EUR 100 000 to 200 000 per third party[42] and a duration of about 9 to 12 months. Financial support to third parties should in line with the conditions set out in Part K of the General Annexes.

iv. establish competence centres / nodes in Member and Associated States. It shall build on the previous EC-funded actions within the FP7, H2020 and CEF[43].

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

b) **Research and Innovation Action: Domain-specific/challenge-oriented Human Language Technology.**

The actions shall

Advance the state of art in Human Language Technologies through well-identified mission-oriented challenges involving researchers and industrial users of language technologies. Each proposal should address a specific sector of high commercial and/or societal impact or a technological challenge common/relevant to several sectors. Proposers should include a detailed analysis of the expected advances in terms of language technology-related research The actions should address concrete real-life issues defined by industrial users. The proposals must convincingly argue the demand for the proposed solution and provide clear indicators to benchmark the research results. The projects shall create a sustainable ecosystem of multilingual applications and services tailored for the specific needs of the addressed sector.

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

[42] 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 when this is necessary to achieve the objectives of the action.

[43] https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/eTranslation

Expected Impact:

- Provide European research and language technology industry with a better access to and usage of quality language resources and tools;
- Increase in the quality and coverage of multilingual solutions used by industrial players in sectors relevant to the emergence of the Digital Single Market;
- Increase in the uptake of language technologies in Europe in various sectors;
- Cost savings for private and public sector users of language technology solutions.

Type of Action: Research and Innovation action, Innovation action

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

ICT-30-2019-2020: An empowering, inclusive Next Generation Internet[44]

Specific Challenge: Every citizen, from all walks of life, should be able to fully take part in the Digital Single Market. This means that the Next Generation Internet will have to empower users, including its most vulnerable or disabled one, to have access to the same digital learning opportunities, in forms that are accessible, perceivable and understandable by everybody.

Scope: The objective is to support actions on smarter, open, trusted and **personalised learning** solutions to optimise digital learning and to allow learners to engage and interact with content and with peers.

a. **Innovation Action: Digital Learning Incubator**

The objective of this action is to advance **personalised and inclusive digital learning** through a fast-paced adoption cycle of technological and methodological solutions. The work will build on cross-links and advances in the various NGI technologies (such as machine-learning, AR/VR, AI) research fields and foster synergies between all the relevant market players, researchers and educational agents working on promising and innovative products. The action will be based on a "push and pull" strategy whereby the research actors push the best research projects to enter the innovation cycle and the market actors pull for the ideas with best market traction.

The action will:

- set up an Incubator bringing together all relevant stakeholders to form strategic alliances that can jointly achieve fast-paced breakthroughs in the area of personalised and inclusive learning online. The Incubator will allow fast-track experimentations in form of small scale projects,

[44] It is expected that this topic will continue in 2020.

providing access to knowledge, research prototypes, learning resources and data to parties interested to conduct these experimentations.

- launch open calls for highly promising small scale projects to work on a topic/challenge set out in a roadmap. It shall foresee suitable arrangements for oragnizing the corresponding competitive evaluation and selection.

The action shall select these small scale projects through the use of financial support to third parties. Up to 90% of the EU funding of the action should be allocated to the financial support of these third parties, typically of the size of EUR 100 000 to 200 000 per third party[45] and a duration of about 9 to 12 months. Financial support to third parties should in line with the conditions set out in Part K of the General Annexes.

The Commission considers that up to 1 proposal requesting a contribution from the EU of around 7 million would allow this area to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

b) Coordination and support action in the area of Digital Learning

The action will:

- stimulate the collaboration between all EU-funded FP7 and H2020 projects on digital learning, analyse the outcomes and best practices carried out in these projects, support the dissemination of their results as well as ensure their integration within the Next Generation Initiative and link with other support measures.

- identify: a) emerging research challenges, notably those arising from digital certification of learning outcomes and blockchain technologies and their uptake for a more inclusive and personalised learning; b) address legal, organisational and technological challenges underpinning the uptake of the proposed solutions, notably in relation to their scalability; c) make policy recommendations in view of the priorities of the next programme for research, innovation and deployment.

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

Expected Impact:

- Increase in the overall uptake of technology for personalised and inclusive learning for all, regardless of their age, gender or other socioeconomic factors.
- Increase in the number of distributed learning solutions for children with special educational needs.

[45] 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 when this is necessary to achieve the objectives of the action.

- Increase in the number of start-ups/SME's deploying personalised and inclusive learning solutions to the market.

Type of Action: Innovation action, Coordination and support action

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

ICT-31-2018-2019: EU-US collaboration on NGI

Specific Challenge: Building upon the EU-US collaboration in previous work programmes in the area of research experimentation, the aim is to reinforce cooperation and strategic partnerships in the area of Next Generation Internet, to establish a continuous dialogue among the key actors in the US and European programmes and to implement focused projects for joint developments. Proposals shall foresee twinning with entities participating in projects funded by the US to exchange knowledge and experience and exploit synergies. This collaboration will be implemented in accordance with the "Implementation arrangement between the European Commission and the government of the United States of America for cooperation between researchers funded separately by the European Union's and the United States framework programmes on research and innovation" signed on 17 October 2016[46].

Scope: **a) Coordination and Support Actions**. Proposals should cover one of the following two areas of this sub-topic:

- Organise workshops and other support activities: to facilitate the coordination of research and innovation initiatives in the EU and US, and to promote collaboration between the research groups. Create a Next Generation Internet open ecosystem engaging relevant initiatives and key actors from the EU and the US.

- Fellowship programme: support 3 to 6 months fellowships for Internet researchers notably from hi-tech startups, SMEs, mid-caps, research centres or academia to broaden the understanding of different approaches, perspectives and values, in view to then contribute to concrete NGI services and products 'Made in Europe'. The project will only provide financial support for travel and subsistence, and only citizens of the EU and associated countries will be eligible for funding. For grants awarded under this topic for the fellowship programme beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied

The Commission considers that proposals requesting a contribution from the EU of EUR 1 million for the first area of this sub-topic (Organise workshops and other support activities) and of EUR 1.5 million for the second area of this sub-topic (Fellowship programme) would allow this specific challenge to be addressed appropriately. Nonetheless, this does not

[46] http://ec.europa.eu/research/iscp/pdf/policy/eu-usa_implementing_arrangement_2016.pdf

preclude submission and selection of proposals requesting other amounts. At least one proposal will be selected in each of the two areas of this sub-topic.

b) Research and Innovation Action.

Common experiments by EU/US teams on emerging topics for the Next Generation Internet / Tomorrow's Internet programmes on top of EU/US experimental platforms.

For grants awarded under this topic for Research and Innovation actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied. Only organisations established in the EU and associated countries will be eligible for European Commission funding.

The Commission considers that proposals for Research and Innovation actions requesting a contribution from the EU of EUR 3.5 million would allow this specific challenge to be addressed appropriately. As a reference, 80% of the EU funding should be allocated to financial support for the third parties. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact: Proposals should provide appropriate metrics for the claimed impacts.

- Enhanced EU – US cooperation in Next Generation Internet, including policy cooperation.

- Reinforced collaboration and increased synergies between the Next Generation Internet and the Tomorrow's Internet programmes.

- Developing interoperable solutions and joint demonstrators, contributions to standards

- An EU - US ecosystem of top researchers, hi-tech startups / SMEs and Internet-related communities collaborating on the evolution of the Internet.

Type of Action: Coordination and support action, Research and Innovation action

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

Cross-cutting activities

ICT-32-2018: STARTS – The Arts stimulating innovation

Specific Challenge: The ever-increasing role of technology in our daily life offers huge potential for added value for our society. Artists can help unleash this potential. They can help shape a better relation of technology and humans and stimulate human-centred innovation through their transversal competencies and unconventional thinking. The challenge of the S+T+ARTS=STARTS program – innovation at the nexus of Science, Technology and the

Arts - is to better address innovation in industry and society by engaging artists in European R&I projects to explore unconventional art-inspired solutions to industrial/societal problems.

Scope: The topic will support art-driven innovation in European R&I projects by inclusion of artists in research consortia.

a) STARTS lighthouse pilots (RIA instrument) will explore art-inspired solutions to industrial/societal challenges in two chosen areas. Pilots will engage industry, technology, end-users, and artists in a broad artistic exploration of technologies with the aim of creating novel products, processes and services that respond better to human needs. The added value of artistic practices to realise unexpected solutions via artistic exploration must be clearly put forward in the two light house pilots.

(i) Lighthouse pilot in 'art-inspired interactive human-centred environments' created by digital objects and novel media, like IoT, augmented reality or social media. The pilot will explore how these digital objects and media can lead – via artistic exploration – to novel experiences and new models for creativity and thereby to unexpected solutions for challenges in the city, in the home or for mobility.

(ii) Lighthouse pilot in 'art-inspired urban manufacturing' driven by de-centralised digitally-enabled production systems and co-creation in urban environments. The pilot will explore how digitally-enabled small-scale production/manufacturing systems and networks combined with artistic exploration and creativity in design and process - can revive the social, ecological and economic urban space and lead to unexpected products and services in an urban environment.

It is expected to fund one lighthouse pilot in each of the two chosen areas (i) and (ii). For grants awarded under this topic for Research and Innovation Actions at least 30% of the EU funding requested shall be allocated to contributions to the work by artists and creatives.

For grants awarded under this topic for Research and Innovation Actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied. Third party support is expected to help cover the work of artists and creatives.

b) Coordination and Support Action (CSA instrument) to create a STARTS ecosystem by coordinating artistic and innovation relevant aspects of the two lighthouse pilots and of other European/international R&I projects that put artists and creatives at the centre of innovation. Tasks comprise analysing and helping implement best practices for including artists in R&I, organising events, providing online spaces for artists and technologists to meet, presenting the results from art-technology collaborations in exhibitions that are highly visible in the art world and in industry, and assisting European research teams to learn from art and design thinking as a strategy for innovation.. It is expected to fund one Coordination and Support Action.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 4 million for each of the two light house pilots for Research and Innovation Actions and of up to EUR 1 million for maximum one Coordination and Support Action would allow the areas to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. All proposals under a) and b) should target a duration of 3 years.

Expected Impact:

- The demonstration of value-added to industry and society in having artists contribute to the development of radically new products, services and processes.
- Signalling effect for future uptake of art-driven solutions to concrete industrial and societal challenges and art-driven user-centred products and services.
- Efficient working models how art-technology collaboration can contribute to innovative processes in research, industry and society.
- Burgeoning STARTS ecosystem involving industry, technology, research, end-users, societal stakeholders, and the Art world that reconciles and unites the goals and thinking of industry and technology with that of the Art world.

Type of Action: Coordination and support action, Research and Innovation action

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

ICT-33-2019: Startup Europe for Growth and Innovation Radar

Specific Challenge: The challenge is to scale up innovative businesses across the EU, detect high potential innovations and support innovators in going to market. Actions under this heading reinforce the Startup Europe[47] and Innovation Radar[48] initiatives and link to the activities of the European Innovation Council in a complementary way by targeting exclusively ICT innovators that are not supported by the EIC.

Scope: Actions should help startups and scaleups achieve market success and mature the innovation excellence of high potential innovators. Actions should support the creation of new jobs and high growth businesses and support their growth on a pan-European and international level. Innovators identified, promoted and supported by the Innovation Radar are expected to enrich and benefit from the Startup Europe ecosystem[49]. Projects should demonstrate sustainability of proposed actions beyond the life of the project. Where

[47] http://ec.europa.eu/digital-agenda/about-startup-europe

[48] https://ec.europa.eu/digital-agenda/en/innovation-radar

[49] This includes ICT innovators in EU-funded PCP and PPI procurements in the ICT domain. Innovators targeted by the Innovation Radar include startups, SMEs, spinoffs and research teams.

appropriate, the projects should seek synergies with ESIF funds or ESIF supported actions in order to improve the synergies between H2020 and ESIF.

a. Innovation actions

Connecting local tech startup ecosystems and supporting cross-border activities: among the 4-5 startups ecosystems connected by each project, at least half of them will be located in less developed ecosystems. The project should develop a single online entry point to each one of the ecosystems and connect them to the **Startup Europe one-stop-shop**. Cross-border activities will include: connecting tech entrepreneurs with e.g. potential investors, business partners, accessing skills and services helping startups soft land in new international markets. Particular focus will be placed on stimulating partnerships between scaleups and corporates with a view to procurement, mergers or acquisitions. Similar attention will be placed to support SMEs, startups and scaleups, wherever situated in Europe, to access public procurement opportunities across borders.

b. Coordination and support actions

- Provide targeted and tailored support to SMEs, startups, scaleups, spinoffs and market-oriented researchers planning to launch a spin-off, who are supported by EU funded ICT projects[50] and are delivering market-creating innovations that have scale-up potential.
- Insight and intelligence from the Innovation Radar is to be used to detect EU-funded innovators who face the biggest market opportunities (enhancement of Innovation Radar data by merging with relevant third party data sources is welcomed).
- Support is expected to include mentoring, coaching, investor readiness training, coaching on how to bid for public procurement sales opportunities, connecting innovators with potential customers, business partners and investors (Business Angels, Venture Capital, Crowdfunding and other relevant forms of financing).

Expected Impact: Proposals should address the following and provide appropriate metrics for measuring success with respect to a defined baseline:

a. Innovation actions

- Increased connectedness among members of tech startup ecosystems and their companies (startups and scaleups) and to the larger European business ecosystem seeking maximum synergies;
- Increased access to customers, private and public, better access to qualified employees, access to the right combination of finance and prospects for scaling up across border;

[50] From Framework Programme 7, Competitiveness and Innovation Program and Horizon 2020 programme.

- Stimulate European investments in digital sectors through increasing the number of cross-border investments; Demonstrate sustainability of proposed actions beyond the life of the project.

b. Coordination and Support actions

- Increase the number of digital technology based spin-offs, startups and scale-ups or successfully transferred technology from EU funded projects;

- Enable innovative ICT based companies or technology to reach investment maturity and market introduction readiness, and/or winning for the first time public procurement contracts across the EU.

Type of Action: Innovation action, Coordination and support action

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

ICT-34-2018-2019: Pre-Commercial Procurement open

Specific Challenge: The challenge is to enable public procurers to collectively implement PCPs in order to close the gap between supply and demand for innovative ICTs. The objective is to bring radical improvements to the quality and efficiency of public services by encouraging the development and validation of breakthrough solutions through Pre-Commercial Procurement[51].

Scope: **PCP actions** targeting consortia of procurers with similar procurement needs that want to procure together the development of innovative ICT based solutions to modernize public services whilst creating growth opportunities for industry and researchers in Europe in new markets. This topic is open to proposals for PCP actions in all areas of public sector interest requiring innovative ICT based solutions. It is open both to proposals requiring improvements mainly based on one specific ICT technology field, as well as to proposals requiring end-to-end solutions that need combinations of different ICT technologies.

Proposals shall demonstrate sustainability of the action beyond the life of the project. Activities covered shall include cooperation with policy makers to reinforce the national policy frameworks and mobilise substantial additional national budgets for PCP and PPI, as well as awareness raising, technical assistance and/or capacity building to other procurers beyond the project to mainstream PCP/PPI implementation and to remove obstacles for introducing the innovative solutions to be procured into the market.

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

[51] https://ec.europa.eu/digital-single-market/en/pre-commercial-procurement

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

Specific requirements for PCP actions are described in part E of the General Annexes of the Work Programme.

Expected Impact:

- Reduced fragmentation of demand for innovative solutions;
- Increased opportunities for wide market uptake and economies of scale for the supply side through the use of joint specifications, wide publication of results and where relevant contribution to standardisation, regulation or certification.

Type of Action: Pre-Commercial Procurement

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

ICT-35-2018: Fintech: Support to experimentation frameworks and regulatory compliance

Specific Challenge: "Fintech" is at the confluence of various digital technologies, financial areas and the entrepreneurial landscape, with many startups and scaleups proposing disrupting services. The challenge is to increase the role Europe play in Fintech so that EU startups can better scale-up across Europe and at global level. Facilitating the interactions between innovators, supervisors and regulators is particularly relevant in this context.

Scope:

- Bring together a group of regulatory or supervisory bodies, and other relevant organisations to investigate new approaches for piloting innovative Fintech solutions, anticipating risks, and facilitating the operations of Fintech firms that want to grow and scale-up across Europe.
- Build capacity and expertise regarding new technologies and models to support early understanding for regulators or supervisors and to offer specific advice to Fintech firms that want to grow and scale-up across Europe. Such regulatory advice would be provided by pools of experts. It should in particular support common understanding and interpretation of data-related policies and rules.
- Support the cross-border networking of ecosystems, hubs and accelerators focusing on Fintech, in particular to help startups appraise regulatory issues, to engage with other stakeholders like established financial or insurance firms and to identify opportunities for innovation procurements in Fintech.
- Envisage possible actions and technical solutions to evaluate the impact of regulation and facilitate regulatory compliance in financial areas. This could concern in particular

initiatives based on distributed ledger technologies, advanced regtech solutions or algorithmic regulation.

Expected Impact:

- Reinforce the position of Europe amongst leaders in Fintech, encouraging cross border collaboration and practical approaches for Fintech experimentation frameworks; enabling Fintech firms to grow and scale-up across Europe.
- Develop common understanding, interpretation and expertise regarding technology evolution and Fintech-related regulations and policies, in particular those concerning data.
- Put Europe in the lead for innovating in regulation, appraising the impact of regulation and facilitating regulatory compliance.

Type of Action: Coordination and support action

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

Conditions for the Call - Information and Communication Technologies

Opening date(s), deadline(s), indicative budget(s):[52]

Topics (Type of Action)	Budgets (EUR million)		Deadlines
	2018	2019	
Opening: 31 Oct 2017			
ICT-02-2018 (RIA)	30.00		17 Apr 2018
ICT-03-2018-2019 (IA)	30.00		
ICT-04-2018 (IA)	25.00		
ICT-04-2018 (RIA)	30.00		

[52] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The deadline(s) in 2019 are indicative and subject to a separate financing decision for 2019.
The budget amounts for the 2018 budget are subject to the availability of the appropriations provided for in the draft budget for 2018 after the adoption of the budget 2018 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.
The budget amounts for the 2019 budget are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2019.

ICT-07-2018 (IA)	8.00		
ICT-07-2018 (RIA)	39.00		
ICT-07-2018 (CSA)	1.00		
ICT-11-2018-2019 (IA)	50.00		
ICT-12-2018-2020 (RIA)	30.00		
ICT-12-2018-2020 (CSA)	1.00		
ICT-13-2018-2019 (RIA)	10.00		
ICT-13-2018-2019 (CSA)	3.00		
ICT-16-2018 (CSA)	1.00		
ICT-16-2018 (IA)	9.00		
ICT-16-2018 (RIA)	10.00		
ICT-18-2018 (IA)	50.00		
ICT-21-2018 (CSA)	2.00		
ICT-24-2018-2019 (RIA)	21.50		
ICT-24-2018-2019 (CSA)	7.00		
ICT-25-2018-2020 (CSA)	3.00		
ICT-26-2018-2020 (RIA)	20.00		
ICT-27-2018-2020 (CSA)	1.50		
ICT-28-2018 (IA)	10.00		
ICT-28-2018 (RIA)	10.00		
ICT-28-2018 (CSA)	1.00		
ICT-29-2018 (RIA)	18.00		
ICT-29-2018 (IA)	7.00		
ICT-31-2018-2019 (CSA)	2.50		
ICT-32-2018 (CSA)	1.00		
ICT-32-2018 (RIA)	8.00		
ICT-34-2018-2019 (PCP)	6.00		

ICT-35-2018 (CSA)	2.50		
ICT-17-2018 (RIA)	60.00		31 Jan 2018
ICT-22-2018 (RIA)	6.00		
Opening: 26 Jul 2018			
ICT-11-2018-2019 (IA)		40.00	14 Nov 2018
ICT-14-2019 (RIA)		80.00	
ICT-19-2019 (CSA)		2.00	
ICT-19-2019 (RIA)		90.00	
ICT-25-2018-2020 (RIA)		20.00	
Opening: 05 Sep 2018			
ICT-23-2019 (RIA)		4.00	15 Jan 2019
Opening: 16 Oct 2018			
ICT-01-2019 (RIA)		38.00	28 Mar 2019
ICT-01-2019 (CSA)		2.00	
ICT-03-2018-2019 (IA)		30.00	
ICT-05-2019 (RIA)		45.00	
ICT-05-2019 (IA)		30.00	
ICT-05-2019 (CSA)		1.50	
ICT-06-2019 (RIA)		30.00	
ICT-08-2019 (RIA)		11.00	
ICT-09-2019-2020 (CSA)		2.00	
ICT-09-2019-2020 (RIA)		20.00	
ICT-09-2019-2020 (IA)		28.00	
ICT-10-2019-2020 (RIA)		42.00	
ICT-13-2018-2019 (IA)		48.00	
ICT-15-2019-2020 (CSA)		1.50	
ICT-15-2019-2020 (RIA)		28.50	

ICT-20-2019-2020 (RIA)		44.00	
ICT-24-2018-2019 (RIA)		21.50	
ICT-30-2019-2020 (IA)		7.00	
ICT-30-2019-2020 (CSA)		1.00	
ICT-31-2018-2019 (RIA)		3.50	
ICT-33-2019 (IA)		10.00	
ICT-33-2019 (CSA)		1.50	
ICT-34-2018-2019 (PCP)		6.00	
Overall indicative budget	514.00	688.00	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme. The following exceptions apply:

ICT-17-2018, ICT-18-2018, ICT-19-2019	The limit for a full proposal is 100 pages.
ICT-31-2018-2019	For the fellowship programme only citizens of the EU and associated countries are eligible for the financial support to third parties.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme. The following exceptions apply:

ICT-22-2018	Criterion 3 "Quality and efficiency of the implementation": additional evaluation sub-criterion: Credibility and quality of the proposed collaboration mechanisms to effectively and efficiently carry on joint research activities and deliver joint outcomes with the twinning project from China.

ICT-23-2019	Due to the specific scope of this topic, in addition to the minimum number of participants set out in the General Annexes, proposals shall include at least two participants from Taiwan. Proposals will only be selected on the condition that the eligibility of Taiwanese partners is validated by Taiwan Government prior to technical review.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme.

The full evaluation procedure is described in the relevant guide published on the Participant Portal.

Grant Conditions:

ICT-17-2018, ICT-18-2018, ICT-19-2019, ICT-20-2019-2020	**Complementary grant agreements** will be implemented across projects originating from RIA, IA and CSA implemented under these topics through use of the respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement.
ICT-24-2018-2019, ICT-26-2018-2020, ICT-32-2018	For grants awarded under this sub-topic for Research and Innovation actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied.
ICT-24-2018-2019	For grants awarded under this sub-topic for Coordination and Support Actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of prizes. The respective options of Article 15.2 and Article 15.3 of the Model Grant Agreement will be applied.
ICT-25-2018-2020, ICT-31-2018-2019	For grants awarded under this sub-topic for Coordination and Support Actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied.

ICT-29-2018, ICT-30-2019-2020	For grants awarded under this topic for Innovation actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied.
ICT-34-2018-2019	The funding rate for Pre-Commercial Procurement (PCP) actions is limited to 90% of the total eligible costs (PCP is procurement of R&D services) to leverage co-financing from the procurers.

Consortium agreement:

All topics of this call	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.

Call - Digitising and transforming European industry and services: digital innovation hubs and platforms[53]

H2020-DT-2018-2020

Introduction

In April 2016, the Commission issued a communication[54] outlining its strategy for allowing the European Union to fully seize the opportunities offered by digitisation across industrial and services sectors. Beyond the support to key technological areas, an essential aspect is to foster the uptake of digital technologies and innovations, as well as synergies with other key enabling technologies.

The **'digitising and transforming European industry and services' focus area** ambitions to support Horizon 2020's contribution to the implementation of this strategy, through projects cutting across technological boundaries and reinforcing links between LEIT and Societal Challenges.

To that end, the focus area will be mainly implemented with the two following types of activities:

1. **digital innovation hubs**, which provide easy access to the latest digital innovations and experimentation facilities to potential users,
2. **cross-sectorial and integrated digital platforms** and **large-scale pilots** for experimentation and co-creation with users.

For more details about the impact of the focus area, please refer to the annex 1 of the general introduction to the work programme.

[53] It is expected that this call will continue in 2020.
Drawing on the success of actions of previous work programmes leveraging cascading grants to enable agility and reach out to new or key actors in the innovation chain (such as SMEs and mid-caps) not necessarily involved in standard EU R&I projects, part of the budget allocated to digital innovation hubs as well as to platforms and pilots actions under this call will be dedicated to the support of experiments and smaller projects funded through financial support to third parties (in accordance with article 137 of the Financial Regulation). While their size will be small in comparison with standard Horizon 2020 actions, in line with article 23 (7) of the Rules for Participation the budget to be allocated per third party may exceed the default maximum amount foreseen in the Financial Regulation. Specific limits corresponding to the specific objectives to be addressed, and to the consequent expected scale and duration of the activities to be carried out by third parties are provided for the topics DT-ICT-01-2019, DT-ICT-02-2018, DT-ICT-07-2018-2019, DT-ICT-08-2019, DT-ICT-10-2018-2019, DT-ICT-11-2018-2019.

[54] COM(2016)180 final – 'Digitising European Industry - Reaping the full benefits of a Digital Single Market'

Support to Hubs

The Digitising European Industry Strategy[55] aims to ensure that any business in Europe has access to a Digital Innovation Hub at 'a working distance'. A Digital Innovation Hub (DIH) helps companies become more competitive by improving their business/production processes as well as products and services by means of digital technology. DIHs offer services to test and experiment with advanced technologies, to manufacture innovative products or act as broker between user companies and technology suppliers.

Many components of Digital Innovation Hubs already exist supported for examples by Member States, regions or the knowledge and innovation communities (KIC) of EIT. Through the focus area on 'digitising and transforming European industry and services', the European Commission is adding value to these investments by supporting highly innovative experimentation with a cross-border dimension. To qualify for support, the following is required:

1. Consortia participating in the call should demonstrate that they are deeply rooted in innovation ecosystems that offer digital transformation services to companies in their proximity. They should provide a clear analysis how the proposed project will add value to an already existing service offer, and how it is aligned with the national or regional digitisation of industry initiative .

2. Every project should support a critical mass of dedicated highly innovative, cross border experiments bringing together technology suppliers and users. At least 50% of the budget should directly benefit SMEs or slightly bigger companies. For grants awarded under topics DT-ICT-01-2019, DT-ICT-02-2018, DT-ICT-03-2020, DT-ICT-04-2020, DT-ICT-05-2020 beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied.

3. Activities should aim at long-term sustainability and include a business plan for the digital innovation hubs, a plan to attract investors, to address training and skills development needs and dissemination. Established networks reaching out to SMEs like the Enterprise Europe Network and the NCP network should be used.

4. Selected projects are expected to collaborate on building a network of Digital Innovation Hubs, covering most regions in Europe.
   In addition to the topics described underneath hubs will also be called in the topic **DT-RUR-12-2018: ICT Innovation agriculture – Digital Innovation Hubs for Agriculture**[56]**.**

[55] https://ec.europa.eu/digital-single-market/en/digitising-european-industry

[56] Topic published under the Societal Challenge 2 Work Programme "Food Security, sustainable agriculture and forestry, marine, maritime and inland water research and the bio economy".

Proposals are invited against the following topic(s):

DT-ICT-01-2019: Smart Anything Everywhere

Specific Challenge: "Smart anything everywhere" stands for the next wave of products that integrate digital technology. The challenge is to accelerate the design, development and uptake of advanced digital technologies by European industry - especially SMEs and mid-caps - in products that include innovative electronic components, software and systems, and especially in sectors where digital technologies are underexploited[57].

Scope: **a. Innovation Actions SAE**

As Phase 3 of Smart Anything Everywhere, this sub-topic calls for Digital Innovation Hubs that strengthen European SMEs and mid-caps by experimenting and testing with one or more of the following technologies, or by supporting them to manufacture these products. Projects should also support eco-system building for promising platforms developed in earlier R&I products.

- Area 1: Cyber-physical and embedded systems: the goal is to help businesses from any sector uplift the quality and performance of their products and services by including (semi)-autonomy, paying special attention to security and privacy and to the collaboration between humans and machines.

- Area 2: Customised low energy computing powering CPS and the IoT: the goal is to help businesses who are developing products for situations where high computing capacity and low energy would be a competitive advantage.

- Area 3: Flexible and Wearable Electronics: the goal is to help businesses in further maturing, innovating and validating their products with thin, organic and large area electronics technologies, including wearable, portable and embedded objects. Focus is on i) access to design, technology and prototyping which are ready to use, and ii) application experiments driven by concrete user requirements and business cases.

- Area 4: Widening Digital Innovation Hubs: it addresses all three technology areas mentioned above and the technologies addressed in I4MS[58]. It calls for Digital Innovation Hubs in industrial regions which are so far underrepresented in Smart Anything Everywhere and I4MS[59], and builds upon a mentoring programme developed by I4MS[60]. These hubs should strongly collaborate with other Innovation Actions funded

[57] For an overview of already existing projects in this initiative see www.smartanythingeverywhere.eu/

[58] www.i4ms.eu. Technology areas addressed are: Robotics, Analytics, simulation and artificial intelligence, Additive Manufacturing, Laser based manufacturing equipment

[59] see https://ec.europa.eu/futurium/en/content/digital-innovation-hubs-catalogue-project-0

[60] http://dih.i4ms.eu/

under SAE and I4MS, e.g. through joint highly innovative cross-border experiments.

All proposed innovation actions may involve financial support to third parties (typically in the order of EUR 20 000 – 100 000[61] per third party).

For this topic, the four requirements described in the introductory section 'Support to Hubs' have to be applied.

The Commission considers that proposals requesting a contribution from the EU of up to 8 million would allow all areas to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. At least one innovation action is supported for each area.

b. Coordination and Support Activities SAE

The action will support the SAE network and help achieve broad coverage in technological, application, innovation, and geographic terms, and to link up with regional/national innovation initiatives, and other Digital Innovation Hubs. Its tasks and services shall include maintaining a single innovation portal, sharing of best practices, dissemination, brokering, leveraging further investment and training. For these support actions, close cooperation with ECSEL, and other CSAs funded under the Digitising European Industry focus area is looked for.

Expected Impact: Proposals should address all of the following impact criteria, providing metrics to measure success when appropriate.

- Attract a significant number of new users of advanced ICT in the manufacturing sector, and more innovative technology suppliers, in particular SMEs and mid-caps.
- Creation of a sustainable network of Digital Innovation Hubs, providing European added value to investments done at national and regional level in Digital Innovation Hubs.
- Availability of Digital Innovation Hub services across Europe and its regions with strong industrial capacities

Type of Action: Innovation action, Coordination and support action

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

DT-ICT-02-2018: Robotics - Digital Innovation Hubs (DIH)

Specific Challenge: The challenge is to provide a sustainable ecosystem of robotics stakeholders covering the entire value network to facilitate and accelerate a broad uptake and

[61] 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 when this is necessary to achieve the objectives of the action.

integration of robotic technologies, and supporting the digitisation of industry through robotics.

Scope: **a. Innovation Actions**

Proposals should address the provision of a network of robotics Digital Innovation Hubs (DIH) in the four prioritised application areas (PAA) of Healthcare, Infrastructure Inspection and Maintenance, Agri-Food and Agile Production. Proposals are expected to: develop a network of DIHs, address the delivery of services (technical and non-technical); provide access to best practice and research results in robotics relevant to the chosen application area; contribute to common system platforms, engaging in the development of industry-led standards and developing and disseminating standards demonstrators; facilitate access to pilots and collaborate with all the robotics actions funded in the WP and beyond, as appropriate.

Proposals are also expected to connect, share expertise, and closely collaborate with the DIHs in the other PAAs via the Central Robotics DIH CSA (see below). DIHs should address ethical, data privacy and protection issues, and consider cyber-security issues (including security by design). DIHs should support the development of use-case demonstrators at TRL 5 and above, preferably based on open system platforms.

Proposals are expected to contribute to a Working Group that connects the actions funded in this WP with the Central Robotics DIH CSA to disseminate best practice, to coordinate access to technology, resources, demonstrators and open platforms, and to facilitate the cross development of platforms.

Proposals are expected to use financial support to third parties (FSTP) to support industry, in particular SMEs, in their digital transformation, through for instance, demonstrators and platforms development, technology transfer experiments, or other services (technical or non-technical), as appropriate. FSTP should comply with the conditions set out in part K of the General Annexes of the Work Programme. At least 50% of the budget is expected to be dedicated to FSTP and the maximum amount of FSTP is EUR 300.000[62] per third party for the entire action duration. For innovation actions of this topic, the four requirements described in the introductory section 'Support to Hubs' have to be applied. The Commission considers that proposals requesting a contribution from the EU of EUR 16 million for DIHs in each Priority Area would allow this topic to be addressed appropriately. However, this does not preclude submission and selection of proposals requesting other amounts.

At least one action in each Priority Area will be supported.

b. Coordination and Support Activities

[62] 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 when this is necessary to achieve the objectives of the action.

Proposals should address the provision of a Central Robotics DIH CSA, to support and cooperate closely with the PAA-oriented DIH actions, to network them, to coordinate their activities and to develop synergies among them.

Proposals are expected to disseminate best practices in developing pilots, demonstrators and open platforms, and championing the development of open industry-led system platform standards.

The Commission considers that proposals requesting a contribution from the EU of EUR 2 million for the Central Robotics DIH CSA would allow this topic to be addressed appropriately. However, this does not preclude submission and selection of proposals requesting other amounts.
One Central Robotics DIH CSA will be supported.

Expected Impact:

- Increased deployment of robotics in each PAA.
- Formation of supply chains around platforms and modules that straddle PAA
- Introduction of cross-industry-based standards for modules and systems
- Generation of new businesses based around platform supply
- The development supply chains.
- Leveraging effect on other sources of funding, in particular regional and national funding

Type of Action: Innovation action, Coordination and support action

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

DT-ICT-03-2020: I4MS (phase 4) - uptake of digital game changers and digital manufacturing platforms

DT-ICT-04-2020: Photonics Innovation Hubs

DT-ICT-05-2020: Big Data Innovation Hubs

DT-ICT-06-2018: Coordination and Support Activities for Digital Innovation Hub network

Specific Challenge: The challenge is to coordinate Digital Innovation Hubs across Europe

Scope: The action will link up sectorial and technological hubs with regional/national innovation hubs to improve collaboration, reinforce specialisation and offer the best possible support for SMEs and mid-caps everywhere in Europe. The action will include the

organisation of workshops, conferences and dissemination material, and the development of a business model for collaboration among DIHs. The action will contribute to a catalogue of Digital Innovation Hubs which is currently under development[63]. For this support action, close cooperation with other CSAs funded under the Digitising European Industry focus area is required.

Expected Impact:

- Creation of a sustainable network of specialised Digital Innovation Hubs, where public investments are serving several regions of Europe.
- Reinforced links with other bottom-up initiatives, supported by regional, national and European policies and funds.
- Increased number of services and applications operated by European companies, especially small businesses and entrepreneurs.

Type of Action: Coordination and support action

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

Platforms and Pilots

The Digitising European Industry initiative includes the launch of a set of initiatives supporting the building of the digital industrial platforms of the future[64]. European industry needs to come to agreements on functions and interfaces for those platforms, reference architectures and interaction protocols that have the potential to create markets and market opportunities leading to ecosystems and standards.

Proposals are expected to make a significant step forward in platform building, interoperability between existing platforms, integration of relevant digital technologies such as IoT, AI, photonics, robotics, cloud and Big Data, and validation via pilots and experimentation facilities. Starting from suitable reference architectures, platform interfaces are defined, tested via piloting, supported via ecosystem building to prepare their roll-out, and evolved into standards.

Various platform development activities exist at EU or national level, e.g. the Reference Architectural Model Industrie 4.0 (RAMI 4.0) and the Industrial Data Space. To develop the next-generation digital platforms, proposals need to bring various initiatives together and act as linking pins. Proposals should build on existing platforms, pilot sites, testbeds, and

63 https://ec.europa.eu/futurium/en/content/digital-innovation-hubs-catalogue-project-0

64 COM(2016) 180 final, 19 April 2016

experimental environments that have been developed in these various initiatives when applicable[65].

Proposals need to address all of the following four activities, namely platform building, large-scale piloting, ecosystem building, and standardisation.

In platform building, proposals need to develop next-generation digital platforms, which build on the state-of-the-art, reuse what is available, and integrate different technologies, such as IoT, AI, robotics, cloud and Big Data. Platforms should aim at openness and interoperability between platforms to avoid lock-in, preventing dominant positions of individual players, and comply with standards and regulation. Proposals need to target solutions for SMEs and mid-caps, taking into account interoperability with emerging and future solutions. This may require the mapping of reference architecture models for integrating existing sectorial platforms. The interfaces of the platform need to be described via open specifications and reference implementations need to be developed. A major aim is to offer platform functionalities that can be generically reused in multiple contexts to support various types of applications and services.

In large-scale piloting, pilots are set up that make use of the digital platforms, develop prototype applications on top of the platforms, and validate the platforms in both reduced, controlled environments and in real-life use cases. Pilots may adapt platforms to specific application needs and validate their relevance for such needs, in order to foster take-up and large scale deployment. The pilots should cover innovative application scenarios with high socio-economic impact. Demonstration of cooperation between large-scale pilots in different domains and combination of services from different sectors/domains are welcome. The key need is to deliver interoperable solutions that provide an experience that customers or businesses require, to test them in complex regulatory environments, and to give guidance for secure and safe implementation.

In ecosystem building, the take-up of digital platforms is fostered by expanding the ecosystem of players involved and through opportunities for entrepreneurs by promoting new market openings allowing also smaller and newer players to capture value. For instance, small and innovative ICT players can develop services/applications with a clear societal and economic value, on top of the digital platforms. Moreover, additional small-scale pilots can be conducted by SMEs, validating the digital platforms and prototype applications. Experiments running on top of the pilots, under specific scenarios, will allow for the validation and acceptance by any actors in the ecosystem and users in particular.

In standardisation, contributions should be made to suitable standardisation bodies or pre-normative activities, as outlined in the Communication on Priorities of ICT Standardisation for the Digital Single Market[66].

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65 Relevant ongoing initiatives at EU level include the set of Large Scale Pilots called for under the Internet of Things Focus Area in 2016 (IoT-01-2016) and the Factories of the Future projects under FoF-11-2016.

66 COM(2016) 176 final, 19 April 2016

Projects for grants awarded under topics DT-ICT-07-2018-2019, DT-ICT-08-2019, DT-ICT-09-2020, DT-ICT-10-2019, DT-ICT-11-2019, DT-ICT-12-2020, and DT-TDS-01-2019 (located in the SC1-Health, demographic change and wellbeing part of the Work programme) should support a critical mass of large-scale piloting and ecosystem building activities. For these grants, beneficiaries may strengthen these activities by providing financial support to third parties in line with the conditions set out in part K of the General Annexes of the Work Programme. Consortia need to define the selection process of organisations, for which financial support will be granted (typically in the order of EUR 50 000 – 150 000 per third party[67]). Maximum 20% of the EU funding can be allocated to this purpose. The financial support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied.

Proposals should contain an outline business case and industrial exploitation strategy. They also need to define clear business models and justify how the results support those business models.

Expected Impact

Projects are expected to have a high impact on citizens, industry, businesses or public services. In particular:

- Increased prospects for future digital industrial platforms by validation of technological choices, sustainability and reproducibility, of architecture models, standards, and interoperability, as well as of verification of non-functional characteristics such as security and privacy.
- Strengthened links with other, bottom-up programmes and initiatives, supported by regional, national and European policies and funds.
- Increased number of services and applications operated by European companies, especially small businesses and entrepreneurs.
- Significant and measureable contribution to standards or pre-normative activities.
- Increased number of platforms, applications, business processes and innovative business models validated via large-scale piloting.
- Emergence of sustainable ecosystems around digital platforms.

Proposals should describe how the proposed work will contribute to the impact criteria above, in addition to the expected impacts under the specific topic addressed, and provide KPIs, the baseline and targets to measure impact.

Proposals are invited against the following topic(s):

[67] 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 when this is necessary to achieve the objectives of the action.

DT-ICT-07-2018-2019: Digital Manufacturing Platforms for Connected Smart Factories

Specific Challenge: Digital manufacturing platforms play an increasing role in dealing with competitive pressures and incorporating new technologies, applications and services. Advances are needed in digital manufacturing platforms that integrate different technologies, make data from the shop floor and the supply network easily accessible, and allow for complementary applications. The challenge is to fully exploit new concepts and technologies that allow manufacturing companies (especially mid-caps and SMEs) to fulfil the demands from changing supply and value networks.

Scope: a) Innovation Action - Develop and establish platforms for the connected smart production facilities of the future including their supply chains, driven by EU actors and safeguarding European interest in an area of key importance for the European economy. Proposals need to address at least two industrial sectors with several different use cases, especially in their piloting activities. In accordance with the strategy defined in the multi-annual roadmap[68] of the FoF cPPP, proposals should target at least one of the following 'grand challenges':

1. Agile Value Networks: lot-size one (2018 call)
2. Excellence in manufacturing: zero-defect processes and products (2018 call)
3. The human factor: human competences in synergy with technological progress (2019 call)
4. Sustainable Value Networks: manufacturing in a circular economy (2019 call)

Reference implementations are preferably developed in open-source, with (as far as possible) one permissive open-source licence to be selected for all open-source components. Where applicable, APIs and SDKs are made available to third party developers to develop complementary applications.

For the Innovation Actions in this topic, the four activities and impact criteria as described in the introductory section 'Platforms and Pilots' have to be applied. For large-scale piloting and ecosystem building activities, proposals may involve financial support to third parties, as explained in the introductory section 'Platforms and Pilots', to support SMEs in piloting and developing prototype applications on top of digital manufacturing platforms.

b) Coordination and Support Activities are needed to cross-fertilise the Industrial Platform communities, allowing for easier take-up of digital technologies from ongoing and past research projects to real-world use cases, and supporting the transfer of skills and know-how between academia and industry in both directions. Coordination and Support Activities are targeted in the 2019 call.

[68] See roadmap document "Factories 4.0 and Beyond" on http://www.effra.eu/

The Commission considers that proposals requesting a contribution from the EU up to EUR 16 million for Innovation Actions and up to 2 M€ for one CSA would allow the areas to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. At least one innovation action is supported for each 'grand challenge'. Maximum one proposal will be selected for the CSA.

Expected Impact:

- Significant increase in the options for SMEs and mid-caps to integrate different technologies, unlock the value of their data, deploy complementary applications, and to become a more responsive link in changing supply and value networks.
- Strengthened competitive position of European platform providers.
- Increased cooperation between industrial and academic communities; increased synergy and collaboration between projects.

Type of Action: Innovation action, Coordination and support action

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

DT-ICT-08-2019: Agricultural digital integration platforms

Specific Challenge: Agricultural research and innovation supports the sector in coping with a complex mix of challenges it is facing, including for example the pressures on natural resources and farm revenues. Knowledge creation and accessible information systems and tools to monitor, gather, transform and above all share vital information between key stakeholders can help the sector to become more sustainable. However, as well as the potential for new knowledge, a substantial part of the existing knowledge and its underpinning information flows, has yet to be exploited to its full potential. The resulting performance gap has strong social, ecological and economic implications. An improved functioning of the agricultural knowledge and innovation systems is needed, for timely innovation and to speed up the rate of knowledge creation. One of the most important constraints concerns the limited interoperability and lack of openness of different technical systems, thus limiting the choices farmers can make between suppliers of new technologies. An enhanced interoperability would allow for increased data sharing and the resulting knowledge generation. Another main constraint is the lack of information on the effectiveness of new technologies which slows down their take up.

Scope: Pilots should address all of the below aspects:

- Building platforms integrating different technologies like Internet of Things (IoT) devices, cloud, photonics, networks, geolocalisation (including through Galileo and EGNOS (the European Geostationary Navigation Overlay Service)) and robotics combined with applications based on data analytics and knowledge management. There is a need for a wide adoption of open, interoperable standards to ensure that all

connected systems can talk to each other, allowing the farmers and relevant other stakeholders to pick and choose the most appropriate combination of tools from different suppliers. Pilots will validate the means to achieve high level of interoperability of different systems through reference architecture, semantics technologies and standardisation framework that demonstrate communication exchange of data across different systems and platforms.

- Sharing data and generating knowledge via capturing and translating more and precise information. High precision data capturing and a high degree of data sharing should serve as basis for decision support systems delivering tailored advice at farm level, complementing and/or extending advisory services. The core technical enablers for analysing the amounts of data will be low-maintenance, robust and scalable monitoring and communication systems as well as artificial intelligence and semantics technologies. These services should include direct and detailed feedback to the farmers on appropriate practices and management strategies.

- Developing decision support systems that will include, but are not restricted to, a benchmarking system on the productivity and sustainability performance of farms, services, technologies and practices. For this purpose data models and semantic standards need to be defined to elicit performance indicators and derive decision making, as well as allowing sharing the data from the different farms.

Pilots in the selected areas should clearly cover the supply and demand sides. For large-scale piloting and ecosystem building, projects in this topic may involve financial support to third parties to extend the digital innovation space for farmers, advisory services and innovators, based on a network of farms and in close cooperation with existing agricultural knowledge and innovation infrastructures of the different Member States and Associated Countries and regions. For farmers, the platforms should have a mass-tailored advisory and knowledge dissemination service, including economic and technical benchmarking. It shall cover a large number of farms, including small farms. Advisory services based on local eco-systems should be investigated and linked in the pilots. For innovators, the platforms should work as test-bed, testing and benchmarking new technologies and services. This should be made possible by allowing for recruiting pilot farms and/or making available the necessary data.

Proposals should fall under the concept of multi-actor approach[69] and allow for strong involvement of the farming sector in the proposed activities. Projects are required to develop adequate data governance model(s) defining the terms for access to data owned by another party. Activities should allow for a wide geographic coverage within Europe. In addition, proposals shall cover at least three sub-sectors (e.g. arable crops, livestock, vegetable and fruit production).

[69] For further information on the multi-actor approach concept please refer to the Introduction to SC2 Work Programme

For this topic, the four activities and impact criteria described in the introductory section 'Platforms and Pilots' have to be applied. Pilot projects are expected to contribute to the consolidation and coherence work that will be implemented by the CSA supporting the activities defined under the topic "DT-ICT-13-2019: Digital Platforms/Pilots Horizontal Activities".

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

Expected Impact:

- Demonstrate measureable benefits from intensified data and information flows across a wide range of farm types, notably small farms;
- Improved and inclusive information flows and management within and among the targeted agricultural sectors based on transparent and fair data governance practices;
- Identification of user needs, validation of user acceptance, especially demonstration of viable concepts addressing privacy, security, vulnerability, liability and trust in connected data spaces;
- More information on environmental, social and economic performance of technologies, practices and management, increasing their respective adoption;
- Creation of opportunities for entrepreneurs by promoting new market openings, providing access to valuable datasets and direct interactions with users, expanding local businesses to European scale;
- Exploration and validation of new industry and business processes and innovative business models validated in the context of the pilots.

Type of Action: Innovation action

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

DT-ICT-09-2020: Digital service platforms for rural economies

DT-ICT-10-2018-19: Interoperable and smart homes and grids

Specific Challenge: When energy production is becoming decentralised and ICT is increasingly present in homes, the integration of renewable energy sources (RES) and promotion of energy efficiency should benefit from smarter homes, buildings and appliances, as well as (the batteries in) electric vehicles. Smart homes and buildings are one crucial element because system integration and optimisation of distributed generation, storage and flexible consumption will require interoperable smart technologies installed at building level. Internet of Things (IoT) enables a seamless integration of home appliances with related home

comfort and building automation services allowing to match user needs with the management of distributed energy across the grid, and to gain access to benefits from Demand Response. Novel services should lead to more comfortable, convenient and healthier living environment at lower energy costs for consumers whilst enabling an active participation of consumers in the energy system and energy markets.

Scope: The aim of the pilot is to exploit IoT reference architectures models that allow for combining services for home or building comfort and energy management, based on platforms that enable the integration of relevant digital technologies like IoT, AI, cloud and big data services and where applicable, combined with blockchain technologies. Energy services, where appropriate, can be combined with additional non-energy services and foster the take-up of smart energy communities (in particular peer-to-peer energy markets). The aim is also to demonstrate platforms through a large-scale pilot for experimentation and co-creation with users under real-life conditions in interaction with the electricity and wider energy system, and to demonstrate the benefits of energy management through IoT application and services for the users. The envisaged architecture should allow for third party contributions that may lead to new value added services both in energy and the home/building domain.

This shall be done by developing interoperability and seamless data sharing, through aligning existing standards from the utility and ICT domains, across the devices and systems to enable innovative building energy management services, with the aim to save costs to consumers, to facilitate the integration of renewable energy from distributed intermittent sources and to support energy efficiency. The pilot needs to demonstrate plug-and-play energy management solutions within the home, by taking into account legacy of existing smart home or building solutions, mapping their approach to common architecture models and implementing relevant standards (such as SAREF). Pilots need to ensure interoperability in the communication interfaces between smart devices and from the smart device to the gateway/energy manager and/or to the cloud, i.e. a service provider that uses the data generated from the device, so that smart home services can also be used for the benefit of the electricity and wider energy system. Selected pilots should promote the use of these interoperable solutions as widely as possible involving many different types of appliances (e.g. including white-goods, heating, cooling and ventilation, home & building automation energy management, metering and control, batteries, photovoltaic panels, charging for electric vehicles), and explore the need for further standardisation and legislation. Pilot work plans should include feedback mechanisms from the users to allow adaptation and optimisation of the technological and business approach to the particular use case.

The selected large-scale pilot shall in particular address all of the following issues:

- demonstrate scalability and stimulate spill-over effects; demonstrate that such platforms lead to a marketplace for new services in EU homes and buildings; identify best-practices, inter alia for consumer involvement, in installation, and in sales packages of devices and services;

- for large-scale piloting and ecosystem building, proposals shall involve financial support to third parties, in particular SME's and start-ups, to support the incorporation of users of the pilots, developers of additional applications, replication of the pilots through new sites or new connected devices, and complementary assessment of the acceptability of the use case where appropriate;

- the selected project shall cover the whole value chain for IoT-based services: appliance manufacturers and technology providers, ICT suppliers, energy suppliers, as well as independent aggregators or energy service companies (ESCOs), and one or more grid service operators (transmission system operators (TSOs) and distribution system operators (DSOs));

- the selected project is expected to contribute to the consolidation and coherence work in cooperation with similar EU-funded projects[70] through the BRIDGE initiative [71] and the CSA supporting the activities defined under "DT-ICT-13-2019: Digital Platforms/Pilots Horizontal Activities a)" below by contributing their results of horizontal nature (interoperability approach, standards, security and privacy approaches, business validation and sustainability, methodologies, metrics, etc.);

- link with Member States' and Associated Countries' initiatives in this area.

For this topic, the four activities and impact criteria described in the introductory section 'Platforms and Pilots' have to be applied. The Commission considers that proposals requesting a contribution from the EU up to EUR 30 million for Innovation Actions would allow the areas to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Increasing number of energy apps/services and home devices and appliances that are connected through the Internet allowing to shift consumption according to wholesale market or grid-constraints-related price signals.

- Validation of user acceptance, as well as demonstration of viable concepts that ensure privacy, liability, security and trust in connected data spaces.

- Accelerated wider deployment and adoption of IoT standards and platforms in smart homes and buildings in Europe and development of secure, cost-effective and sustainable European IoT ecosystems and related business models.

- Demonstration that such platforms lead to a marketplace for new services in EU homes and buildings with opportunities also for SMEs and start-ups.

[70] Wherever appropriate, actions should seek synergies from other R&I initiatives like LC-SC3-EE-13-2018-2019-2020, LC-SC3-EC-1-2018-2019-2020, LC-SC3-ES-5-2018-2020.

[71] http://www.h2020-bridge.eu/

- Contribution to increasing the use of renewable energy and increased energy efficiency, offering access to cheaper and sustainable energy for consumers and maximising social welfare.

Type of Action: Innovation action

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

DT-ICT-11-2019: Big data solutions for energy

Specific Challenge: Tomorrow's energy grids consist of heterogeneous interconnected systems, of an increasing number of small-scale and of dispersed energy generation and consumption devices, generating huge amounts of data. The electricity sector, in particular, needs big data tools and architectures for optimized energy system management under these demanding conditions.

Scope: **Innovation Actions** targeting large-scale pilot test-beds for big data application in the electricity sector. The aim is to develop/pilot and deploy a reference architecture for large-scale multi-party data exchange, management & governance and real-time processing (including distributed/edge processing) in the electricity sector and to translate this reference architecture into an open, modular data analytics toolbox for the safe and effective operation of grids and provision of innovative energy services. The reference architecture should ensure compatibility with legacy formats, interfaces and operating systems of the energy system, allow replication and scale-up, be compliant with applicable EU standards, and should enable the integration of relevant digital technologies like IoT, AI, cloud and big data services. The analytics toolbox shall be able to handle a wide variety of data and support the development of a wide range of energy services, at least to increase the efficiency and reliability of the operation of the electricity network (e.g. by predictive maintenance), to optimize the management of assets connected to the grid (in particular small-scale/renewable electricity generation and those used for demand response), to increase the efficiency and comfort of buildings, and to de-risk investments in energy efficiency (e.g. by reliably predicting and monitoring energy savings). Proposers should demonstrate that they have access to appropriate large-scale and realistic datasets, and should involve as many as necessary of the following types of participants: network operators, suppliers, independent aggregators, ESCO's, power exchanges, building management and renovation sectors, software integrators/developers. Proposals should address, as appropriate, analytics, simulation, prediction, cloud computing. Projects shall collaborate with EU-funded projects through the BRIDGE initiative [72].

For this topic, the four activities and impact criteria described in the introductory section 'Platforms and Pilots' have to be applied.

[72] http://www.h2020-bridge.eu/

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

All grants under both subtopics will be subject to Article 30.3 of the grant agreement (Commission right to object to transfers or licensing).

Expected Impact: Proposals should address the following impact criteria, **providing metrics to measure success** where appropriate:

- Effective integration of relevant digital technologies in the energy sector, resulting in integrated value chains and efficient business processes of the participating organizations;
- Enhancing energy asset management, increasing consumer participation and innovative network management, creating new data-driven business models and opportunities and innovative energy services;
- Contribution to increasing the use of renewable energy and increased energy efficiency based on optimised energy asset management, offering access to cheaper and sustainable energy for energy consumers and maximising social welfare;
- New data-driven paradigms for energy management systems able to deal with increased complexity of the energy systems;
- Improving availability of big data and big data management & analysis facilities for real-life scale research, simulation and test purposes.

Type of Action: Innovation action

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

DT-ICT-12-2020: The smart hospital of the future

DT-ICT-13-2019: Digital Platforms/Pilots Horizontal Activities

Specific Challenge: Coordination and Support activities are needed to support the operation of the pilot projects under the Platforms and Pilots topics in this Focus Area, and to support exploitation of the outcomes of these projects. These activities are expected to identify synergies among the pilot projects of the Focus Area, to promote cross-fertilisation, and to exchange best-practices and lessons learned. There is a need to increase coverage in technological, application, innovation, and geographic terms of these projects, as well as improve their engagement with relevant external stakeholders, and their links with regional/national and other European initiatives.

In addition, coordination and support activities are needed to pave the way for future digital industrial platforms in another promising sector, the construction sector. There is major

improvement potential in optimising resource use, environmental performance, health, comfort, and resilience to climate change.

Scope: a) **Support pilot activities and knowledge transfer across different sectors**: Coordination of the selected platform and pilot projects under the topics of this Focus Area, and where applicable with similar initiatives in Member States and Associated Countries, and with standardisation initiatives and support in ecosystem building to increase the impact of the overall set of projects. Exploitation of synergies between technology-based platform and pilot activities such as IoT and data value chains and the sector-specific platform and piloting projects of the Focus Area related to issues such as architecture, interoperability and standards approaches. Exchange on requirements for the development of common methodologies for design, testing and validation and for success and impact measurement. Furthermore, proposals need to promote the results obtained, support the enlargement of the ecosystems around the projects, facilitate the access for entrepreneurs/API developers/Makers and SMEs in general, and support the transfer of skills and know-how to industry.

b) **Legal, regulatory and security support:** Further development and exploitation of security and privacy mechanisms towards best practices for digital platforms and pilots including contribution to pre-normative activities and to standardization; regulatory and legal support in relation to data ownership and protection, security, liability, across sector legislations. The corresponding activities will be developed and addressed in the pilots and consolidated at programme level under this horizontal support activity line.

c) **Preparation of a digital industrial platform for the construction sector:** proposals should bring together relevant stakeholders and define a reference architecture for a digital industrial platform for the construction sector that increases productivity and optimises material usage in the construction sector, including for SMEs. It needs to take into account the recently developed framework with core indicators to assess the environmental performance of buildings, including circular economy aspects[73]. Proposals should take stock of other ongoing initiatives, promote mutual learning and coordination, and identify knowledge and intervention gaps. Widespread use of Building Information Modelling and building passports will promote information sharing about different resources and their life cycles, re-use of materials, productive processes, including improved engineering, procurement and supply chain management and are therefore part of the scope.

Proposals should address only one of the above-mentioned subtopics a), b), or c). The Commission considers that proposals requesting a contribution from the EU up to EUR 2 million for a) and EUR 1 million for each of b) and c) would allow above areas to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. At least one coordination and support action is supported for each of the areas above.

Expected Impact:

[73] http://ec.europa.eu/environment/eussd/buildings.htm

- Tangible contributions from European key players to actively engage with the platform building process;
- Efficient information sharing across the programme stakeholders for horizontal issues of common interests;
- Maintaining and extending an active eco-system of relevant stakeholders, including start-ups and SMEs;
- Validation in usage context of usability, risk and security assessment and identification of gaps related to trust, security and privacy, respect for the scarcity and vulnerability of human attention, and liability and sustainability;
- Strengthening of the role of EU on the global scale, in particular in terms of standardisation activities and access to foreign markets;
- Increased prospects on productivity improvements in the construction sector, and on a contribution to a more sustainable construction sector.

Type of Action: Coordination and support action

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

Conditions for the Call - Digitising and transforming European industry and services: digital innovation hubs and platforms

Opening date(s), deadline(s), indicative budget(s):[74]

Topics (Type of Action)	Budgets (EUR million)			Deadlines
	2018	2019	2020	
Opening: 31 Oct 2017				
DT-ICT-02-2018 (IA)	64.00			17 Apr 2018
DT-ICT-02-2018 (CSA)	2.00			

[74] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The deadline(s) in 2019 and 2020 are indicative and subject to separate financing decisions for 2019 and 2020.
The budget amounts for the 2018 budget are subject to the availability of the appropriations provided for in the draft budget for 2018 after the adoption of the budget 2018 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.
The budget amounts for the 2019 and 2020 budget are indicative and will be subject to separate financing decisions to cover the amounts to be allocated for 2019 and for 2020.

DT-ICT-06-2018 (CSA)	1.00			
DT-ICT-07-2018-2019 (IA)	48.00			
Opening: 26 Jul 2018				
DT-ICT-08-2019 (IA)		30.00 [75]		14 Nov 2018
DT-ICT-10-2018-19 (IA)	15.00 [76]	15.00		
DT-ICT-13-2019 (CSA)		4.00		
Opening: 16 Oct 2018				
DT-ICT-01-2019 (IA)		48.00		02 Apr 2019
DT-ICT-01-2019 (CSA)		1.00		
DT-ICT-07-2018-2019 (IA)		45.00		
DT-ICT-07-2018-2019 (CSA)		2.00		
DT-ICT-11-2019 (IA)		30.00 [77]		
Opening: To be defined				
Focus area topic(s) for 2020			166.00	To be defined
Overall indicative budget	130.00	175.00	166.00	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme.

[75] of which EUR 15.00 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part.

[76] of which EUR 15.00 million from the 'Secure, clean and efficient energy' WP part.

[77] of which EUR 15.00 million from the 'Secure, clean and efficient energy' WP part.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme.

The full evaluation procedure is described in the relevant guide published on the Participant Portal.

Grant Conditions:

DT-ICT-01-2019, DT-ICT-02-2018, DT-ICT-07-2018-2019, DT-ICT-08-2019, DT-ICT-10-2018-19, DT-ICT-11-2019	For grants awarded under this topic for Innovation actions beneficiaries may provide support to third parties as described in part K of the General Annexes of the Work Programme. The support to third parties can only be provided in the form of grants. The respective options of Article 15.1 and Article 15.3 of the Model Grant Agreement will be applied.

Consortium agreement:

All topics of this call	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.

Call - Cybersecurity[78]

H2020-SU-ICT-2018-2020

Within the next decade cybersecurity and privacy technologies should become complementary enablers of the EU digital economy, ensuring a trusted networked ICT environment for governments, businesses and individuals. The EU ambition is to become a world leader in secure digital economy. The compliance of the European infrastructures, products and services with relevant directives/regulations (e.g. NIS[79], eIDAS[80], GDPR[81], proposal for an e-Privacy regulation) and standards will promote trust and confidence to the European consumers and providers/suppliers, paving the way for a competitive, trustworthy Digital Single Market.

The Communication on Strengthening Europe's Cyber Resilience System and Fostering a Competitive and Innovative Cybersecurity Industry[82] shaped the main related challenges and several strategic initiatives to address them. The Cybersecurity contractual Public Private Partnership (cPPP) was established in July 2016 aiming at building trust among Member States and industry by fostering cooperation at early stages in the research and innovation process and helping to align demand and supply. It has been an important mean of consultation providing input for H2020 WP2018-2020 and it will facilitate the engagement of end-users in sectors that are important beneficiaries and customers of cybersecurity solutions (e.g. energy, transport, health, finance) towards defining and providing to the industry their sector-specific digital security, privacy and data protection common requirements. The topics below belonging to this Cybersecurity call are part of the contribution of the Commission to the cybersecurity cPPP. They also contribute to the Focus Area "Boosting the effectiveness of the Security Union".

For more details about the impact of the focus area, please refer to the annex 1 of the general introduction to the work programme.

Proposals under this call may be subject to security scrutiny if they could potentially lead to security-sensitive results that should be classified (see guide for classification).

78 It is expected that this call will continue in 2020.

79 Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union.

80 Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC.

81 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

82 Brussels, 5.7.2016 COM(2016) 410 final.

Proposals under this call should consider the relevant human factor and social aspects when developing innovative solutions.

Proposals are invited against the following topic(s):

SU-ICT-01-2018: Dynamic countering of cyber-attacks

Specific Challenge: The prevention of and the protection against attacks that target modern ICT components, complex ICT infrastructures and emerging technologies (e.g. IoT) remains a difficult task. The complexity of heterogeneous collections of hardware and software components finds its roots in the diversity of development contexts and of levels of maturity, in the growing means of networked interactions, in the massive exchange of information and data, and in the varied schedules of systems lifecycles that generate highly dynamic behaviours. The increase of encrypted flows over the Internet should lead to adopt new techniques for detection of suspicious cyber activities and traffic patterns, and for classification of flows, while keeping privacy and confidentiality. Another relevant challenge is to use machine learning and analytics for cybersecurity.

Scope: Proposals are invited against at least one of the following two subtopics:

a) Cyber-attacks management - advanced assurance and protection

Innovative, integrated and holistic approaches in order to minimize attack surfaces through appropriate configuration of system elements, trusted and verifiable computation systems and environments, secure runtime environments, as well as assurance, advanced verification tools and secure-by-design methods. This may entail a whole series of activities, including behavioural, social and human aspects in the engineering process until developed systems and processes address the planned security/privacy/accountability properties.

Proposals should explore how recent progress in artificial intelligence, in deep learning and in other related technologies can be used to provide breakthroughs in the fight against cyber-attacks (e.g. recognition of malicious activities on the network). Deep learning applications may also be used for cyber threat intelligence in anticipation of cyberattacks to identify malicious activity trends in the cyber space and correlate with attackers' information, tools and techniques.

Proposals may also cover secure execution environments not only including the execution platforms themselves plus the operating systems, but also the mechanisms (e.g. security supporting services, authentication/access control mechanisms) that ensure an adequate level of security, privacy and accountability in the execution of all processes.

Proposals are encouraged to provide mechanisms for informing the users on their security/privacy levels, for providing warnings and assisting them in handling security and privacy related incidents.

b) Cyber-attacks management – advanced response and recovery

Innovative capabilities to dynamically support human operators (e.g. Incident Response professionals), in controlling response and recovery actions, including information visualization. The capabilities should include the assessment how attacks propagate in a particular infrastructure and/or across interconnected infrastructures (e.g. attack-defence graphs) and what the best measures are to withstand and recover from a threat/attack, including the convergence with measures beyond cyber that can be needed (e.g. security policies).

Proposals should address the use of -and the contribution to- appropriate threat intelligence sources as well as the share of information with relevant parties (e.g. industry cooperation groups, Computer Security Incident Response Teams - CSIRTs).

Proposals should explore forensics, penetration testing, investigation and attack attribution services -local or remote- to achieve proper identification and better protection against future attacks and zero-day vulnerabilities. Approaches can include the combination of massive data and logs collection from various sources (e.g. network traffic, dark web) to facilitate investigation on security alerts and to find suspicious files trajectories in order to have the most appropriate response. Efficient utilization of both structured data (e.g. logs) and unstructured data (e.g. data coming from social networks such as pictures, tweets, discussions on forums) should be addressed.

Applicants should also consider the efficient handling (e.g. classification, anomaly detection) of encrypted network traffic and in particular where data stays encrypted, while keeping compliance with end user's privacy requirements.

Proposals need to consider dynamic, evidence based security and privacy risk assessment methodologies and management tools targeting emerging/advanced technologies (e.g. IoT, virtualised and service-oriented systems/networks).

Proposals are encouraged to provide mechanisms for informing the users on their security/privacy levels, for providing warnings and assisting them in handling security and privacy related incidents.

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

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

For grants awarded under this topic for Innovation Action the Commission or Agency may object to a transfer of ownership or the exclusive licensing of results to a third party established in a third country not associated to Horizon 2020. The respective option of Article 30.3 of the Model Grant Agreement will be applied.

Expected Impact: Short/medium term

- Enhanced protection against novel advanced threats.
- Advanced technologies and services to manage complex cyber-attacks and to reduce the impact of breaches.
- The technological and operational enablers of co-operation in response and recovery will contribute to the development of the CSIRT Network across the EU, which is one of the key targets of the NIS Directive.

Long term

- Robust, transversal and scalable ICT infrastructures resilient to cyber-attacks that can underpin relevant domain specific ICT systems (e.g. for energy) providing them with sustainable cybersecurity, digital privacy and accountability.

Type of Action: Innovation action

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

SU-ICT-02-2020: Building blocks for resilience in evolving ICT systems

Specific Challenge: Algorithms, software and hardware systems must be designed having security, privacy, data protection and accountability in mind from their design phase in a measurable manner. Relevant challenges include: (a) to develop mechanisms that measure the performance of ICT systems with regards to cybersecurity and privacy and (b) to enhance control and trust of the consumer of digital products and services with innovative tools aiming to ensure the accountability of the security and privacy levels in the algorithms, in the software, and ultimately in the ICT systems, products and services across the supply chain.

Scope: Proposals are invited against at least one of the following three subtopics:

a) Cybersecurity/privacy audit, certification and standardisation

Innovative approaches to (i) design and develop automated security validation and testing, exploiting the knowledge of architecture, code, and development environments (e.g. white box) (ii) design and develop automated security verification at code level, focusing on scalable taint analysis, information-flow analysis, control-flow integrity, security policy, and considering the relation to secure development lifecycles, (iii) develop mechanisms, key performance indicators and measures that ease the process of certification at the level of services and (iv) develop mechanisms to better audit and analyse open source and/or open license software, and ICT systems with respect to cybersecurity and digital privacy.

b) Trusted supply chains of ICT systems

Innovative approaches to (i) develop advanced, evidence based, dynamic methods and tools for better forecasting, detecting and preventing propagated vulnerabilities, (ii) estimate both dynamically and accurately supply chain cyber security and privacy risks, (iii) design and

develop security, privacy and accountability measures and mitigation strategies for all entities involved in the supply chain, (iv) design and develop techniques, methods and tools to better audit complex algorithms (e.g. search engines), interconnected ICT components/systems (v) devise methods to develop resilient systems out of potentially insecure components and (vi) devise security assurance methodologies and metrics to define security claims for composed systems and certification methods, allowing harmonisation and mutual recognition based on evidence and not only on trust.

The trusted supply chain for ICT systems/components should be considered by proposals in its entirety, in particular by addressing the IoT ecosystems/devices that are part of the supply chain.

c) Designing and developing privacy-friendly and secure software and hardware

Innovative approaches to establish methods and tools for (i) security and privacy requirements engineering (including dynamic threat modelling/ attack trees, attack ontologies, dynamic taxonomies and dynamic, evidence based risk analysis), (ii) embedded algorithmic accountability (in order to monitor the security, privacy and transparency of the algorithms/software/systems/services), (iii) system-wide consistency including connection between models, security/privacy/accountability objectives, policies, and functional implementations, (iv) metrics to assess a secure, reliable and privacy-friendly development, (v) secure, privacy-friendly and accountability-enabled programming languages (including machine languages), hardware design languages, development frameworks, as well as secure compilation and execution, (vi) novel, secure and privacy-friendly IoT architectures enabling consistent trustworthy and accountable authentication, authorization and accounting services across all IoT devices/ecosystems with enhancement of Public Key Infrastructures (PKIs) aiming to support PKI services (e.g. registration, revocation) for IoT devices.

For each of the sub-topics above, the outcome of the proposals is expected to lead to development up to Technology Readiness level (TRL) 5.

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

For grants awarded under this topic for Research and Innovation Action the Commission or Agency may object to a transfer of ownership or the exclusive licensing of results to a third party established in a third country not associated to Horizon 2020. The respective option of Article 30.3 of the Model Grant Agreement will be applied.

Expected Impact: Short/medium term

- Improved market opportunities for the EU vendors of security components.
- Increased trust both by developers using/integrating the ICT components and by the end-users of IT systems and services.

- Protect the privacy of citizens and trustworthiness of ICT .
- Acceleration of the development and implementation of certification processes.

Long term

- Advanced cybersecurity products and services will be developed improving trust in the Digital Single Market.
- The use of more harmonized certification schemes will increase the business cases for cybersecurity services as they will become more reliable.
- Validation platforms will provide assessments with less effort compared with nowadays and assure a better compliance with relevant regulations and standards.

Type of Action: Research and Innovation action

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

SU-ICT-03-2018: Establishing and operating a pilot for a Cybersecurity Competence Network to develop and implement a common Cybersecurity Research & Innovation Roadmap

Specific Challenge: EU's strategic interest is to ensure that the EU retains and develops essential capacities to secure its digital economy, infrastructures, society, and democracy. Europe's cybersecurity research, competences and investments are spread across Europe with too little alignment. There is an urgent need to step up investment in technological advancements that could make the EU's digital Single Market more cybersecure and to overcome the fragmentation of EU research capacities. Europe has to master the relevant cybersecurity technologies from secure components to trustworthy interconnected IoT ecosystems and to self-healing software. European industries need to be supported and equipped with latest technologies and skills to develop innovative security products and services and protect their vital assets against cyberattacks. This should contribute inter alia to achieve the objective of European strategic autonomy.

The Public Private Partnership on Cybersecurity[83] created in 2016 was an important first step aiming at triggering up to EUR 1.8 billion of investment. However, the scale of the investment under way in other parts of the world suggests that the EU needs to do more in terms of investment and overcome the fragmentation of capacities spread across the EU. In this context in a recent Joint Communication[84] the Commission announced the intention to create a Cybersecurity Competence Network with a European Cybersecurity Research and Competence Centre.

[83] C(2016) 440 final

[84] Joint Communication to the European Parliament and the Council: Resilience, Deterrence and Defence: Building strong cybersecurity for the EU, JOIN (2017) 450 final

Scope: The objective of this topic is to scale up existing research for the benefit of the cybersecurity of the Digital Single Market, with solutions that can be marketable. For this, participants should in parallel propose, test, validate and exploit the possible organisational, functional, procedural, technological and operational setup of a cybersecurity competence network with a central competence hub. Projects under this topic will help build and strengthen cybersecurity capacities across the EU as well as provide valuable input for the future set-up of the Cybersecurity Competence Network with a European Cybersecurity Research and Competence Centre as mentioned by the Joint Communication.

To achieve the above, support will go to consortia of competence centres in cybersecurity to engage together in:

- Common research, development and innovation in next generation industrial and civilian cybersecurity technologies (including dual-use), applications and services; focus should be on horizontal cybersecurity technologies as well as on cybersecurity in critical sectors (e.g. energy, transport, health, finance, eGovernment, telecom, space, manufacturing);
- Strengthening cybersecurity capacities across the EU and closing the cyber skills gap;
- Supporting certification authorities with testing and validation labs equipped with state of the art technologies and expertise.

Each proposal should bring together cybersecurity R&D&I centres in Europe (e.g. university labs/public or private non-profit research centres) to create synergies and scale up existing competences and demonstrated strengths to the European level. Proposals should take into consideration relevant active digital ecosystems and public-private cooperation models and focus on solving technological and industrial challenges. The centres within the proposal should aim to collectively develop and implement a Cybersecurity Roadmap covering the above and addressing multiple and complementary cybersecurity disciplines (e.g. cryptography, network security, application security, IoT/cloud security, data integrity and privacy, secure digital identities, security/crisis management, forensic technologies, security investigation, cyber psychology, bio-security). When developing the Roadmap the results of the work done by the cPPP on cybersecurity, notably its Strategic Research and Innovation Agenda, will serve as a starting point. Consideration should also be given to the relevant work of ENISA, Europol and other EU agencies and bodies.

The Roadmap should include targets to be achieved with deliverables by the end of the project (typically three to four years) that constitute clear milestones in its implementation, as well as priorities to be addressed in the future by the Cybersecurity Competence Network.

To implement this Roadmap, partners in the proposal(s) are expected to set up a functional network of centres of expertise with a coordinating "competence centre" (this role should be undertaken by one of the partners in the network, with the necessary capacity, resources and experience). Work includes the assessment of various organisational and legal solutions for the Cybersecurity Competence Network, taking into account various criteria, including the EU mechanisms and rules, national and regional funding structures, as well as those offered

by industry. Based on the above work, a governance structure should be proposed (i.e. business model, operational and decision-making procedures/processes, technologies and people) and will be implemented, tested and validated in the demonstration cases (see below) involving all partners in the network to showcase (in a measurable manner) its performance and optimise the suggested governance structure.

Projects will demonstrate the effectiveness of their selected governance structure by providing collaborative solutions to enhance cybersecurity capacities of the network and develop cyber skills (e.g. by looking at models to align cybersecurity curricula at graduate/post graduate levels; align cybersecurity certification programmes; classify skills with work roles).

Projects should ensure outreach, to raise knowledge and awareness of cybersecurity issues among a wider circle of professionals, where possible in cooperation with EU and national efforts, and to spread the developed expertise.

Projects should also include industrial partners and their cybersecurity research collaborators to create synergies and: (a) collaboratively identify and analyse scalable (short/mid/long term[85]) cybersecurity industrial challenges in the selected sectors and (b) demonstrate their ability to collaborate in developing appropriate solutions to solve critical challenges through (not less than four) research and innovation demonstration cases.

These demonstration cases will constitute the core part of the work to be done within the project. They will be based on a specific research & development roadmap to tackle selected industrial challenges and will implement it covering a complete range of activities, from research & innovation through testing, experimentation and validation to certification activities.

Projects under this topic are implemented as a programme through the use of complementary grants. The respective options of Article 2, Article 31.6 and Article 41.4 of the Model Grant Agreement will be applied. Proposals shall therefore foresee resources for clustering activities with other projects funded under this topic to identify synergies, best practices and kick-off the process of creating the network involving the sub-networks already created by awarded projects. This task will contribute to the actual set-up of the Cybersecurity Competence Network and a European Cybersecurity Research and Competence Centre at a later stage.

A proposal must involve distinct cybersecurity R&D&I excellence centres in Europe (e.g. university labs, public or private non-profit research centres, taking into consideration public-private cooperation models and the ecosystems around them), with complementary expertise, from at least 9 Member States or Associated Countries. With the aim of reinforcing technology and industrial capacity as widely as possible across Europe, proposals should

[85] *Short term*: referring to cybersecurity challenges in existing industrial products that can be addressed by the research and computational capabilities of the Network, *medium term*: referring to cybersecurity challenges in upcoming products that can be addressed by the research and computational capabilities of the Network and the Center and *long term*: high risk research for challenges that will shape new policies for long-term innovation capabilities requiring computational and research capacities beyond the existing ones by the Network.

include a substantial representation of the most relevant RD&I excellences centres in Europe, with a widespread European coverage and good geographical balance of activities as regards the scope of work. This will ensure the proposals meeting the policy goals of the initiative of supporting the establishment of the future Cybersecurity Competence Network with a European Cybersecurity Research and Competence Centre of the European Union.

The consortium in a proposal must involve at least 20 partners.

A proposal should also include industrial partners from various (not less than 3) sectors (e.g. telecom, finance, transport, eGovernment, health, space, defence, manufacturing) that will be involved in the demonstration cases.

The support and involvement of the relevant governmental bodies and authorities (e.g. for monitoring and assessing the projects' results during their life-cycles) will be considered as an asset.

The Commission considers that proposals requesting a contribution of up to EUR 16 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

For grants awarded under this topic the Commission may object to a transfer of ownership or the exclusive licensing of results to a third party established in a third country not associated to Horizon 2020. The respective option of Article 30.3 of the Model Grant Agreement will be applied.

Under this call topic, the beneficiaries nominated as project coordinators cannot, in this capacity, be awarded more than one grant from the European Union budget. In case an applicant organisation appears as coordinator in more than one proposal, only the last submitted proposal will be considered for evaluation. This approach should allow different governance models to be tested through this topic and provide a wide range of complementary outcomes, including lessons learnt, for the future set-up.

Expected Impact:

- Cybersecurity solutions, products or services for the identified critical challenges, increasing the cybersecurity of the Digital Single Market , in particular for sectors from which stakeholders are involved;

- A feasible, sustainable governance model for the Cybersecurity Competence Network developed and tested through successful pilot projects addressing selected industrial challenges;

- Clearly demonstrated strengthening of Member States' research and innovation competence and cybersecurity capacities, also within their national cybersecurity ecosystems, to meet the increasing cybersecurity challenges;

- Synergies between experts from various cybersecurity domains demonstrated;

- Bridges built between the network and industrial communities;
- Research and Development programme with a common Research and Innovation Roadmap reflecting all different cybersecurity sectors and covering a wide range of activities from research to testing;
- A cybersecurity skills framework model developed, which can be used as a reference by education providers to develop appropriate curricula; by employers, to help assess their cybersecurity workforce, and improve job descriptions; by citizens to reskill themselves;
- Establishment of foundations for pooling and streamlining the development and deployment of cybersecurity technology and strengthening industrial capabilities to secure EU's digital economy, society, democracy, space and infrastructures.

Type of Action: Research and Innovation action

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

SU-ICT-04-2019: Quantum Key Distribution testbed

Specific Challenge: Europe's economic activities and Europe's single market is dependent on well-functioning underlying digital infrastructures, services and data integrity, not the least for critical infrastructures like energy, transport, health, finance, etc. Current security of the digital infrastructures and services will soon be under threat of no longer providing long-term security. Confidentiality of data and communications, authentication, as well as the long-term integrity of stored data have to be guaranteed, even in the advent of quantum computers. Introducing Quantum Key Distribution (QKD) in the underlying infrastructure has the potential to maintain end-to-end security in the long-term.

Scope: Building an experimental platform to test and validate the concept of end-to-end security, providing quantum key distribution as a service. Proposals should develop an open, robust, reliable and fully monitored metropolitan area testbed network (ring or mesh configuration). The aim is to integrate equipment, components, protocols and network technologies with QKD systems and current digital security and communication networks. Where necessary, R&D activities can be addressed. The testbed should be modular, to test different components, configurations and approaches from multiple suppliers and benchmark the different approaches against overall performance. The proposed solutions should demonstrate resistance against known hacking techniques, including quantum hacking techniques. The testbed should make use as much as possible of existing network infrastructure (fibres and/or satellites), provide a quantum key exchange rate compatible with concrete application requirements over metropolitan distances (i.e. of at least 40km). The proposed testbed should demonstrate different applications and use cases of QKD (including for authentication), optimizing end-to-end security rather than the security of individual elements.

Proposals should include an assessment of the applications and parts of the infrastructure for which the integration of QKD is economically justified, as well as an assessment of the minimal acceptable key rate for each application and its total cost of ownership.

Proposals should bring together relevant stakeholders such as telecommunication equipment manufacturers, users, network operators, QKD equipment providers, digital security professionals and scientists.

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

For grants awarded under this topic the Commission may object to a transfer of ownership or the exclusive licensing of results to a third party established in a third country not associated to Horizon 2020. The respective option of Article 30.3 of the Model Grant Agreement will be applied.

Expected Impact:

- Demonstrating the feasibility of quantum communication networks.
- Validation of quantum network technologies, architectures, protocols, including broader cryptographic services based on QKD infrastructure.
- Interoperability of quantum and classical networks, as well as multi-vendor interoperability.
- Development of standards for QKD components, equipment and protocols.

Type of Action: Innovation action

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

Conditions for the Call - Cybersecurity

Opening date(s), deadline(s), indicative budget(s):[86]

[86] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The deadline(s) in 2019 and 2020 are indicative and subject to separate financing decisions for 2019 and 2020.
The budget amounts for the 2018 budget are subject to the availability of the appropriations provided for in the draft budget for 2018 after the adoption of the budget 2018 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

Topics (Type of Action)	Budgets (EUR million)			Deadlines
	2018	2019	2020	
Opening: 01 Feb 2018				
SU-ICT-03-2018 (RIA)	50.00			29 May 2018
Opening: 15 Mar 2018				
SU-ICT-01-2018 (IA)	40.00			28 Aug 2018
Opening: 26 Jul 2018				
SU-ICT-04-2019 (IA)		15.00		14 Nov 2018
Opening: 25 Jul 2019				
SU-ICT-02-2020 (RIA)			47.00	19 Nov 2019
Overall indicative budget	90.00	15.00	47.00	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme. The following exceptions apply:

SU-ICT-03-2018	- At least 20 legal entities. They must be independent of each other and be established in at least nine different Member States or Associated countries. - Under this topic, the beneficiaries nominated as project coordinators cannot, in this capacity, be awarded more than one grant from the European Union budget. In case an applicant organisation appears as coordinator in more than one proposal, only this applicant's last submitted proposal will be considered for evaluation

The budget amounts for the 2019 and 2020 budget are indicative and will be subject to separate financing decisions to cover the amounts to be allocated for 2019 and for 2020.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme.

The full evaluation procedure is described in the relevant guide published on the Participant Portal.

Grant Conditions:

SU-ICT-01-2018, SU-ICT-02-2020, SU-ICT-03-2018, SU-ICT-04-2019	For grants awarded under this topic the Commission may object to a transfer of ownership or the exclusive licensing of results to a third party established in a third country not associated to Horizon 2020. The respective option of Article 30.3 of the Model Grant Agreement will be applied.
SU-ICT-03-2018	Complementary grant agreements will be implemented across projects originating under this topic through use of the respective options of Article 2, Article 31.6 and Article 41.4 2 of the Model Grant Agreement.

Consortium agreement:

SU-ICT-01-2018, SU-ICT-02-2020, SU-ICT-03-2018, SU-ICT-04-2019	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.

Call - EU-Japan Joint Call

H2020-EUJ-2018

Proposals are invited against the following topic(s):

EUJ-01-2018: Advanced technologies (Security/Cloud/IoT/BigData) for a hyper-connected society in the context of Smart City

Specific Challenge: Following the integration and federation of IoT with Big Data and Cloud, which has been explored in past coordinated calls, a remaining challenge to address is **enhanced security and privacy** and how the human user deals with the ever-increasing amount of sensors, smart objects and data. Both EU and Japan have excellent competences in the fields of cybersecurity systems and visualisation technologies. Especially, security aspects are of increasing importance in these years. **There is a need for simple, efficient and trustable systems based on advanced technologies combining Security, Cloud and IoT/Big Data technologies** that can provide **intelligent** detection and countermeasures for device malware attacks, automatic vulnerability discovery and patching, analytics and IoT/Big Data applications. All of these require **advanced cloud and edge computing technologies** and **interoperable IoT devices and platforms.**

These new requirements, including security aspects, will have an enormous impact on the underlying cloud/IoT platforms and associated services, especially for cross-border demonstrations of technologies and applications.

Furthermore, **interoperability** of IoT devices/platforms is of particular interest in the context of Smart Cities (the areas of energy, social infrastructure, traffic/transport, healthcare, and disaster/crime prevention) in order to promote collaboration between a variety of business operators and platforms connecting to various IoT devices, open source, standards, SDKs, common APIs, are the cornerstone of the EU-Japan collaboration.

Scope: The proposals should address one of the two following areas:

1) Advanced technologies combining Security, IoT, Cloud and Big data for a hyper-connected society

The focus is to research, develop and test advanced technologies combining Security, IoT, Cloud and Big data. The following technologies are expected for research and development: agility against emerging threats; automatic vulnerability discovery and patching; open-sourcing of security tools; IoT security; cloud security; data security; privacy protection; data anonymization; blockchain in the context of IoT/Cloud; critical information infrastructure protection, cross border application demonstrations; etc.

2) Interoperable technologies of IoT devices/platforms in the context of Smart Cities

The focus is to research, develop and test interoperable technologies of IoT devices/platforms in the context of Smart Cities. The following technologies are expected for research and development: edge/fog/cloud computing; low power; scalability; open-standards-based platforms; system and reference architectures; open application programming interfaces (API); data sharing among cross-market/cultural platforms; managing distributed data among different communities and regions; bridging different standardizations; technical verification; cross border application demonstrations; energy management; transportation systems; maintenance systems for life infrastructure; etc. A further objective is to contribute to standardization activities under the cooperation of EU-JP research institutes and IoT-related consortia (e.g. the Alliance for IoT Innovation (AIOTI) and IoT Acceleration Consortium), and promote a global expansion of research results in Smart Cities.

The Commission considers that proposals requesting a contribution from the EU up to EUR 1.5 million would allow this specific challenge to be addressed appropriately by one project of EUR 1.5 million in each of the suggested areas. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Credible demonstrations based on cross-border business and/or societal applications of robust interoperable technologies identifying policy/legal obstacles (i.e., free flow of data, data protection, data portability etc.).
- Concrete implementations of interoperable solutions that integrate IoT, Cloud and Big Data including security that are candidates for standardisation.
- Facilitation of the development of cloud-enabled, secure and trustworthy IoT/big data applications (i.e., integrating intelligent security systems and visualisation technologies and devices/interfaces).
- Promotion of the use of data related to Smart Cities and the creation of new increasingly efficient services in urban and regional administrative management.
- Joint contributions to standardization activities under the cooperation of EU-Japan research institutes and IoT-related consortia (e.g. AIOTI and IoT Acceleration Consortium).

Type of Action: Research and Innovation action

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

EUJ-02-2018: 5G and beyond

Specific Challenge: The next phase of 5G activities running during the 2018-20 period covers both in EU and in Japan, technologies and systems demonstrations and trials. The challenge is hence to demonstrate technologies and system interoperability for 5G applications of interest

in the two regions in early version of the IMT-2020 standards, but also to go further to address long-term challenges beyond 5G.

The overall goal is to evaluate in real setup innovative end-to-end 5G systems built on the outcomes of previous phases of the 5G R&I. The optimisation of the frequency bands and their usage with different coverage requirements as well as the validation of geographic interoperability are key targets.

Scope: The proposals should address one of the two following areas:

1) Large-scale demonstrations and trials towards 5G applications: The objective is to research, develop and test technologies to enable applications developers and researchers to take advantage of the 5G integrated access/core network infrastructures and testbeds in Europe and Japan, in order to showcase the adaptability of the latest 5G systems, technologies and early version of the IMT-2020 standards.

The area of large-scale demonstrations and trials towards 5G applications, should showcase the adaptability of the 5G infrastructure to the 5G KPI's and the use of the integrated environment to contribute to global R&D and standardization efforts of 5G systems by having an open environment for the trials.

The focus should be on trials and demonstrations of 5G applications in the use cases of Enhanced Mobile Broadband (eMBB) and Broadband Access in Dense Areas. Typical applications scenarios could cover, but are not limited to, mobile 3D immersive experience, ultra high definition live video and HD video sharing in crowded environments. Typical test/demonstration environments will include high user density shopping malls, stadiums and open crowded streets.

To try out highly innovative solutions targeting new opportunities which will emerge with the worldwide deployment of 5G ecosystems, the participation of industry from both regions, and particularly SMEs, is key.

2) Joint research on enabling technologies for beyond 5G: 5G mobile technology is expected to handle a fully mobile and connected society. The demands for this are characterized by the tremendous growth in connectivity and data traffic density/volume as well as the required multi-layer densification to enable this. Beyond 5G should further support such trend.

Focus should be towards the enormous capacities foreseen to be needed in the backhaul and fronthaul networks to carry the traffic, as fibre-optic networks, may not be an option everywhere. A viable alternative in such cases is to use radio-based backhaul/fronthaul links in the millimeter or sub-millimeter wave bands to support super high rate applications, > 100 Gb/s, and targeting use new of very high frequency, notably spectrum > 275 GHz.

The goal is for an alternative transmission system occupying bandwidths as large as several tens of GHz to allow the realization of such high data rates with less complexity in the baseband.

Communication system and networks using both of advanced optical/photonic technologies and radio technologies should be expected for Beyond 5G.

The Commission considers that proposals requesting a contribution from the EU up to EUR 1.5 million would allow each area to be addressed appropriately. Nevertheless this does not preclude submission and selection of proposals requesting other amounts.

Expected Impact:

- Large-scale joint demonstrators converging towards open 5G applications.
- Global interoperability demonstrations for 5G networks.
- Support of common standardisation roadmaps for 5G starting with 3GPP Release14, including coordinated and common standards in the SDN/NFV domain. Standardization impact through EU and Japanese research efforts are addressed through H2020 as well as 5GPF (5G Promotion Forum) and should also be relevant in the context of the 5G spectrum process for WRC-19
- Joint contributions to global 5G specifications for IMT-2020 in relevant organisations (e.g. 3GPP, ITU-R), especially in view of 5G phase 2 standardisation (beyond eMBB) and spectrum harmonization for IMT-2020.
- Open new prospects for wireless technologies in terms of applications and use of novel spectrum.
- Relevant results for wireless links in the millimeter or sub-millimeter wave bands in support of the identification of frequency bands above 275 GHz for use by administrations for the land-mobile and fixed services applications for WRC-19 agenda item 1.15.

Type of Action: Research and Innovation action

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

Conditions for the Call - EU-Japan Joint Call

Opening date(s), deadline(s), indicative budget(s):[87]

[87] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts for the 2018 budget are subject to the availability of the appropriations provided for in the draft budget for 2018 after the adoption of the budget 2018 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

Topics (Type of Action)	Budgets (EUR million)	Deadlines
	2018	
Opening: 31 Oct 2017		
EUJ-01-2018 (RIA)	3.00	31 Jan 2018
EUJ-02-2018 (RIA)	3.00	
Overall indicative budget	6.00	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme. The following exceptions apply:

EUJ-01-2018	Additional admissibility criterion: Participants in the EU collaborative projects are required to conclude a coordination agreement with the participants in the coordinated project of the scope 1) funded by NICT (National Institute of Information and Communications Technology) or the scope 2) funded by MIC (Ministry of Internal Affairs and Communications). A final draft of this agreement has to be provided with the proposal. Additional eligibility criteria: • Proposals submitted to this call which do not include coordination with a Japanese proposal submitted to MIC or NICT for evaluation will be considered ineligible. • The proposed project duration shall not exceed 36 months. • The Japanese authorities can consider non-eligible proposals with participation of partners from third countries (countries other than Japan, EU and Associated states). Consultation to MIC or NICT representatives is highly advisable before submitting proposals involving

	third country organisations. Proposals will only be selected on the condition that their corresponding coordinated Japanese project will be funded by MIC or NICT.
EUJ-02-2018	Participants in the EU collaborative projects are required to conclude a coordination agreement with the participants in the coordinated project of the scope 1) funded by MIC (Ministry of Internal Affairs and Communications) or the scope 2) funded by NICT (National Institute of Information and Communications Technology). A final draft of this agreement has to be provided with the proposal. Additional eligibility criteria: • Proposals submitted to this call which do not include coordination with a Japanese proposal submitted to MIC or NICT for evaluation will be considered ineligible. • The proposed project duration shall not exceed 36 months. • The Japanese authorities can consider non-eligible proposals with participation of partners from third countries (countries other than Japan, EU and Associated states). Consultation to MIC or NICT representatives is highly advisable before submitting proposals involving third country organisations. Proposals will only be selected on the condition that their corresponding coordinated Japanese project will be funded by MIC or NICT.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme.

The full evaluation procedure is described in the relevant guide published on the Participant Portal.

Grant Conditions:

EUJ-01-2018	Grants awarded under this topic will be jointly funded with: NICT (National Institute of Information and Communications

	Technology). (Scope 1) MIC (Ministry of Internal Affairs and Communications) (Scope 2) The respective options of Article 2, Article 41.5 and Article 50.3.1 (i) (j) of the Model Grant Agreement will be applied.
EUJ-02-2018	Grants awarded under this topic will be jointly funded with: MIC (Ministry of Internal Affairs and Communications) (Scope 1) NICT (National Institute of Information and Communications Technology). (Scope 2) The respective options of Article 2, Article 41.5 and Article 50.3.1 (i) (j) of the Model Grant Agreement will be applied.

Consortium agreement:

EUJ-01-2018, EUJ-02-2018	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.

Call - EU-Korea Joint Call

H2020-EUK-2018

Proposals are invited against the following topic(s):

EUK-01-2018: Cloud, IoT and AI technologies

Specific Challenge: Over the last years Cloud computing technologies have evolved into the major driver that brought together IoT, Big Data and mobile computing into an integrated and ubiquitous computing platform. The capability offered by the cloud platforms to deliver on-demand computing power and the ability to process the vast amount of data coming from an abundance of devices/sensors will provide a huge impetus to AI technologies as never realized before. In order to provide AI services on Cloud computing platforms, the harmonious management of computing resources through multi-cloud federation environment as well as huge data management and analytics are necessary. In addition, there is a need for new mechanisms using intelligence to manage the deluge of data from various surroundings; standardizing open IoT data management platforms to enable launching new value-added AI services; data acquisition method using IoT technologies.

Combining Cloud, IoT and AI will bring tremendous technological advances with enormous benefits to business and societal applications.

Scope: The main focus of the joint research is to develop innovative solutions integrating AI with Cloud and IoT technologies to support future AI applications in an efficient way.

A number of R&D areas need to be considered so as to deliver these **advanced cloud platforms with IoT for AI** (i.e., innovative cloud computing models to deliver cross-border future AI applications; new data management models built on AI-based optimal resource allocation; new approaches for cloud resources orchestration for AI data processing; new approaches to handle a dynamic dataset in the federated clouds for AI functions; Cloud and IoT combined platforms managing intelligence from IoT objects and surroundings and supporting data-intensive applications; efficient navigation, device control and enhanced decision-making technologies using intelligence, etc.).

The technologies developed should be validated through concrete cross-border AI applications in business (cross-border enterprise settings) and/or societal contexts (e.g. autonomous vehicles in a complex urban area, smart living environments, personal health systems, etc.).

The Commission considers that proposals requesting a contribution from the EU of EUR 2.2 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:

- Concrete implementation of interoperable and reliable combined cloud/IoT solutions to support robust AI applications.
- Facilitate and enhance the adoption of combined cloud/IoT platforms and development, operation and delivery of AI services in future.
- Credible demonstrations based on cross-border business and/or societal AI applications on the cloud platform developed.
- Joint contributions to international standardization and/or forum activities.

Type of Action: Research and Innovation action

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

EUK-02-2018: 5G

Specific Challenge: The next phase of 5G covers, both in EU and in South Korea, technologies and systems demonstrations and trials. The challenge is hence to demonstrate innovative use of 5G technologies and system interoperability for a number of 5G applications of interest in the two regions in early version of the 5G standard. The possibilities of even broader regional test beds or demonstrators can be proposed, e.g. through extension to other countries or regions as this could further strengthen the co-operation towards a global 5G.

The overall goal is to evaluate in real setup innovative end-to-end 5G systems built on the outcomes of the previous phase of the 5G R&I in the earlier joint call with South Korea and focus on demonstrations of applications and use cases in joint pilots in line with the phase 3 targets of 5G-PPP and their validation in a system context and in the context of multiple use cases, with performances well beyond those of early 5G trials planned over the 2018-20 period.

The call will further advance common interests in standards (e.g. cell free networks and related RAN architecture) as well as advances concerning the core network, such as slicing and virtualisation which require more efforts in cloud like core environments and open source approaches.

Scope: The focus should be on large-scale demonstrations and trials towards 5G applications, this to have a strong focus on the harmonization for 5G standards and spectrum.

The proposals should address one of the two areas (a or b):

a) Focus on mmwave and super broadband services: The 5G vision on super broadband services mainly related to very high definition immersive video services (virtual reality) using mmWave frequency bands. This should be in the proposed specific context of the ground/aerial vehicles and also possibly include a focus towards autonomous network technologies toward safe and automated 5G networks.

This focus should include demonstration of 5G technologies concerning,

(1) Access networks, notably: i) Various duplexing technologies with (or without) interference cancellation; ii) Efficient radio transmission technology for the mmwave relay links; iii) Advanced beamforming (fast switching & adaptive hybrid.

(2) Core networks, notably: i) Implementation and Proof of Concepts of 5G core systems prototype software (e.g. AMF, SMF, UPF); ii) Implementation of end-to-end network slicing and orchestration and management of autonomous 5G networks; iii) Implementation of Multi-Access Edge Computing (MEC).

b) Focus on interoperability and integration of 5G vertical testbeds on heterogeneous environments: An open approach is to be taken to achieve a closer co-operation in spectrum harmonisation and co-operation in interoperability testing, e.g. in the C-band and/or Ka-band, to achieve coexistence and inter-working between same/different radio access technologies considering both terrestrial (i.e., cellular) and non- terrestrial links (i.e., satellite) incorporating QoS transparency between difference 5G mobile core networks.

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

Expected Impact: - Global interoperability demonstrations for 5G networks, contribution to the integration framework towards access and core.

- Joint contributions to global 5G standards specifications in relevant organisations (e.g. 3GPP, ITU-R), especially in view of 5G phase 2 standardisation (beyond eMBB) and IMT2020 spectrum harmonization.

- Succesful showcasing trials or testbeds with, ideally, joint demonstration across regions.

Type of Action: Research and Innovation action

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

Conditions for the Call - EU-Korea Joint Call

Opening date(s), deadline(s), indicative budget(s):[88]

[88] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts for the 2018 budget are subject to the availability of the appropriations provided for in the draft budget for 2018 after the adoption of the budget 2018 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.

Topics (Type of Action)	Budgets (EUR million)	Deadlines
	2018	
Opening: 31 Oct 2017		
EUK-01-2018 (RIA)	2.20	31 Jan 2018
EUK-02-2018 (RIA)	4.00	
Overall indicative budget	6.20	

Indicative timetable for evaluation and grant agreement signature:

For single stage procedure:

- Information on the outcome of the evaluation: Maximum 5 months from the final date for submission; and
- Indicative date for the signing of grant agreements: Maximum 8 months from the final date for submission.

Eligibility and admissibility conditions: The conditions are described in General Annexes B and C of the work programme. The following exceptions apply:

All topics of this call	Additional admissibility criterion: Participants in the EU collaborative projects are required to conclude **a coordination agreement** with the participants in the coordinated project funded by MSIT (Ministry of Science and ICT/IITP (Institute for Information and Communications Technology Promotion). A final draft of this agreement has to be provided with the proposal. Additional eligibility criteria: • Proposals submitted to this call which do not include coordination with a South Korean proposal submitted to MSIT/IITP for evaluation will be considered ineligible. • The proposed project duration shall not exceed 36 months. • The Korean authorities can consider non-eligible proposals with participation of partners from third countries (countries other than South Korea, EU and Associated states). Consultation to MSIT/IITP representatives is highly advisable before submitting proposals involving third country organisations.

	• Proposals will only be selected on the condition that their corresponding coordinated South Korean project will be funded by MSIT/IITP.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in General Annex H of the work programme.

Evaluation Procedure: The procedure for setting a priority order for proposals with the same score is given in General Annex H of the work programme.

The full evaluation procedure is described in the relevant guide published on the Participant Portal.

Grant Conditions:

EUK-01-2018	Grants awarded under this topic will be jointly funded with: MSIT (Ministry of science and ICT)/IITP (Institute for Information and Communications Technology Promotion) The respective options of Article 2, Article 41.5 and Article 50.3.1 (i) (j) of the Model Grant Agreement will be applied.
EUK-02-2018	Grants awarded under this topic will be jointly funded with: MSIT (Ministry of science and ICT/IITP (Institute for Information and Communications Technology Promotion) The respective options of Article 2, Article 41.5 and Article 50.3.1 (i) (j) of the Model Grant Agreement will be applied.

Consortium agreement:

EUK-01-2018, EUK-02-2018	Members of consortium are required to conclude a consortium agreement, in principle prior to the signature of the grant agreement.

SME instrument & Fast-Track-to-Innovation

The respective calls for the EIC-SME instrument call (H2020-EIC-SMEInst-2018-2020) and EIC-Fast-Track-to-Innovation (H2020-EIC-FTI-2018-2020) are found under the Horizon 2020 Work Programme Part – ***Towards the next EU Framework Programme for Research and Innovation: European Innovation Council (EIC) Pilot*** (part 17 of this work programme).

Other actions[89]

1. External expertise

This action will support:

- The use of appointed independent experts for the monitoring of running projects.
- The use of individual independent experts to advise on, or support, the design and implementation of EU research policy. The activities carried out by the experts will be essential to the development and monitoring of the Union policy on Research, Technological development and demonstration. They will be paid a special allowance of EUR 450/day for each full working day spent assisting the Commission. This amount is considered to be proportionate to the specific tasks to be assigned to the experts, including the number of meetings to be attended and possible preparatory work.

Type of Action: Expert Contracts

Indicative timetable: All along the two years according to operational needs.

Indicative budget: EUR 6.50 million from the 2018 budget and EUR 6.50 million from the 2019 budget and EUR 6.50 million from the 2020 budget

2. Digital Assembly Events 2018 and 2019

DG CONNECT is organising the Digital Assembly Events 2018 and 2019. DG CONNECT plans to procure via Framework Contracts and call for tenders for indicatively 10 contracts before the end of 2019. The events are expected to take place in the 2rd calendar quarter of 2018 and in the 2nd calendar quarter of 2019. The call for tenders are expected to be launched on the 1st and 2nd calendar quarter of 2018 and 2019.

Type of Action: Public Procurement - null

Indicative timetable: Q2 2018 and Q2 2019

Indicative budget: EUR 1.00 million from the 2018 budget and EUR 1.00 million from the 2019 budget and EUR 1.00 million from the 2020 budget

[89] The budget amounts for the 2018 budget are subject to the availability of the appropriations provided for in the draft budget for 2018 after the adoption of the budget 2018 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.
The budget amounts for the 2019 and 2020 budget are indicative and will be subject to separate financing decisions to cover the amounts to be allocated for 2019 and for 2020.

3. ICT conferences, studies and other activities

In addition to calls for proposals, other actions are also expected to be undertaken on specific activities that the DG CONNECT will support. These include:

- The organisation of two ICT conferences (2018 and 2020) and the organisation of an ICT proposers' day. DG CONNECT plans to conclude service contracts in 2018 and 2019, and also use existing Framework Contracts for this purpose. The events are expected to take place in the 4th calendar quarter of 2018, 4th Calendar quarter of 2020 and in the 3rd calendar quarter of 2019 respectively. Indicative budget in 2018: EUR 4.5 million. Indicative budget in 2019: EUR 3.5 million. DG CONNECT plans to procure via framework contracts and calls for tender for a total of indicatively 25 contracts before the end of 2019 for the three events, depending on the operational needs. The calls for tenders are expected to be launched in the 1st calendar quarter of 2018 and 2019 respectively.

- Studies including socio-economics and impact analysis studies and studies to support the monitoring, evaluation and strategy definition for the ICT priority of LEIT in H2020. DG CONNECT plans to procure via framework contracts and calls for tender indicatively 40 study contracts before the end of 2019. The calls for tenders are expected to be launched in the 2nd and 3rd calendar quarter of 2018 and 2019. Indicative budget in 2018: EUR 4.0 million. Indicative budget in 2019: EUR 4.0 million.

- Policy support activities, including benchmarking activities, evaluation and impact assessments, the development of ad hoc support software, possibly using existing Framework Contracts. DG CONNECT plans to procure via framework contracts and calls for tender indicatively 10 contracts before the end of 2019. The calls for tenders are expected to be launched in the 2nd and 3rd calendar quarter of 2018 and 2019. Indicative budget in 2018: EUR 3.0 million. Indicative budget in 2019: EUR 3.0 million.

- Publications and support to other events (e.g. information, communication, dissemination etc.), either through the use of existing Framework Contracts, or the launch of indicatively 15 calls for tenders during 2018 and 2019. The calls for tenders are expected to be launched in the 2nd and 3rd calendar quarter of 2018 and 2019. Indicative budget in 2018: EUR 1 million. Indicative budget in 2019: EUR 1 million.

Details will be provided in the texts of these calls for tender.

Type of Action: Public Procurement - null

Indicative timetable: As described in detail above

Indicative budget: EUR 12.50 million from the 2018 budget and EUR 13.00 million from the 2019 budget and EUR 13.00 million from the 2020 budget

4. EUROSTAT[90]

EUROSTAT subvention for benchmarking ICT Take up by households and by enterprises.

Eurostat, on the basis of co-delegation, will coordinate the Households and Enterprises surveys that will be conducted by the national statistical institutes and other competent national authorities of the Member States and Associated Countries where appropriate.

Legal entities: To perform these surveys, grants will be awarded to the national statistical institutes [91] and other competent national authorities in accordance with Article 5 of Regulation (EC) No 223/2009 on European Statistics.

Funding rate: up to 90%.

Eligibility conditions for participation: At least one legal entity established in an EU Member State or Horizon 2020 Associated Country in accordance with Article 9(3)(d) of the Regulation (EU) No 1290/2013.

Award criteria: The following aspects of the applications will be assessed on the basis of the following main criteria:

1. Excellence: Relevance of applications in relation to the objectives and priorities of the Eurostat annual work programme;
2. Impact: Furthering the objectives and priorities of the Eurostat annual work programme;
3. Quality and efficiency of the implementation: Quality of the proposal including the efficiency of the proposed approach, the organisation and/or the methods proposed, etc.

Type of Action: Grants to identified beneficiaries in accordance with Article 5 of Regulation (EC) No 223/2009 on European Statistics

Indicative timetable: Q2 2018 and Q2 2019

Indicative budget: EUR 2.00 million from the 2018 budget and EUR 2.00 million from the 2019 budget and EUR 2.00 million from the 2020 budget

[90] This grant will be awarded without call for proposals in line with Article 190(1)(e) of the Rules of applications of Regulation (EU, Euratom) 966/2012, Regulation No 1268/2012 and Article 11(2) of the Rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)", Regulation (EU) No 1290/2013

[91] In line with Regulation (EC) No 808/2004 of the European Parliament and of the Council of 21 April 2004 concerning Community statistics on the information society (OJ L 286, 31.10.2009, p. 31) and Regulation (EC) No 223/2009 of the European Parliament and of the Council of 11 March 2009 on European statistics (OJ L 87, 31.3.2009, p.164).

5. Framework Partnership Agreement in European low-power microprocessor technologies (Phase 1)

Within the Framework Partnership Agreement in European low-power microprocessor technologies awarded in 2017, the selected consortium will be invited to submit a Research and Innovation Action proposal for the design and development of European low-power processors and related technologies for extreme-scale, high-performance big-data and emerging applications, in the automotive sector for example, in accordance with the research roadmap defined in the FPA. The designs should follow a modular approach that would allow a rapid scale-up or scale-down.

The grant will be subject to Article 30.3 of the grant agreement (Commission right to object to transfers or licensing).

In particular, the proposal is expected to cover both of the following topics

a) Low-power Processing System Units demonstrating the synergies between high performance computing at the exascale level and scalability to distributed collaborating systems in emerging computing applications, in the automotive sector for example, providing industry in Europe with a competitive edge in processor technology to be further exploited across a wide range of applications from engineering, science and bio-medical to automotive, manufacturing, finance and emerging big-data and smart objects fields.

Generate the functional and non-functional requirements for low-power Processing System Units (using representative HPC and big-data benchmarks, emerging applications specifications, in the automotive sector for example, and targeting maximum energy-efficiency and reliability); design the architecture of the Processing System Units; verify, tape-out, validate, test and bring up the Processing System Units; develop the required firmware and system software leveraging, as much as possible, on open source efforts and solutions. Sustainability and economic viability of the developed solutions are key aspects.

b) Low-power Processing Units for application acceleration

Generate the functional and non-functional requirements for low-power Processing Units (using relevant representative benchmarks/applications) and design the architecture of the Processing Units to accelerate specific applications such as connected and autonomous driving, cognitive computing, deep learning or other emerging applications. The applications must have high-volume potential. Processing Units may be realised as standalone components, distributed collaborating systems or IP-blocks. Where relevant, open-source hardware approaches may be employed. Work in this topic is required to interface with topic a) in order to achieve maximum interoperability (including IP-block interfacing) and roadmap synchronisation.

Wherever appropriate, the proposal, and in particular in addressing topic a), could seek synergies and co-financing from relevant national / regional research and innovation programmes, including structural funds addressing smart specialisation. Work combining

different sources of financing should include a concrete financial plan detailing the use of these funding sources for the different parts of the activities.

The standard evaluation criteria, thresholds, weighting for award criteria and the maximum rate of co-financing for this type of action are provided in parts D and H of the General Annexes.

Expected impact:

- Demonstrating the synergies of the design for high performance computing at the exascale level and computing demanding emerging applications, in the automotive sector for example.
- Strengthening the competitiveness and leadership of European industry & science, in particular of the European technology supply in low-power microprocessor technologies for HPC, Big-Data and emerging applications based on on-site distributed collaborating systems such as connected and autonomous driving, cognitive computing, deep learning, etc.
- Availability of European processing units with drastically better performance/power ratios compared to current offerings for HPC, Big-Data and other emerging applications, such as connected and autonomous driving, cognitive computing, deep learning, etc.
- Covering important segments of the broader and/or emerging high-end computing markets.

Type of Action: Specific Grant Agreement

Indicative timetable: Q1 2018

Indicative budget: EUR 80.00 million from the 2018 budget

6. Framework Partnership Agreement in European low-power microprocessor technologies (Phase 2)

Within the Framework Partnership Agreement in European low-power microprocessor technologies awarded in 2017, the selected consortium will be invited to submit a Research and Innovation Action proposal for the test and validation of European low-power processors and related technologies for extreme-scale, high-performance big-data and emerging applications, in the automotive sector for example, in accordance with the research roadmap defined in the FPA. The designs should follow a modular approach that would allow a rapid scale-up or scale-down.

The grant will be subject to Article 30.3 of the grant agreement (Commission right to object to transfers or licensing).

In particular, building on results of phase 1, the phase 2 proposal is expected to validate the 1st generation of innovative low-power Processing System Units (using representative HPC and

big-data benchmarks and emerging applications, in the automotive sector for example, and targeting maximum energy-efficiency and reliability); finalize the required firmware and system software leveraging, as much as possible, on open source efforts and solutions; develop the boards and blades; validate the 1st generation Processing System Units in complete rack(s) with the porting of a representative set of real-life HPC and big data kernels and emerging applications incl. on-site distributed collaborating systems, in the automotive sector for example. Sustainability and economic viability of the developed solutions are key aspects.

Wherever appropriate in order to address specific technology needs and/or activities, the consortium may seek additional partners to join the FPA consortium, provided they respect the objectives of the project.

Wherever appropriate, the proposal could seek synergies and co-financing from relevant national / regional research and innovation programmes, including structural funds addressing smart specialisation. Work combining different sources of financing should include a concrete financial plan detailing the use of these funding sources for the different parts of the activities.

The standard evaluation criteria, thresholds, weighting for award criteria and the maximum rate of co-financing for this type of action are provided in parts D and H of the General Annexes.

Expected impact:

- Validating the synergies of the design for high performance computing at the exascale level and computing demanding emerging applications, in the automotive sector for example.
- Strengthening the competitiveness and leadership of European industry & science, in particular of the European technology supply in low-power microprocessor technologies for HPC, Big-Data and other emerging applications.
- Availability of European processing units with drastically better performance/power ratios compared to current offerings for HPC and Big-Data and other emerging applications.
- Covering important segments of the broader and/or emerging HPC and Big-Data markets.

Type of Action: Specific Grant Agreement

Indicative timetable: Q3 2020

Indicative budget: EUR 40.00 million from the 2020 budget

7. Fostering transnational cooperation between National Contact Points (NCP) in the area of ICT: follow-up project[92]

The action will facilitate transnational cooperation between Horizon 2020 NCPs in the area of ICT with a view to identifying and sharing good practices and raising the general standard of support to programme applicants, taking into account the diversity of actors that make up the constituency of the ICT sector. It will involve one consortium of NCPs focussing on transnational cooperation on issues specific to the ICT sector, within the context of Horizon 2020 calls for proposals.

All activities must be tailored according to the nature of this sector.

The proposal should show that the activities put forward will deliver tangible benefits to potential applicants. Activities should capitalise on relevant work of the previous NCP network project in this sector, and of the 'NCP Academy' (*www.ncpacademy.eu*). Various mechanisms may be included, such as benchmarking, joint workshops, enhanced cross-border brokerage events, and specific training linked to the ICT sector.

Where relevant, activities should make use of commonly available tools (e.g. for brokerage and partner search, benchmarking tools, guidebooks, promotional tools etc).

To help close the innovation divide, a substantial component of the proposed activities must be devoted to activities aimed at helping NCPs in those countries that have been participating at low levels in the programme up to now. These activities should help these NCPs rapidly acquire the know-how on NCP operations accumulated in other countries including, for example, training, mentoring, and twinning. They may also include awareness raising actions aimed at increasing visibility of well-qualified potential applicant organisations in the above mentioned countries.

The action is a continuation the project Idealist2018 (Grant Ageement Number 645216) and builds on its current participants and network. Therefore, the legal entities listed below are beneficiaries of the Project Idealist2018 or the host organisations of NCPs from EU Member States and Associated Countries who have been officially appointed by the relevant national authorities, and who have expressed a willingness to participate in this proposal. NCPs opting not to be a beneficiary are nevertheless invited and encouraged to participate in the project activities (e.g. workshops), and costs for such participation (e.g. travel costs paid by the consortium) may be included in the estimated budget and be eligible for funding by the Commission.

In line with Articles 2, 31.6 and 41.4 of the Model Grant agreement, the project arising from this grant will complement other NCP network projects. This means that the beneficiaries and

[92] This grant will be awarded without call for proposals in line with Article 190(1)(e) of the Rules of applications of Regulation (EU, Euratom) 966/2012, Regulation No 1268/2012 and Article 11(2) of the Rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)", Regulation (EU) No 1290/2013.

those of the complementary grants must cooperate and provide access to their results. They must conclude a written collaboration agreement regarding the coordination of the complementary grants and the work of the action.

The duration of the action will be 2 years from 1 January 2019.

Expected impact:

- An improved, more consistent and professionalised NCP service across Europe, thereby helping simplify access to Horizon 2020 calls, and lowering the entry barriers for newcomers,
- An increase in the quality of proposals submitted, including those from countries where success rates are currently lower than average.

Legal entities:

Agjencia e Kerkimit, Teknologjise dhe Inovacionit, Rruga “Papa Gjon Pali i II”, Nr 3, Tiranë, Shqipëri, Albania

INFORMATION SOCIETY TECHNOLOGIES CENTER, P SEVAK 1 , 0014 , YEREVAN, Armenia

OESTERREICHISCHE FORSCHUNGSFOERDERUNGSGESELLSCHAFT MBH , Sensengasse 1, 1090 Vienna, Austria

Univerzitet "Džemal Bijedić" u Mostaru, University Campus, 88104 Mostar, Bosnia and Herzegovina

AGENCE BRUXELLOISE POUR L'ENTREPRISE, Chaussée de Charleroi 110, 1060 Brussels, Belgium

INSTITUTE OF INFORMATION AND COMMUNICATION TECHNOLOGIES, UL. ACAD G BONCHEV BL 2, Sofia 1113, Bulgaria

VEREIN EURESEARCH, Effingerstrasse 19 , 3008 , BERN, Switzerland

RESEARCH PROMOTION FOUNDATION, STROVOLOS AVENUE 123 , 2042 , NICOSIA, Cyprus

TECHNOLOGICKE CENTRUM AKADEMIE VED CESKE REPUBLIKY, Ve Struhach 1076/27 , 160 00 , PRAHA, Czech Republic

Centro para el Desarrollo Tecnológico Industrial, Calle Cid 4, 28001 Madrid, Spain

Business France, BOULEVARD SAINT JACQUES 77 , 75014 , PARIS 14, France

International Center for Advancement of Research, Technology and Innovation, Bakhtrioni Str. Block I , 0194 , Tbilisi, Georgia

ETHNIKO IDRYMA EREVNON, VAS KONSTANTINOU 48 , 11635 , ATHINA, Greece

AGENCY FOR MOBILITY AND EU PRPGRAMMES, FRANKOPANSKA 26 , 10000 , ZAGREB, Croatia

Nemzeti Kutatasi Fejlesztesi es Innovacios Hivatal, "Kethly Anna ter 1 1077 BUDAPEST Hungary"

Israel's National Technological Innovation Authority , Hamered Street 29 , 61500 , TEL AVIV, Israel

Rannsóknamiðstöð Íslands, Borgartún 30, REYKJAVIK, Iceland

AGENZIA PER LA PROMOZIONE DELLA RICERCA EUROPEA, Via Cavour n.71, 00184 – Rome (Italy)

Luxinnovation GIE, 5 avenue des Hauts-Fourneaux L-4362 Esch-sur-Alzette, Luxembourg

VALSTS IZGLITIBAS ATTISTIBAS AGENTURA , Valnu street 1, Riga, LV-1050, Latvia

DAS Solutions S.R.L, 1/7 Studentilor str, Chisinau, MD-2045, Moldova

MASIT ICT CHAMBER OF COMMERCE, Blvd: Partizanski odredi br: 4, 1000 Skopje, Former Yugoslav Republic Of Macedonia

Norges Forskningsråd / The Research Council of Norway, Drammensveien 288 0283 Oslo / Postboks 564, 1327 Lysaker, Norway

INSTYTUT PODSTAWOWYCH PROBLEMOW TECHNIKI POLSKIEJ AKADEMII NAUK, Adolfa Pawinskiego 5B , 02-106 , WARSAW, Poland

Fundação para a Ciência e a Tecnologia, AVENIDA D CARLOS I 126 , 1249-074 , LISBOA, Portugal

INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE IN INFORMATICA , MARESAL AVERESCU AVENUE 8-10 , 011455 , BUCURESTI, Romania

CENTRUM VEDECKO-TECHNICKYCH INFORMACII SR, LAMACSKA CESTA 8 A , 811 04 , BRATISLAVA, Slovakia

Ministry of Higher Education and Scientific Research, Bureau 710, 50, Avenue Mohamed V, 1002 Tunis, Tunisia

Non-governmental organization «Agency of European innovations», 11/3 Petra Pancha str., Lviv, 79020, Ukraine

EFPC (UK) LTD, OAKFIELD HOUSE, 378 BRANDON STREET, ML1 1XA, MOTHERWELL, Scotland, United Kingdom

SINGLEIMAGE LIMITED, BOXWORTH END 26 , CB4 5RA , SWAVESEY CAMBRIDGESHIRE, United Kingdom

Type of Action: Grant to identified beneficiary - Coordination and support actions

Indicative timetable: Q1 2019

Indicative budget: EUR 1.50 million from the 2019 budget

8. "Digital Opportunity" pilot scheme

Specific Challenge: Digital skills are needed to take full advantage of the opportunities emerging from LEIT ICT areas, as the presence of non-technical barriers such as the availability of appropriate skills can act as an obstacle to the effective uptake of technologies. This is the case for instance for Artificial Intelligence, Cybersecurity, HPC and quantum computing, Internet of Things (IoT), cloud computing, big data and data analytics, where Europe experiences a shortage of specialists. Currently, 40% of enterprises in need of ICT specialists (most of them SMEs) find it difficult to recruit them. Any strategy aiming at the diffusion of LEIT ICT technologies can't neglect the importance of having adequate human capital for their use. Education is not adapting at the necessary pace, and the acquisition of digital skills is increasingly taking place on the job. The private sector can therefore contribute effectively by facilitating on-the-job learning through internships.

Scope: To fully exploit the potential of LEIT ICT and to overcome the lack of appropriately skilled workforce in these technologies, the action supports internships for higher education students and recent graduates in companies in ICT producing and using sectors.

Expected Impact:

The activities supported under this Action are meant to increase the offer of deep-tech skills required to perform tasks and jobs in an economy which is being quickly and continuously digitally transformed. The action will be monitored through the following indicator:

- Number of higher education students and graduates performing an internship in digital skills. The target is 5,000 for the period 2018-2020

The action will be implemented by the Erasmus+ National Agencies for higher education. Grants will be financed in the form of lump sums. The use of these types of grants for cross-border internships have been authorised by Commission Decision C(2013)8550[93]. The action will comply with conditions laid in Regulation (EU) No 1290/2013[94]; in particular, applicants

[93] C(2013)8550 of 4 December 2013 authorising the use of lump sums, reimbursement on the basis of unit costs and flat-rate financing under the "Erasmus +" Programme.

[94] Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006

from countries associated to Horizon 2020 Framework Programme will be eligible to receive funding.

Type of Action: Indirect Management

Indicative timetable: Q4 2017 and Q4 2018

Indicative budget: EUR 5.00 million from the 2018 budget and EUR 5.00 million from the 2019 budget

9. Inducement prize: Tactile Displays for the Visually Impaired

The detailed information for this prize were included in the work programme 2016-2017 part 5.i *'Information and Communication Technologies'*, adopted with Commission Decision C(2017)2468 of 24 April 2017 available at the following link:

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

The Contest for this prize was published by the Commission on 23 May 2017 and information is available at the following link:

http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/tactileprize-01-2017.html

The indicative budget for the prize is EUR 3 million from the 2019 budget[95].

Type of Action: Prize

Indicative budget: EUR 3.00 million from the 2019 budget

[95] The budget amounts for the 2019 budget are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2019.

Calls and other actions for 2020[96]

[96] The budget amounts for the 2020 budget are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2020.

Call - Information and Communication Technologies - Continued[97]

H2020-ICT-2018-2020-continued

ICT 2020 Topics

Digitising European Industry

ICT-36-2020 Disruptive photonics technologies

ICT-37-2020 Advancing photonics technologies and application driven photonics components and the innovation ecosystem

ICT-38-2020 Artificial intelligence for manufacturing

ICT-39-2020 Digital advances for local/urban manufacturing

ICT-09-2020 Robotics in Applications Areas

ICT-10-2020 Robotics Core Technology

European Data Infrastructure: HPC, Big Data and Cloud technologies

ICT-12-2020 Big Data technologies and extreme-scale analytics

ICT-15-2020 Cloud Computing

ICT-40-2020 Advanced testbeds for innovative cloud technologies

5G

ICT–20-2020 5G Long Term Evolution

ICT–41-2020 Network innovations with 5G third party services

ICT–42-2020 5G core technologies innovation

ICT-43-2020 EU-Brazil 5G collaboration

Next Generation Internet

ICT-25-2020 Interactive Technologies

ICT-26-2020 Artificial Intelligence: Consolidation of the European AI-on-demand platform through Research and Use-cases

ICT-27-2020 Internet of Things

ICT-44-2020 Next Generation Media

[97] This is the continuation of a call for which information is provided in the first sections of this work programme.

ICT-30-2020 An empowering, inclusive Next Generation Internet

Cross-cutting activities

ICT-45-2020 Reinforcing European presence in international ICT standardisation: Standardisation Observatory and Support Facility

Call- Digitising and transforming European industry and services - continued in 2020

H2020-DT-2018-2020[98]

Topics:

DT-ICT-03-2020 I4MS (phase 4) - uptake of digital game changers and digital manufacturing platforms

DT-ICT-04-2020 Photonics innovation hubs

DT-ICT-05-2020 Big data Innovation hubs

DT-ICT-09-2020 Digital service platforms for rural economies

DT-ICT-12-2020 The smart hospital of the future

[98] This is the continuation of a call for which information is provided in the first sections of this workprogramme

Other actions for 2020

1. External expertise

2. Digital Assembly Event 2020

3. ICT conferences, studies and other activities

4. EUROSTAT

Budget[99]

	Budget line(s)	2018 Budget (EUR million)	2019 Budget (EUR million)	2020 Budget (EUR million)
Calls				
H2020-ICT-2018-2020		514.00	688.00	
	from 09.040201	*514.00*	*688.00*	
H2020-DT-2018-2020		115.00[100]	145.00[101]	166.00
	from 09.040201	*115.00*	*145.00*	*166.00*
H2020-SU-ICT-2018-2020		90.00	15.00	47.00
	from 09.040201	*90.00*	*15.00*	*47.00*
H2020-EUJ-2018		6.00		
	from 09.040201	*6.00*		
H2020-EUK-2018		6.20		
	from 09.040201	*6.20*		
H2020-ICT-2018-2020-continued				625.00
	from			*625.00*

99 The budget figures given in this table are rounded to two decimal places.
The budget amounts for the 2018 budget are subject to the availability of the appropriations provided for in the draft budget for 2018 after the adoption of the budget 2018 by the budgetary authority or, if the budget is not adopted, as provided for in the system of provisional twelfths.
The budget amounts for the 2019 and 2020 budget are indicative and will be subject to separate financing decisions to cover the amounts to be allocated for 2019 and for 2020.

100 To which EUR 15.00 million from the 'Secure, clean and efficient energy' WP part will be added making a total of EUR 130.00 million for this call.

101 To which EUR 15.00 million from the 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' WP part and EUR 15.00 million from the 'Secure, clean and efficient energy' WP part will be added making a total of EUR 175.00 million for this call.

	09.040201			
Contribution from this part to call H2020-NMBP-TR-IND-2018-2020 under Part 5.ii of the work programme			10.00	
	from 09.040201		*10.00*	
Contribution from this part to call H2020-SC1-FA-DTS-2018-2020 under Part 8 of the work programme			25.00	
	from 09.040201		*25.00*	
Contribution from this part to call H2020-EIC-FTI-2018-2020 under Part 17 of the work programme		17.82	17.82	17.82
	from 09.040201	*17.82*	*17.82*	*17.82*
Other actions				
Expert Contracts		6.50	6.50	6.50
	from 09.040201	*6.50*	*6.50*	*6.50*
Public Procurement		13.50	14.00	14.00
	from 09.040201	*13.50*	*14.00*	*14.00*
Grants to identified beneficiaries in accordance with Article 5 of Regulation (EC) No 223/2009 on European Statistics		2.00	2.00	2.00
	from 09.040201	*2.00*	*2.00*	*2.00*
Specific Grant Agreement		80.00		40.00
	from 09.040201	*80.00*		*40.00*
Grant to Identified beneficiary			1.50	
	from 09.040201		*1.50*	
Indirect Management		5.00	5.00	
	from	*5.00*	*5.00*	

	09.040201			
Prize			3.00	
	from 09.040201		*3.00*	
Estimated total budget		856.02	932.82	918.32