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**COUNCIL DECISION ESTABLISHING THE SPECIFIC PROGRAMME  
IMPLEMENTING HORIZON 2020 - THE FRAMEWORK PROGRAMME  
FOR RESEARCH AND INNOVATION (2014-2020)**

**WORK PROGRAMME 2014 – 2015**

5. *Leadership in enabling and industrial technologies*
  - i. *Information and Communication Technologies*

*9 September 2013*

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## ***LEIT –Information and Communication Technologies ICT***

### **Seizing the ICT opportunities**

ICT underpins innovation and competitiveness across a broad range of private and public markets and sectors. ICT also enables scientific progress in all disciplines.

The potential and capabilities of modern ICT systems are still growing exponentially fuelled by the progress in electronics, microsystems, networking, the ability to master increasingly complex cyber-physical systems and robots and progress in data processing and human machine interfaces.

These developments provide major opportunities for Europe to develop the next generation of open platforms on top of which a multiplicity of innovative devices, systems and applications can be implemented.

These new solutions will enable a wealth of new business developments in particular for SMEs and will contribute to boosting competitiveness, creating jobs and supporting growth.

### **Main features**

The first ICT Work Programme under H2020 provides a balanced response to the main challenges faced by Europe in the field: firstly, the need to maintain a strong expertise in key technology value chains; secondly, the necessity to move quicker from research excellence to the market.

It combines a strong support to industrial roadmaps with new mechanisms to encourage disruptive innovation. The former will reinforce medium to long term commitment to industrial strategies and provide continuity and stability. The latter will offer flexibility and openness and will help develop dynamic eco-systems in which innovators can operate. Both strands will require the involvement of new actors, on one hand to exploit and leverage new technologies and on the other to initiate and drive change.

### **Key Enabling technologies (KETs)**

The two ICT KETs (micro- and nanoelectronics and photonics) play an essential role in accelerating technological progress and in creating innovative products with improved or completely new functionalities. They provide indispensable technology bricks that enable a wide range of product applications and contribute to solving societal challenges.

Beyond the support to individual KETs, the cross-fertilisation of different KETs is vital. Cross-cutting KETs actions that bring together different ICT KETs and other KETs for developing innovative products and for contributing to solving societal challenges will be supported in the work programme.

### **Responsible Research and Innovation**

Given the transformative impact of ICT on society at large, this Work Programme pays particular attention to the ethical and societal acceptability of the targeted research and innovation, including citizens' concerns for their right to privacy and to protection of personal data. It calls for a stronger involvement of users and citizens, as well as of social scientists wherever they are needed. It also includes a specific challenge exploring a 'Human-centric Digital Age' to help understand better the way technologies, networks and digital media change the way people behave, think, interact and socialize. In addition, attention is given to the importance of security, through a dedicated set of activities as well as a pervasive consideration for security issues throughout the other research and innovation areas.

## **Information and Communication Technologies Calls**

*H2020 - ICT - 2014*  
*H2020 - ICT - 2015*

### ***A new generation of components and systems***

Electronics, microsystems and embedded systems underpin innovation and value creation across the economy. The objective is to reinforce Europe's stronghold positions in these areas and to capture opportunities arising in new growth markets driven by advances in relevant technologies. This area addresses the broad range of systemic integration from smart integrated components to cyber-physical systems. It covers technology-driven R&D which is mostly application-independent, complemented by more application-driven R&I, where components and systems are demonstrated, instantiated, integrated and validated. Work is complementary to the activities addressed by the Electronic Components and Systems Joint Undertaking (ECSEL), notably focussed on large scale federating projects and integrated demonstrations and pilots. In that context topics under this area contribute also to the implementation of parts of the Strategic Research Agendas of Artemis-IA ([www.artemis-ia.eu](http://www.artemis-ia.eu)) and EPoSS ([www.smart-systems-integration.org](http://www.smart-systems-integration.org)).

Three related topics: Topic 1 will help reinforce and expand Europe's leading industrial position in embedded systems and cyber-physical systems. Topics 2 and 3 are driven by the vision that the heterogeneous integration of micro / nanotechnologies and materials into smart microsystems will deliver affordable high performance functionalities for a broad spectrum of use. Research and innovation in the various topics will also contribute to the implementation of the Strategic Research Agenda of the Public Private Partnership on Energy Efficient Buildings.

### **ICT 1 – 2014: Smart Cyber-Physical Systems**

Specific Challenge: Cyber-Physical Systems (CPS) refer to next generation embedded ICT systems that are interconnected and collaborating including through the Internet of things, and providing citizens and businesses with a wide range of innovative applications and services. These are the ICT systems increasingly embedded in all types of artefacts including our clothes and our own body, and making "smarter" and more comfortable our personal devices, our homes, cars, transport systems, offices, factories and cities, etc.

Often endowed with control, monitoring and data gathering functions, CPS need to comply with essential requirements like safety, security and near-zero power consumption as well as size, usability and adaptability constraints. To maximise impact and return on investment in this field, the following challenges must be addressed:

- De-verticalising technology solutions with CPS platforms that cut across the barriers between application sectors including mass consumer markets.
- Bringing together actors along the value chain from suppliers of components and customised computing systems to system integrators and end users.
- Creating new ICT Platforms for both vertical and core markets from automotive, health and energy to wireless communications and digital consumer products and services.

Scope: Activities should address the development of new paradigms, concepts, and platforms or toolboxes laying the foundation for future generations of CPS. Participants should include

suppliers and users of CPS, tool providers, system integrators, auditors/certification bodies of systems and related academia and research institutes (including SSH).

**a. Research & Innovation** actions should cover one or both of the following themes:

- **Modelling and integration frameworks:** modelling techniques and comprehensive integrated tool chains for clearly defined use cases. Major aspects to be addressed include the holistic modelling of the system behavioural, computational, physical and/or human aspects of CPS; and the seamless interoperability between CPS tools. Solutions should ensure flexibility and tractability of systems.
- **Smart, cooperative and open CPS:** Methods for engineering Cyber-physical Systems that are able to respond in real-time to dynamic and complex situations while preserving control, system safety, reliability and dependability features. This includes CPS that are aware of the physical environment, enabling effective and fast feedback loops between actuation and sensing, possibly with cognitive and learning capabilities; further CPS with cooperation and negotiation capabilities supporting distributed services, autonomous, reactive and targeted problem solving and/or improved man-machine interaction. Also covered are open and heterogeneous CPS and Systems of Systems to facilitate seamless connectivity, dynamic reconfiguration as well as handling of emergent properties. The developed methods should enable evolutionary, adaptive and iterative system life-cycles and guarantee Quality of Service at functional and extra-functional level.

Projects are expected to be driven by industrial requirements, to be well balanced between industry and academia, and to include a demonstration and validation phase with realistic use cases.

**b. Stimulating innovation and connecting innovators across value chains:** in view of broader adoption of novel embedded and cyber-physical systems technologies and their enablers in industrial and societal applications.

- **Towards platforms and ecosystems:** Prepare reference architectures and platforms for open, smart and co-operative CPS applicable across sectors and application domains, including industrial consensus building, reference implementations, pre-normative activities, proof-of concept demonstration and validation in key application domains.
- **Towards a "smart everywhere" society:** Support will go the establishment of European networks of embedded systems design centres. The networks' goal will be to help businesses from any sector uplift the quality and performance of their products and services with innovative embedded ICT components and systems. This will be done through a number of development and experimenting actions conducted with the help of the centres.. Clustered in large scale projects and driven by user requirements, these experiments shall **facilitate users-suppliers partnerships across value chains and regions**. With special emphasis on SMEs and mid-caps, focus is on technologies and processes, which are customised, integrated, tested and validated at the system level. The network must include vertical competences from embedded software and systems down to the components subsystems and components level. To better cope with the speed of innovation part of the actions and partnership are to be defined from the outset, while additional experiments, may be identified through open calls during the action.

**c. Support Activities** for cross-sectorial platform-building structuring of constituencies and road-mapping, roadmapping development of a strategic collaboration agenda for modelling and simulation of CPS with the US, consensus building related to business models and non-technical societal and legal issues relevant to the wider diffusion of

embedded and cyberphysical systems (human behaviour, social aspects, liability, security and privacy,...).

Expected impact:

- Reduction of development time for CPS by 30% as compared to the state of art in 2013 and significant reduction in maintenance costs.
- Stronger pan-European collaboration across value chains and technology levels from the components and hardware to higher systems level stimulating consensus building on open tools, platforms and standards.
- Development in Europe of a competitive offer for next generation core ICT platforms spanning from operating systems and middle ware to application development and deployment tools. This should translate into a significant increase of Europe's market share in this area and in higher added value generated from embedded ICT.
- Uplifting Europe's innovation capacity and competitiveness across all economic sectors with the wider adoption of networked embedded ICT, notably in SMEs.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Coordination and Support Actions

## **ICT 2 – 2014: Smart System Integration**

Specific Challenge: The aims are to develop the next generations<sup>1</sup> of smart systems technologies and solutions, based on systemic miniaturisation and integration, of heterogeneous technologies, functions and materials, and to establish European competitive ecosystems for the design, R&D, prototyping and testing, manufacturing and industrialisation of smaller, smarter (predictive, reactive and cognitive) and energy autonomous Smart Systems. These ecosystems will provide services for cost efficient access to European manufacturing capabilities and expertise, including training, design and pilot line production and testing, in particular for new users of Smart Systems.

This specific challenge contributes to the strategy of micro and nano electronics KET in the area of More than Moore and complements the activities under specific challenge 6.1.

Scope: The focus is on:

**a. Research & Innovation** actions for one or both of the following:

- To advance the state of the art of **heterogeneous integration of micro and nanotechnologies** (nanoelectronics, micro- electro-mechanic, magnetic, photonic, micro-fluidic, acoustic, bio/chemical principles and microwave technologies) into **smart systems**.

Work will be driven by *industrial requirements* and specifically target multi-disciplinary R&D in the following areas:

- Miniaturised systems based on high density 3-dimensional heterogeneous integration.

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<sup>1</sup> According to EPoSS (European Technology Platform for Smart Systems Integration) Strategic Research Agenda

- Autonomous deployable smart systems that include efficient energy management (Zero Power technologies) and energy harvesting from their operating environment,
- Advanced Smart systems with multi-functional properties, based on micro-sensors and micro-actuators, including all types of MEMS/NEMS devices.

Actions may address performance, design and testing, but the focus will be on the integration into systems, including manufacturability and packaging.

- Research and development of **application specific** smart systems. Work will be driven by *users-requirements* and will target concrete solutions. It will exploit the convergence of key enabling technologies, focusing on the synergies between micro-nanoelectronics and biotechnologies.

Work should develop along the full value chain and include validation of results in realistic environments and business cases. Relevant industrial supplier(s) in the addressed application(s) must be included in the consortium. Actions should include tests, end-of life and recyclability issues.

**b. Innovation actions** target access services for academia, research institutes and SMEs to accelerate the deployment of smart systems and enable the access to design and manufacturing capabilities for prototyping, early validation and first production. Assessment for technology suppliers in smart systems will target the evaluation of equipment, processes and building blocks with potential customers.

**c. Pre-commercial procurement action** will focus on in lab on chip based solutions for in-vitro diagnosis.

**d. Coordination and Support Actions**

- Networking and collaboration among and with clusters in smart system integration in order to promote, create awareness and establish roadmaps.
- Surveying and coordinating the consideration of societal issues and users' requirements across the projects.
- Training activities or organisation of conferences in the area of smart systems integration.

Actions should ensure close synergies with national/regional R&D activities when relevant.

Expected impact:

**a. R&I actions**

- Increased integration and combination of new functionalities at micro- and nano scale, with decreased size (x10), decreased costs (x10), increased predictive and cognitive functions and increased autonomy with energy management and scavenging,
- Secured and reinforced European leadership in the microsystem sector, expanding its share in smart systems for medical, telecommunication, consumer, energy and transport applications,
- Seized new opportunities in addressing societal challenges, e.g. in health, well-being, environment and food/beverage quality and safety.

**b. Innovation actions**

- Wider adoption of miniaturised smart systems in innovative and sustainable products meeting industrial and end-users needs in a broad range of applications and sectors

- Overcoming the "valley of death" in bioelectronics by building the full innovation chain, and best practices in validation, regulation and market exploitation.
- c. Increased awareness, access and adoption of innovative solutions by European public procurers in healthcare
- d. More coordinated R&I activities in smart systems integration in Europe; increase awareness, education and training skills.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Pre-Commercial Procurement
- d. Coordination and Support Actions

**ICT 3 – 2014: Advanced Thin, Organic and Large Area Electronics (TOLAE) technologies**

Specific Challenge: TOLAE is an emerging technology and is the basis for advanced products that are thin, light weight, flexible and/or stretchable, suitable for large market sectors such as the textile, automotive, health, paper, plastic, advertising or construction industries.

Today however, most of the existing products are limited in functionality and performance and are suitable only to a few niche markets. Further efforts are needed to address the main technology barriers of TOLAE, in particular the lack of more efficient and stable materials and of more complex TOLAE circuitry and functionalities. The performance of components and the integration level should also be increased, connectivity should be enhanced and the route to manufacturability improved in terms of reproducibility and yield. Overall, the TOLAE value chain needs to be further developed and become more application-driven while paying attention to recyclability issues.

Scope:

**a. R&I Actions**

To advance the state of the art of TOLAE technologies and manufacturing processes and increase the performance, functionality and complexity of TOLAE devices suitable for smart systems. Focus is on conformable/flexible/stretchable substrates and on the development of advanced material, technologies and scalable manufacturing processes for achieving more functionality, better performance, longer lifetimes, higher mobility/conductivity, more uniformity and better encapsulation of TOLAE devices.

Actions may include related work on design tool development, modelling and design styles/rules. They could also include hybrid integration of micro/nano-electronics and organic electronics or specific needs for fibre and textile electronics.

All actions should demonstrate strong industrial and user commitment and be driven by user requirements. They should include standardisation, validation of results for the target applications and address the supply chain, as appropriate.

**b. Innovation Actions<sup>2</sup>**

To develop and demonstrate novel, innovative products enabled by TOLAE technologies in smart packaging, advertisement and sensing by using suitable manufacturing options (sheet-to-sheet and/or roll-to-roll, printed and/or deposited) with the right balance between performance and volume. Each action should build a dedicated innovation value chain (preferably covering the full value chain). Proposals should contain prototype development and demonstration and may include small scale pilot manufacturing.

All actions should be driven by concrete business cases, and by a thorough attention to user needs and target medium- to high-volume markets. They should include business plans for the targeted products with strong commitment to industrialise and manufacture them in Europe<sup>3</sup>.

**c. Technology Take-up and Innovation Support actions**

Access services<sup>4</sup> to industry, enabling the wider adoption and deployment of TOLAE technologies in innovative products, in particular by SMEs and driven by concrete user requirements and business cases. The action should be led by the TOLAE excellence centres and innovation clusters. It could include activities for improving skills development in TOLAE and for promoting TOLAE to young people, entrepreneurs and the general public.

Close synergies should be sought with existing similar actions and regional / national research and innovation strategies for smart specialisation.

**d. Innovation support through pre-commercial public procurement actions**

Technology take-up and deployment of electronic textile solutions for health care applications.

Expected impact:

**a. Research & Innovation Actions**

- Reinforced industrial leadership in advanced TOLAE technologies and products addressing high-impact, high-volume applications
- Demonstrable break-through innovations in TOLAE functionality or performance and/or in TOLAE manufacturability with high reproducibility and yield
- Improved business opportunities and value creation in Europe by reinforced cooperation along the value chain

**b. Innovation Actions**

- Effective market introduction of new and highly competitive TOLAE products targeting high impact markets/applications in smart packaging, advertisement and sensing
- Overcoming the "valley of death", and building advanced manufacturing capabilities and first exploitation opportunities in Europe

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2 Manufacturing of predominantly OLED products is addressed under ICT Challenge 6.

3 Wherever appropriate, they should seek synergies and co-financing from relevant national / regional research and innovation programmes, e.g. structural funds addressing smart specialisation. Actions combining different sources of public financing should include a concrete financial plan detailing the use of these funding sources for the different parts of their activities.

4 Access services provide fast access to knowledge, training, prototyping, testing, manufacturing, design or engineering services for first users and early adopters, in particular SMEs.

**c. Technology Take-up and Innovation and support Actions**

- Reinforced innovation effectiveness of TOLAE excellence centres and innovation clusters in particular towards SMEs
- Large take-up of TOLAE technologies in innovative products by at least 50 SMEs substantially improving their innovation capacity and time-to-market and with demonstrable revenue growth
- Increased awareness and education and training skills in TOLAE

**d. Innovation support through pre-commercial public procurement actions**

- Wide diffusion of cost-effective electronic textile products by pre-commercial procurement at the hospital or the point of care, enabling significant patient's care improvement while boosting productivity and employment.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Research & Innovation Actions (100% funding)
- d. Pre-Commercial Procurement

### ***Advanced Computing***

With the wider diffusion of embedded ICT and cyber-physical systems and the advent of the Internet of things, customised heterogeneous low-power computing systems delivering high-performance functionality under real-time constraints will drive a large part of computing development in the next decade.

Combined with the need for more energy efficient cloud computing systems and data centres, the same key low-power technologies will underpin progress across the whole computing spectrum. The strategic focus is to reinforce and expand Europe's industrial and technology strengths in low-power ICT. Different market segments should be addressed through an integrated cross-layer (hardware, system, programming, algorithms) and cross-application/cross-market approach.

Work under this area is complementary to, and will be coordinated with work undertaken in the *Future Internet* area under Cloud Computing and by the Excellent Science pillar under Research Infrastructures and FET.

While this area focuses on the integration of advanced components on all levels in computing systems, the development of next generation CPUs is addressed under the Joint Technology Initiative on Electronic Components and Systems (ECSEL). This work of topic ICT 4 -2015 is also complementary to the work on cyber-physical systems under *A new generation of components and systems* and under the JTI.

### **ICT 4 – 2015: Customised and low power computing**

Specific Challenge: A key structural change overtaking computing is the move towards a low-power computing continuum spanning embedded systems, mobile devices, desktops, data centres, etc. The demand for low-power multi/many-core computing systems is intensifying across all computing market segments.

Capitalising on Europe's industrial and technology strengths in low power computing and embedded and cyber-physical systems, the objective is to strengthen European competitiveness in the key parts of the emerging computing value chain. With the wider diffusion of embedded ICT and cyber-physical systems, security becomes increasingly important to be addressed across all levels starting from secure and trusted zones supported on hardware and software level.

#### Scope:

**a. R&I actions** should cover one or both the following themes:

- **Next generation servers, micro-server and highly parallel embedded computing systems** based on ultra-low power architectures: The target is highly performing low-power low-cost micro-servers, which can be deployed across the full spectrum of home, embedded, and business applications. Focus is on delivering full prototypes and validating them under real-life workloads from various application areas. Specific emphasis is given on low-power, low-cost, high-density, secure, scalable small form-factor datacentres ("datacentre-in-a-box").
- **New cross-layer programming approaches** empowering developers to effectively master and exploit the full potential of the next generations of computing systems constituting the computing continuum. Beyond performance, optimisation should

include energy efficiency, time-criticality, dependability, data movement, security and cost-effectiveness. Research should also aim at radically increasing the productivity in programming and maintaining codes by marginalising the need for dual expertise - application engineering and computer system engineering. Focus is on holistic approaches hiding the complexity between the computing HW component level and the level of application families.

- b. Stimulating innovation:** Activities aim at stimulating broad adoption of customised low power computing technologies. They should cover one or both the following themes:
- **Towards platforms and ecosystems:** Establish reference architectures and platforms for customised low-power heterogeneous computing systems delivering high-performance functionality under real-time constraints across several sectors and application domains. Activities should include industrial consensus building, pre-normative activities, reference implementations, proof-of concept demonstration and validation in key application domains. The users' perspective will be paid due attention.
  - **Connecting innovators across value chains:** Driven by the requirements of users, application experiments shall bring together all actors along the value chain to customise and use advanced low power computing systems in cyber-physical systems. With special emphasis on SMEs and mid-caps, experiments are expected to be clustered in large scale projects driven by networks of European hubs to achieve critical mass and to better exploit EU-added value. To better cope with the speed of innovation part of the actions and partnership are to be defined from the outset, while additional experiments or users, may be identified through open calls during the action.
- c. Support Activities** for cross-sectorial platform-building, for clustering of related research projects, for structuring the European academic and industrial research communities, and for constituency building and road-mapping for future research and innovation agendas.

Expected impact:

- Reinforce and broaden Europe's strong position in low-power computing in traditional and new market segments by strengthening the technology competences of European suppliers and the academic community.
- Reduction of energy consumption of servers by 2 orders of magnitude as compared to state of the art in 2013.
- Double the productivity in efficiently programming and maintaining advanced computing systems powering cyber-physical systems as compared to state of the art in programming embedded systems in 2013.
- Increase the adoption of form-factor data-centres and heterogeneous highly parallel computing systems.
- Higher involvement of SMEs, both on the supply and the demand-side.
- Increased adoption of concurrency in applications across all sectors; higher degree of parallelism in applications.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Coordination and Support Actions

## ***Future Internet***

Over the last 30 years, the Internet has become a major infrastructure for growth, job creation, and social progress. Internet must continue to foster and support development and to accommodate all the diverse usages for which it was not initially foreseen. The aim is therefore to address the most critical technical and use aspects for the Internet to be apt to support the huge future expectations of society at large.

The Future Internet topics will therefore i) address the limitations of an Internet not designed to support the very large set of requirements imposed by an ever more diversified usage; ii) support the advent of more efficient computational and data management models responding to the challenges posed by increased device / object connectivity and data-intensive applications; iii) leverage the Internet to foster innovative usages of social and economic value.

The area strategy is based on a complementary set of technology push – usage pull actions. The technology perspective primarily addresses the limitations of communication networks and cloud computing infrastructures and services when moving towards a hyper connected world with hundreds of billions of devices fuelled by ambient and pervasive services. The usage perspective is supported by the early availability of testbeds for experiments and research validation (FIRE+) and by innovative social and business collaborative usages with users in control and taking advantage of advanced technologies. This is complemented with actions towards web entrepreneurs to leverage downstream business opportunities.

## **ICT 5 – 2015: Smart Networks and novel Internet Architectures**

Specific Challenge: The more-than-30 years old Internet architecture is fundamentally a "host centric" architecture, with limited "in network" service capability and static routing/addressing. Key functionalities like security, trust or mobility had not been planned in the original design. Additional service capabilities on the Internet have been made possible with overlay architectures or patches presenting inherent weaknesses. The ever larger portfolio of applications/devices that have to be supported, coupled with a rapidly growing number of application and societal requirements, calls for a new approach towards the Internet architecture, which will also get computer architectures and network architectures closer for greater efficiency.

Over the last couple of years, multiple approaches have been researched: Information Centric Networks, Named Data Networking, Publish Subscribe information Networking, user centric networking are a few of them, breaking the link between information and the physical network address where it is located. Recursive architectures have also been proposed, to better address security and trust issues and to reengineer the layered architecture.

The next wave of research in the field of Internet Architecture should solve remaining problems and bring the most promising options closer to deployment.

Scope: The focus of the research covers innovative Internet architectures and networking concepts that can meet the challenges and opportunities of the 21st century, taking into consideration the larger social, economic and legal issues that arise from the interplay

between the Internet and society. The target research is thus expected to address novel approaches to information access and delivery, built-in security, generalised mobility, and seamless integration with computing environments as typical drivers. The proposed approach should go beyond fixing today's recognised limitations (e.g. ICN for content networking). It should also be adapted to future applications such as sensor based applications. A key target will be to prove that the proposed architecture does actually scale and makes possible a low cost migration strategy from existing IP networks. Comparative pilot experiments using virtualised platforms are encouraged.

Expected impact:

- Number of peer-reviewed scientific publications, patents, new PhDs, and new open source software releases. Key scientific publications like ACM Sigcomm will be targeted;
- Contributions to standards: IETF, IRTF may be targeted;
- Creation of a Future Internet architecture network of European researchers and users of sustainable nature, i.e. beyond the availability of public European research funds.
- Links with International developments in the field, notably with the US NSF Future Internet Architecture programme follow up and with similar programmes in Asia, notably Korea and Japan;
- Migration strategies and roadmaps validated by key industrial players (operators/service providers) and the other stakeholders taking an active part in the development of the internet.
- Contribution towards at least one large scale validation trial.

Type of action:

Research & Innovation Actions (100% funding)

**ICT 6 – 2014: Smart optical and wireless network technologies**

Specific Challenge: Network traffic is expected to keep on showing two-digits annual growth rates in all network segments over the coming years and beyond. The limits of existing technological approaches for both optical and wireless technologies are about to be reached. As far as access networks are concerned, the cost of current solutions also represents a barrier to reaching a (quasi-) universal coverage with ultra-high speed, be it with optical or wireless access. New challenges imposed by major trends in the usage of communications networks are to be taken into account as well as the high projected increase of mobile and ubiquitous broadband access which requires further developments in backhaul networks, for which optical and wireless technologies constitute key enablers.

In the specific wireless domain, spectrum is a scarce public resource whose usage is often strategic for the economy and society, which must be optimised in view of the expected exponential traffic and usages growth as outlined in the Commission Communication on "Promoting the shared use of radio spectrum resources in the internal market"<sup>5</sup>. Finally, communication networks represented about 22% of the ICT carbon footprint in 2011. This is expected to grow fast to almost double in 2020 if underlying network technologies are not significantly improved.

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5 COM(2012) 478 final

Scope:

**a. Research & Innovation actions:** proposals are expected to cover one or both the themes identified below, but not necessarily both of them.

**focus on optical networks** - The target is to address i) the lack of dynamic control of optical network resources within and across operator's domains for lower cost and more flexible use of resources; the ubiquitous delivery of very high speed access at 10 Gbps per user within 10 years and 100 Gbps later; iii) the architectural limitations of inter and intra datacenter connectivity; iv) the limitations of current optical transmission technologies. Attention shall be given to ensuring compatibility with legacy infrastructures and access unbundling regulation as well as to cost- and energy-efficiency.

**focus on wireless networks** - The target is to address the lack of dynamic control of wireless network resources, while optimizing spectrum use and energy efficiency and opening new usages. More flexible use of spectrum may be addressed from an architectural perspective including cognitive radio and spectrum aggregation, through usage of higher bands up to, or above, 60 GHz, through advanced modulation and coding. Hybrid combination of terrestrial and satellite infrastructures to address specific wide area requirements applications may be considered.

**b. Innovation actions**

Two inducement prizes<sup>6</sup>,

"**breaking the optical transmission barriers in the core network**" with focus on optical networks,

"**collaborative sharing of spectrum**" with focus on wireless networks.

**c. Support actions**

Production of technological roadmaps, support dissemination (including the yearly domain conference) and standardisation in the wireless/optical domains, support the integration of results coming from the various projects to provide an overall programme view, support liaison with related international activities, support the elaboration of research, operational and economic metrics in the target domains, and explore demonstrations and validation strategies for the objective.

Expected impact:

**Research & Innovation actions**

- Maintain a state of the art industrial capability on optical network technology in Europe with at least 20% of the global market share;
- Diversify the strong European capabilities in wireless systems through emergence of novel technologies and spectrum usage patterns;
- Support the cost efficient emergence of novel classes of network services and applications by avoiding the "capacity crunch";
- Reduce energy consumption of basic infrastructures by a factor of about 10;
- Decrease spectral radiation exposure through low EMF technologies;
- Move beyond 10 Gbps per user within 10 years and 100 Gbps per user in a farther future over fixed accesses;
- Enable managed and automated cross domain optical resources;
- Reach higher spectrum efficiency, target 10 fold increase;

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<sup>6</sup> implementation details for the Inducement prizes are still under preparation

- Enable new applications through spectrum efficient use of higher frequency bands little used today;
- Achieve ubiquitous access to critical/societal applications;
- Ensure availability of new interoperability open standards for wireless and optical communications and associated SEP (standard essential patents). US, Japan and Korea may be considered as priority countries where international cooperation may be achieved on a win-win basis.

#### **Innovation actions - prizes**

- Break known limits in usage of optical (core network) and wireless network technologies;
- Reinforce scientific excellence and recognition of leading European research groups;
- Achieve participation of institutions that are not usually/frequently involved in classical cooperation actions, and general public awareness on the importance of research in telecommunications and the EU support to it;
- Contribute to addressing the lack of ICT engineer skills in Europe by advertising scientific careers to youngsters.

#### **Support actions**

- Wide dissemination of results, constituency building and maintaining a programme view of the area including complementarity with relevant actions supported at Member States and Associated Countries level.

#### Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Prizes
- c. Coordination and Support Actions

### **ICT 7 – 2014: Advanced Cloud Infrastructures and Services**

Specific Challenge: Cloud computing is being transformed by new requirements such as heterogeneity of resources and devices, software-defined data centres and cloud networking, security, and the rising demands for better quality of user experience.

Cloud computing research will be oriented towards new computational and data management models (at both infrastructure and services levels) that respond to the advent of faster and more efficient machines, rising heterogeneity of access modes and devices, demand for low energy solutions, widespread use of big data, federated clouds and secure multi-actor environments including public administrations.

The aim is to develop infrastructures, methods and tools for high performance, adaptive cloud applications and services that go beyond the current capabilities, strengthening the competitive position of the European industry, including SMEs on a time horizon beyond 2018 and building upon European strengths in telecoms and mobile infrastructures as well as software applications and services.

#### Scope:

- a. **Research & Innovation activities:** proposals are expected to cover one or more of the themes identified below, but not necessarily all of them.

- **High performance heterogeneous cloud infrastructures.** The focus is on development, deployment and management of cloud-based infrastructures and services (IaaS, PaaS, SaaS) over large-scale, distributed, heterogeneous, dynamic computing and storage environments
  - **Federated cloud networking:** Techniques for the deployment and management of federated and decentralised cloud infrastructures, in particular cloud networking techniques (within software-defined data centres and across wide-area networks) and mechanisms to enable incorporation of resources and services independent of their location across distributed hybrid public and private computing and storage infrastructures. Approaches, including standards, to increase interoperability between cloud services and infrastructure providers to enable efficient interworking and migration of services, applications and data.
  - **Dynamic configuration, automated provisioning and orchestration of cloud resources:** Tools for automatic and dynamic deployment and configuration of services to enhance availability, flexibility, elasticity and to meet targeted performance constraints; techniques for managing big data taking into account integrity, consistency and maintenance aspects. Tools to facilitate the coherent deployment of distributed applications over heterogeneous infrastructures and platforms from multiple providers. Mechanisms to off-load computation and storage tasks from mobile devices onto the cloud at both design and execution time.
  - **Automated discovery and composition of services:** Innovative ways to facilitate collaboration between public administrations, users and other stakeholders as to produce, discover, mix and re-use different service components and create new public services through pooling and sharing of resources, data, content and tools, even across national borders. The research will build on the "cloud of public services" concept<sup>7</sup> that requires interoperable, reusable modules for public service functionalities. These are likely to be cross-institutional, cross-sector, easily used, re-used and combined dynamically<sup>8</sup> to address specific needs.
  - **Cloud security:** Mechanisms, tools and techniques to increase trust, security and transparency of cloud infrastructures and services, including data integrity and confidentiality, also when using third party cloud resources.
- b. Innovation platforms for trusted cloud systems:** Collaborative development, adaptation and testing of open source software for innovative and trusted cloud-based services. Allow on-line collaboration across different platforms and different technical environments for geographically dispersed teams. Encourage the rapid prototyping and testing of open applications, including early and active involvement of users.
- c. Coordination and support actions:**  
Support to the definition of common reference models for SLAs in the cloud. Support for the adoption of cloud computing infrastructures and services by addressing legal, economic, and societal factors.  
Support to collaboration among research projects in the areas of software, services and cloud computing, including support to common dissemination / exploitation activities and roadmapping.

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<sup>7</sup> Concept launched and tested in the CIP ICT PSP calls

<sup>8</sup> Study on cloud and service-oriented architectures for e-government [http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/smart2010-0074summaryreport\\_0.pdf](http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/smart2010-0074summaryreport_0.pdf)

Expected impact:

- Significantly higher quality of user experience and trust in clouds through stronger security and data protection, including open and auditable solutions for data security.
- Demonstration - of cloud-based services in federated, heterogeneous and multi-layered (IaaS, PaaS, SaaS) cloud environments; of the dynamic provisioning of interoperable applications and services over heterogeneous resources and devices; of high level of performance and quality of service even in highly secure solutions.
- Increased innovation opportunities for service providers, including SMEs and public administrations, evidenced through implementations of advanced cloud infrastructures and services. Promotion of the reuse of open source software solutions in cloud environments, in particular, involving SMEs and public administrations.
- Demonstration through appropriate use cases of the potential to improve the competitive position of the European cloud sector.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Coordination and Support Actions

**ICT 8 – 2015: Boosting public sector productivity and innovation through cloud computing services**

Specific Challenge: Cloud computing has the potential to reduce the IT expenditure of the public sector across Europe, while at the same time improving the scope for flexible high-quality new services. However, the adoption of cloud computing services by the public sector is inhibited by many barriers, such as related to procurement, technical standards and legal terms of reference, risk of lock-in etc. The overall challenge is to overcome these barriers in order to boost the public sector's productivity by stimulating the preparedness for wide adoption of competitive, secure and reliable cloud computing services.

Specifically the challenge is to widen and deepen the commitment from the public sector in Europe towards full readiness for the operational uptake of cloud computing services in a wide sense, while considering the different delivery models (private, public, hybrid, community clouds) and services (IaaS, PaaS, SaaS).

Scope:

**a. Pre-commercial procurement for public sector cloud computing services (PCP)**

Proposals will define common requirements and terms of reference for future procurement of cloud computing services. This may include standardisation, certification, contract terms and service level agreements for secure and interoperable cloud services. They should build on work undertaken as part of the European Cloud Computing Strategy<sup>9</sup> and in particular on the work undertaken by the project C4E<sup>10</sup>. If relevant and justified, activities can develop on cloud computing initiatives at local, national and international

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<sup>9</sup> See COM(2012) 529, in particular Key Action 3, European Cloud Partnership and the pre-commercial cloud procurement activity C4E; although Key Actions 1 and 2 are relevant as well (<https://ec.europa.eu/digital-agenda/en/european-cloud-computing-strategy>)

<sup>10</sup> <http://www.cloudforeurope.eu/>

levels. Dissemination and best practice activities shall be included, with the aim to expand the number of Member States and Associated Countries committed to prepare themselves for efficient and secure cloud uptake adapted to their needs.

**b. Joint public procurement of innovative cloud computing solutions (PPI)**

Proposals will focus on organizing joint procurement of innovative cloud services by public authorities to better and more efficiently run their services, serve their communities, their citizens and local businesses. These should build upon work undertaken as part of the European Cloud Computing Strategy<sup>11</sup>, and, if relevant and justified, on cloud computing initiatives at local, national and international levels. Activities could include the definition of cloud solutions for joint European IT systems and the provisioning of secure private clouds for public administrations.

Expected impact:

- Increased adoption of smart cloud-based solutions for a range of public services, spanning from generic enabling services to specific applications such as culture, businesses, tourism, education, health care, and cross-border intergovernmental systems;
- Improved quality of service from the public sector to the citizen with the guarantee of a high level of security and privacy;
- Improved cost-effectiveness of public sector IT systems through efficient joint procurement of cloud services, e.g., based on the adoption of standardised solutions and mutual recognition of accreditation requirements;
- Proposals shall provide an appropriate benchmarking for the claimed impacts.

Type of action:

- a. Pre-Commercial Procurement
- b. Public Procurement for Innovative solutions

## **ICT 9 – 2014: Tools and Methods for Software Development**

Specific Challenge: The quality levels required for complex and critical systems for example in terms of reliability, resilience and automatic adaptation, still represent a major challenge given current software development methods and tools.

Breakthroughs in this area could significantly improve the growth and competitiveness of the European industry and encourage faster innovation cycles. They could also foster a more competitive EU software industry, especially in the sector of large and interoperable software systems for industrial and public sector applications.

Scope: Proposals are expected to cover one or both the themes identified below.

- **Software tools and methods for large, complex and data-intensive systems:** Tools and methods for incorporating integrity, robustness and reliability into evolving software systems across the complete software lifecycle, especially for complex and secure

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<sup>11</sup> See previous reference

business-critical systems. Innovative means to manage the complexity of large software and data-intensive systems, including simulation and testing.

- **Software architectures and tools for highly distributed applications:** Novel approaches to development, deployment, management and dynamic reconfiguration of distributed applications. Architectures and tools to maximise quality of experience in elastically scalable applications. Particular account should be taken of data location, latency and data throughput in heterogeneous cloud environments including specialised hardware resources like Graphic Processing Units and sensors.

Expected impact:

- A significant and substantiated productivity increase in the development, testing, deployment and maintenance of data-intensive systems and highly distributed applications;
- Availability and market take-up of innovative tools for handling complex software systems. A credible demonstration that larger and more complex problems can effectively be tackled;
- At macro level, evidence of potential for productivity gains through appropriate use cases in EU industry.

Types of action:

Research & Innovation Actions (100% funding)

**ICT 10 – 2014: Collective Awareness Platforms for Sustainability and Social Innovation**

Specific Challenge: The challenge is to harness the collaborative power of ICT networks (networks of people, of knowledge, of sensors) to create collective and individual awareness about the multiple sustainability threats which our society is facing nowadays at social, environmental and political levels. The resulting collective intelligence will lead to better informed decision-making processes and empower citizens to adopt more sustainable individual and collective behaviours and lifestyles.

Digital Social Platforms shall be built with specific attention to the effective and large scale involvement of stakeholders so far excluded from the debate on societal challenges.

Scope:

***a. Innovation actions: Collective awareness pilots for bottom-up participatory innovation paradigms***

Proposals are expected to develop and test pilot solutions to clearly defined sustainability challenges by harnessing 'network effects', leveraging on innovative combinations of social networks, sensor networks and knowledge co-creation networks.

These pilots should be grounded on recent developments in open data, open source, distributed social networking and open hardware. Pilots shall seize the full potential of existing IT tools, integration of networks and online collaboration and can make use of innovative integrated mobile sensing devices to create collective awareness of risks and

opportunities. They can pioneer new mechanisms for social innovation whose expected return goes beyond GDP measures and traditional success indicators<sup>12</sup>.

Pilots should be user-driven, involving existing communities of people, and possibly addressing a combination of sustainability areas. Participants may include not only industry and academia but also local communities, grassroots activists, hackers, social entrepreneurs, students, citizens, creative industries and civil society organisations.

Consortia are expected to be multidisciplinary in nature: participation of at least two entities from domains different than ICT technologies (e.g. social sciences, psychology, economy, art, etc.) is required.

Given their piloting nature, proposals are expected to be rather compact and small, even though projects including technology development and/or integration may require larger investments.

***b. Multidisciplinary research on collective awareness platforms***

Multidisciplinary research and development proposals will provide a better understanding of the obstacles and opportunities which are fundamental to the development of collective awareness platforms.

Areas of research include but are not limited to the motivations and incentives for online collaboration, the impact of extended awareness and peer pressure in driving more sustainable behaviours, defining online reputation mechanisms, and facilitating policy and technological developments addressing identity, anonymity, ethics, privacy preservation, monitoring of network neutrality, non-discriminatory access, collective governance (including Internet governance), new economic and value creation models beyond GDP, quality requirements for user-generated knowledge.

Attention should also be paid on how to manage online communities in smart manners, in order to extract a "wisdom of the crowds" which appropriately takes into account the individual knowledgeability in specific fields.

Consortia are required to include at least two entities from domains different than ICT technologies.

***c. Digital Social Platforms (DSP)***

The aim is to engage stakeholders usually excluded from the innovation process, in order to generate creative answers to specific societal issues where more established practices have so far failed to reach them on a sufficient scale.

The platforms proposed can build on established and open multi-stakeholder communities of practice and collaboration structures, such as European Innovation Partnerships and scale them up to larger, multi-stakeholder communities engaged in collaboration and co-creation of innovative services and solutions addressing specific societal challenges. Work should address demand driven, bottom up innovation activities. These communities shall include all relevant stakeholders including citizens and public administration.

Proposals should address critical factors for successful social innovation and how innovation in general evolves, succeeds or fails providing a critical mass of data and including a critical mass of participants. Findings shall be transferable and scalable to other enlarged communities across borders and across different societal challenges.

***d. Coordinating pilots and research activities in CAPs***

The aim is to support and coordinate experimental and scientific activities in this field, to compare approaches and distil best practices, involving and networking stakeholders from

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<sup>12</sup> Concrete examples of areas and topics can be found at <http://ec.europa.eu/digital-agenda/en/collectiveawareness> ."

a variety of application areas and disciplines, and bridging real world community-driven pilots of digital social platforms with multidisciplinary research (e.g. Internet Science).

Expected impact:

***At innovation level:***

- Demonstration of the effectiveness, compared to existing solutions, of new bottom-up, open and distributed approaches exploiting network effects;
- Pioneering new promising models of participatory innovation based on open software, open data and open hardware.
- Capability to reach a critical mass and to transpose the proposed approach to other application areas related to sustainability;
- Effective involvement of citizens and relevant (and new) actors, as well as establishment of durable interdisciplinary collaborations in concrete application areas related to sustainability. Qualitative and quantitative indicators should be made available.
- Definition of new concepts and models for the development of digital social platforms, as well as its applicability to societal challenges and deeper understanding of social innovation processes.

***At scientific level:***

- Evidence based understanding of the techno-social issues related to key aspects of the networked society; this impact can be amplified by the public availability of (privacy respecting) data collected in field trials organised by the pilots;

***At societal/social innovation level:***

- Demonstrating how collaborative concepts based on the Internet can offer solutions to societal and sustainability challenges, by making use of commons, collective problem solving, knowledge sharing, social exchange and community-wide participation at local and global scale;
- Achieving in the longer term the active citizen participation in decision making, collective governance (including global Internet governance), self-regulation, new business and economic models. Collective awareness research is expected to demonstrate scalability, reusability of results and general applicability of proposed solutions at local or regional level;
- (only for objective c:) Transferability and scalability of the digital social platforms model, as well as of the services developed, to enlarged communities across borders: assessment of potential for replication, recommendations for effective scaling-up of social innovation activities;
- Measurable improvement in cooperation among citizens, researchers, public authorities, private companies, non-profit, non-governmental and any other civil society organisation in the development of new sustainable production and consumption patterns, new lifestyles, and innovative service creation and information delivery.

Types of action:

- a. Innovation Actions (70% funding)
- b. Research & Innovation Actions (100% funding)

- c. Research & Innovation Actions (100% funding)
- d. Coordination and Support Actions

### **ICT 11 – 2014: FIRE+ (Future Internet Research & Experimentation)**

Specific Challenge: Experimentally-driven research and innovation is a key mechanism towards advancement in Internet technology and applications. Europe needs a Strategic Experimental Infrastructure for Future Internet Research & Experimentation (FIRE+) available to experiments of any size, complexity, or networking technology. Experimenters need to run experiments under controlled and replicable conditions, according to specific requirements by accessing real or virtual equipment, systems and tools on demand, seamlessly and regardless of their geographical location. Additionally, a dynamic and promising segment of experimenters, comprising in particular individuals, small and medium-size developers and innovators cannot afford testbeds or even testing equipment of their own and need to be provided easy and affordable access to said capacities. In addition, Future Internet research and experimentation in Europe could benefit from similar initiatives around the world.

Scope:

- a. Research & Innovation Actions:** proposals are expected to cover one or more of the themes identified below, but not necessarily all of them.

Collaborative projects for the creation, reconfiguration and/or extension of experimental infrastructures. Proposals in any of the following areas are encouraged: Mobile and Wireless, Cloud Computing, Spectrum, Photonics, Internet of Things (IoT), Distributed Service Platforms, Sensors; as well as proposals allowing experimenters to manage, analyse and extract value from data acquired from sensors, mobile devices and/or online interactions in social and real networks.

Proposals with an experimentation aspect that will leverage Europe's Research and Education Network infrastructure (GÉANT). Major emphasis will be put on the integration of real-world devices, in order to really deliver to the end-user.

Proposals to develop the concepts of Experimentation-as-a-Service (EaaS) and Virtual Experimentation. In particular, proposals should allow ad hoc, on demand federation and reconfiguration of facilities and platforms, in order to serve the researcher's requirements and provide tools for reporting, benchmarking and monitoring.

Proposals for Research Actions should reserve at least 50% of their funding for the organization of Open Calls for extensions, rewards and / or experiments.

- b. Innovation Actions**

Proposals for a collaborative project that would identify, evaluate and select ideas for experimentation, testing and validation and enable the step towards actual experimentation planning and execution on top of FIRE+. Ideas and experiments would come from the Future Internet constituency at large, as well as from non-Future Internet constituencies.

- c. Coordination and Support Actions:** proposals are expected to cover one or more of the themes identified below, but not necessarily all of them.

- Identification of European, national and regional experimental facilities, testbeds and laboratories available for integration into FIRE+ in a heterogeneous but reconfigurable and evolving arrangement. The resulting experimental infrastructure must be

extensive, span various technologies and allow for integration on demand in response to experimenters' and users' needs.

- Identification, evaluation and roadmap of the future needs for advanced networking experimentation and ancillary services with a large-scale experimental need on top of existing or future facilities under FIRE+.
- Coordination and Support action for **international cooperation**: Proposals for concrete, reciprocal actions in the short and medium term. The primary target is the cooperation between the EU and the US, but the preparation for multilateral experimentation and federation with other initiatives around the world can also be addressed. These actions will organise workshops linked to concrete actions on joint developments; they will invite US testbeds to join Open Calls of FIRE projects either for experiments or for linking facilities, where each side would fund its own part and GEANT would provide the link; they will also promote EU developments towards the US and reciprocate the exchange of researchers using an Erasmus Mundus-like subscription/selection system.

Expected impact:

- Experimental capability at European level that covers a variety of networking technology areas and allows tens of experiments to be run on top of them each year.
- A reliable, diversified infrastructure of approximately ten world-class experimental facilities and platforms, covering different aspects of advanced networking and applications.
- Potential to experiment without the constraints of the physical location or access to a specific experimental facility.
- Economies of scale in terms of infrastructure and its management by promoting the utilization of existing shared experimental facilities and platforms by experiments under other specific challenges.
- Reduction of the time to experiment by allowing a larger set of experiments to take place on reliable and benchmarked infrastructure that can evolve and be re-configured.
- Response to the needs of individual, small and medium experimenters without access to experimental facilities.
- Positive impact on application areas other than Future Internet, for example Societal Challenges and in particular Smart Cities enabled by advanced Future Internet Infrastructure, via large-scale experimentation involving users.
- Concrete cooperation and cross-fertilisation between European and US initiatives in experimentally-driven research as a first step towards a wider collaboration with other countries, for example Japan, Brazil and South Korea.
- Contribution to standardisation and interoperability of experimental facilities.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Coordination and Support Actions

## **ICT 12 – 2015: More experimentation for the Future Internet**

Specific Challenge: The validation of research results in large-scale, real life experimental infrastructures is essential for the design and deployment of products, applications and services on the Future Internet. There is a need for more experimentally-driven research, which can be served well on top of available infrastructures.

### Scope:

**a. Research & Innovation Actions:** proposals are expected to cover one or more of the themes identified below, but not necessarily all of them.

- Proposals for the integration of experimental facilities, testbeds and laboratories into FIRE+. The resulting experimental infrastructure must be extensive, span various technologies and allow for integration on demand in response to experimenters' needs.
- Collaborative projects for experimentally-driven research on top of existing experimental infrastructures including necessary extensions, adaptations or reconfigurations that serve the experiments. Proposals in any of the areas under point a. of topic FIRE+ are encouraged.

Proposals should reserve at least 50% of their funding for the organization of Open Calls for extensions, rewards and / or experiments.

### **b. Innovation Actions**

Proposals for technically mature experiments on top of FIRE+ facilities for close-to-market products, applications or services. Proposed collaborative projects should include at least one SME and be conducted with the support or participation of EIT ICT Labs or a National Agency; they should have a clear innovation perspective and a clear business perspective (e.g. based on new business models, including SMEs and start-ups).

### Expected impact:

- A set of more than ten experimental facilities and platforms developed at European, national or regional level and integrated into a reliable, diversified experimental infrastructure, covering different aspects of advanced networking and applications.
- Further economies of scale in terms of infrastructure and its management by promoting the utilization of existing shared experimental facilities and platforms by experiments this specific challenge.
- Enabling access to FIRE facilities by SMEs; serving new constituencies and new types of innovation-oriented experimentation previously not served within FIRE+.
- Promotion of innovative applications and services, close-to-market, short-term, focused, mature ideas and acceleration of technology take-up and transfer.

### Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)

## **ICT 13 – 2014: Web Entrepreneurship**

Specific Challenge: Europe needs more entrepreneurship, the Internet is a significant socio-economic motor and entrepreneurship on the web offers a significant potential in terms of growth and jobs.

The challenge is to create an environment in Europe that encourages more web entrepreneurs to start a business in Europe and grow internationally. The focus of this topic is on entrepreneurs who use web and mobile technologies as main components in their business model.

### Scope:

#### **a. Accelerate web entrepreneurship in Europe: Online platforms with new services**

Proposals to develop and test online platforms connecting existing local web entrepreneurship ecosystems and hubs, and build upon these in order to provide new services for web entrepreneurs, complemented with other relevant activities.

The new services should help promising web startups to efficiently launch and scale up their operations across Europe, to create exposure to new financing opportunities, to link potential web entrepreneurs with key mentors located anywhere in Europe and to link acceleration programmes from several locations - providing real EU added value.

Characteristics of the proposed action can include as part of their services initiatives such as "geeks in-residence" to help web startups accelerate in their technological developments. They should be open to include any other measures, local, national or European, which aim to support web entrepreneurs in the launch, growth and internationalisation of their businesses.

To highlight the initiatives in a European context, proposals may include prizes e.g. for highly-visible and innovative web and mobile services and applications.

#### **b. Coordination activities in the area of web entrepreneurs**

Support actions that strengthen the environment for web entrepreneurship in Europe and that exploit synergies across existing stakeholder communities. They aim at increasing the impact, accessibility and reach of the online support platforms and the new services they offer as well as link into other relevant initiatives.

Therefore proposals may also include features such as networking all relevant stakeholders groups; encouraging people, notably the young and the women, to become web entrepreneurs; supporting European initiatives on web entrepreneurship; supporting awards to celebrate web entrepreneurship; promoting the use of MOOCs for web entrepreneurship skills

### Expected impact:

- To support the emergence of a dynamic European ecosystem for web entrepreneurs that also contributes to shaping future web entrepreneurship specific policies, in particular for the implementation of Startup Europe EU initiative<sup>13</sup>.
- To provide new innovative services that will help web entrepreneurs in their process of starting up and scaling up their startups.

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<sup>13</sup> <http://ec.europa.eu/digital-agenda/en/startup-europe>

- A European environment, fora and stakeholders, for web entrepreneurs to share experiences, easily replicate successful example, consider failures as valuable experience and where web startups can be confident in getting support.
- To contribute, together with other relevant initiatives of the Commission, to a positive impact across the continuum of actors from web to non-Web entrepreneurs.

Types of action:

- a. Innovation Actions (70% funding)
- b. Coordination and Support Actions

## **ICT 14 – 2014: Advanced 5G Network Infrastructure for the Future Internet**

Specific Challenge: As Internet usages are proliferating communications networks are faced with new shortcomings. Future networks will have to support in 2020 mobile traffic volumes 1000 times larger than today and a spectrum crunch is anticipated. Wireless access rates are today significantly lower than those of fixed access, which prevents the emergence of low cost integrated access continuum with context independent operational characteristics. Communication networks energy consumption is growing rapidly, especially in the radio part of mobile networks. The proliferation of connected devices makes it very difficult to maintain similar performance characteristics over an ever larger portfolio of technologies and requirements (e.g. Ultra High Definition TV vs. M2M, IoT). Heterogeneity of access technologies entails unsustainable cost with increasing difficulties to integrate an ever larger set of resources with reduced opex. Network infrastructure openness is still limited. It prevents the emergence of integrated OTT (cloud)-network integration with predictable end to end performance characteristics, and limits the possibility for networks to become programmable infrastructures for innovation with functionalities exposed to developers' communities.

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

Scope:

- a. **R&I Actions:** proposals are expected to cover one or more of the strands identified below, but not necessarily all of them.

### **Strand Radio network architecture and technologies**

The challenge is to support an anticipated 1000 fold mobile traffic increase over a decade and to efficiently support very different classes of traffic/services. Actions may address the following topics

- Network architecture, protocols and radio technologies capable of at least a ten times increase in frequency reuse, making possible low cost spectrum exploitation including for new frequency ranges above 3,6 GHz. It covers real time and flexible radio resource allocation as a function of traffic/user distribution with possibility to guarantee and differentiate/prioritize quality of service. The work takes into account novel requirements from cloud networking, from a multiplicity/diversity of connected devices and services to be served and content delivery/cell broadcast requirements. Reduction of energy consumption and end-to-end latency are driving requirements.

- Versatile low cost radio access infrastructure equally supporting low rate IoT and very high rate (>> 1Gbit/s) access, also enabling service access capability over radio links similar to those of fixed access and a fixed-mobile seamless access continuum;
- -Flexible and efficient optical or radio backhaul integration with low latency, compatible with access traffic increase and additional signalling increase for multi cell operations;
- Innovative architectures for 5G transceivers and micro-servers, with identification and prototyping of key hardware building blocks supporting low cost implementation of the identified spectrum usage scenarios.
- Experiment based research preparing for large scale demonstrator and test-beds, leveraging where possible experimental facilities available in EU Member States or Associated Countries.

#### **Strand convergence beyond last mile**

The challenge is to support the integration of an access continuum composed of cooperative fixed and heterogeneous wireless resources, with fixed optical access reaching at least the 10 Gb/s range and functionalities allowing unified control. Beyond technological aspects, access sharing issues related competition, shall be considered as part of the requirements. Actions may address:

- Solving the management heterogeneity of different technologies and protocols used to deploy fixed and heterogeneous wireless networks;
- Architectures to i) optimise the reuse of (possibly virtualised) functionality across heterogeneous access technologies and their location (centralised vs. decentralised) in the network; ii) optimise the reuse and sharing of infrastructures across heterogeneous networks.

#### **Strand network management**

The challenge is to radically decrease network management opex through automation whilst increasing user perceived quality of service, of experience and security. Actions may address:

- Novel simplified (low opex) approaches to overall management of the network, addressing both the network level management (e.g. Self-organising networks –SON) and the service level management with metrics enabling to map user perceived quality of services with the state of the underlying network infrastructure and enabling to value traffic data;
- combination of software defined network implementations with autonomic management of resources;
- Network security across multiple virtualised or SDN based domains, with definition of threat models and authentication mechanisms across multiple domains. Intelligence driven security based on data analytics may be considered.

- b. Innovation Actions:** proposals are expected to cover one or more of the strands identified below, but not necessarily all of them.

#### **Strand Network virtualisation and Software Networks.**

Significant work is on-going globally on the way equipment services and network applications can be designed and deployed, with a highly flexible, manufacturer-independent model of controlling reconfigurable resources supporting changing/emerging application requirements. Actions may address large scale validation, testing and standardisation in following domains:

- Virtualisation: i) of network functionalities at infrastructure level, with physical resources reused by concurrent processes, with open interfaces (API) virtual machines; ii) of the implementation of network services running on top of the infrastructure, taking a broad approach to network services (routing, NAT, firewalls..), beyond fully programmable nodes as high-speed, forwarding devices. Migration paths and co-existence with legacy networking devices is to be considered.
  - Orchestration logic (SDN), enabling network programmability, automation of cross domain network configuration, simplification and programmability of devices, moving towards Operating System (OS) like orchestration mechanism of the software components of the network
  - Tighter integration between the application/service layers and the networking layers, with full landscape aware decision capability enabling improved reconfiguration capability and time to reconfigure.
  - Support of open network functionalities for dynamic integration with third party and OTT cloud environments offering guaranteed and negotiable end to end SLA's including security aspects, and enabling exposure of network resources to third party application developers.
- c. Support Actions:** proposals are expected to cover one or more of the themes identified below, but not necessarily all of them.

In order to ensure coherence and maximum impact of the PPP, additional activities are foreseen:

- Overall programme integration through projects cooperation agreement and analysis of the outcomes generated by the various PPP projects (project portfolio analysis);
- Horizontal supervision of the societal perspective of the addressed technologies
- Monitoring of the openness, fairness and transparency of the PPP process, including sector commitments and leveraging factor;
- Analysis of international activities in the relevant 5G domains and identification of international co-operation opportunities, in view of fostering global solutions, standards and interoperability;
- Support to standardisation bodies through early identification of promising technologies;
- Support to spectrum policy: spectrum requirement identification and operational analysis;
- Development and maintenance of a "5G web site" acting as a "one stop" shop for 5G activities under the PPP, including also economic, spectrum and regulatory aspects.
- Roadmaps for key PPP technologies and for experimental requirements and facilities

Expected impact:

**a. R&I actions**

**At macro level**, the target impact is to keep and reinforce a strong EU industrial base in the domain of network technologies, which is seen as strategic industry worldwide. Retaining at least 35% of the global market share in Europe regarding future network equipment would be a strategic goal.

**At societal level**, the impact is to support a wider spectrum of applications and services offered at lower cost, with increased resilience and with higher efficiency of resources usage (e.g. spectrum), and to reduce network energy consumption.

**At operational level**, following impacts are sought:

- 1000 times higher mobile data volume per geographical area
- 10 times to 100 times higher number of connected devices
- 10 times to 100 times higher typical user data rate
- 10 times lower energy consumption for low power Machine type communication
- 5 times reduced End-to-End latency (5ms for 4G-LTE)
- European industry driving the development of 5G standards, at least for the radio part, and to retain control of 5G SEP (standards essential patents), 20% as a minimum. International co-operation with countries having bold R&D initiatives in the field (Korea, Japan, US, China) may be considered on a win-win basis;
- Availability of a scalable management framework enabling deployment of novel applications, including sensor based applications, with reduction of network management opex by at least 20%. availability of security/authentication metrics across multi domain virtualised networks;

**b. Innovation actions**

**At macro level**, the target impact is i) to create an NFV/SDN industrial capability in Europe with European providers able to compete on a US dominated market by 2020; ii) to reach large scale operational deployment of NFV/SDN based networks in Europe by 2020;

**At operational level**, following impacts are expected:

- network function implementation through generic IT servers (target) rather than on non-programmable specific firmware (today)
- Fast deployment of large scale service platforms on top of network infrastructures, from 90 days (today) to 90 minutes (target)
- Interoperability across multiple operational domains, networks and data centres. International co-operation with countries having bold R&I initiatives in the field (Korea, Japan, US,) may be considered on a win-win basis;

**c. Support actions**

The expected impact relates to the PPP management as a strategic European programme including projects cooperation, exploitation of results, dissemination and standardisation, coherent and systematic research approach, support to roadmapping and constituency building.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding level)
- c. Coordination and Support Actions

### ***Content technologies and information management***

The cultural and creative sectors account for 3.3% of GDP and employ 6.7 million people (3 % of total employment) in the EU. Moreover, worldwide Big Data technology and services are expected to grow from EUR 2.4 billion in 2010 to EUR 12.7 billion in 2015. The challenge is to strengthen Europe's position as provider of products and services based on digital content and data. Research and Innovation activities in this challenge will provide professionals and citizens with new tools to model, analyse, and visualise vast amounts of data from which to extract more value, to make an intelligent use of data coming from different sources and to create, access, exploit, and re-use all forms of digital content in any language and with any device.

Topics in this area address in particular four key aspects of digital content and information management:

- Big Data, with two main problems to be solved: improving the ability of European companies to build innovative data products and services and solving fundamental research problems related to the scalability and responsiveness of analytics capabilities;
- machine translation, to overcome barriers to multilingual online communication which is still hampering a wider penetration of cross-border commerce, social communication and exchange of cultural content;
- tools for creative, media, knowledge and learning industries, mobilizing the innovation potential of the tens of SMEs active in the area;
- multimodal and natural computer interaction based upon multimodal verbal and non-verbal communication.

### **ICT 15 – 2014: Big data Innovation and take-up**

Specific Challenge: The activities supported under this topic address the general technological and systemic data challenges that concern entire value chains and/or bridge across borders, languages, industries and sectors. The aim is to improve the ability of European companies to build innovative data products and services, in order to turn large data volumes into data assets. The horizontal activities within LEIT on data, relevant for a wide range of sectors, will be complemented in the H2020 Societal Challenges by data-related activities addressing specific areas.

#### Scope:

- a. Innovation Actions:** proposals are expected to cover one of the themes identified below, but not both.
- Collaborative projects establishing a European open data integration and reuse **incubator** for **SMEs** to foster the development of **open data supply chains**. Proposals are expected to:
    - identify significant opportunities to establish supply chains for products and services, based on open data resources;
    - attract the participation of European companies willing to contribute some of their own data assets as open data for experimentation;

- allocate at least 70% of the EU funding to attract and manage mini-proposals (to be funded for a period between six and twelve months) from SMEs interested in business or technology innovation in particular on open data;
- link to and reuse data from the European Union Open Data Portal<sup>14</sup> or other local, regional or national Open Data portals, as well as to the CEF programme<sup>15</sup>;
- where appropriate, link to and expand the activities of existing national/regional open data incubators.

The selection process and the partners to be involved in the management of the incubator are to be defined from the outset. Partners involved in the small scale projects should be identified through open calls.

- Collaborative projects focused on **innovation and technology transfer in data analytics solutions and services**. The projects should have a cross-sectorial, cross-border and/or cross-lingual scope, and take into account the users' and societal perspectives. The driver in consortia should be a core of companies dedicated to focused activities with a clear business perspective with verifiable milestones and market validation.

#### **b. Coordination and Support Actions**

- To lay the foundation for effective exchange and reuse of data assets across: industry sectors, national boundaries and language barriers, public and private sectors. Proposals are expected to:
  - define the legal/contractual framework that would foster the exchange of data assets and set up pilots of a self-sustaining data market;
  - attract and involve players from all parts of the data value chain and representing different sectors and markets;
  - implement a close clustering mechanism with projects arising from activity c), involving them in experiments, data reuse pilots, business case workshops etc. and taking input from them in designing the legal framework and infrastructure.
- To contribute to capacity-building by designing and coordinating a network of European skills centres for big data analytics technologies and business development. The network is expected to identify knowledge/skills gaps in the European industrial landscape and produce effective learning curricula and documentation to train large numbers of European data analysts and business developers, capable of (co)operating across national borders on the basis of a common vision and methodology.
- To create a Big Data integrator platform with the objective to coordinate and consolidate relevant technology and user communities in any actions supported in Horizon 2020 addressing or making use of Big Data.

#### Expected impact:

- Enhanced access to and value generation on (public and private sector) open data resulting in hundreds of applications reusing tens of billions of open data records used by millions of European citizens
- Viable cross-border, cross-lingual and cross-sector data supply chains involving hundreds of European actors in a robust and growing ecosystem capable of generating sizable revenues for all the actors involved and SMEs in particular

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<sup>14</sup> <http://open-data.europa.eu/>

<sup>15</sup> <https://ec.europa.eu/digital-agenda/en/connecting-europe-facility>

- Tens of business-ready innovative data analytics solutions deployed by European companies in global markets
- Availability of deployable educational material for data scientists and data workers and thousands of European data professionals trained in state-of-the-art data analytics technologies and capable of (co)operating in cross-border, cross-lingual and cross-sector European data supply chains
- Effective networking and consolidation of Big Data user and contributor communities, technology providers and other relevant stakeholders across all challenges and across the three pillars of Horizon 2020

Types of action:

- a. Innovation Actions (70% funding level)
- b. Coordination and Support Actions

**ICT 16 – 2015: Big data - research**

Specific Challenge: The activities supported within LEIT under this topic contribute to the Big Data challenge by addressing the fundamental research problems related to the scalability and responsiveness of analytics capabilities (such as machine learning, language understanding, data mining and visualization). Special focus is on industry-validated, user-defined challenges like predictions and rigorous progress monitoring and measurement.

Scope:

- a. **R&I actions:** proposals are expected to cover one or both of the themes identified below.
  - Collaborative projects to develop novel data structures, algorithms, software architectures, optimisation methodologies and language understanding technologies for carrying out data analytics, prediction and visualization tasks at extremely large scale and with diverse structured and unstructured data. Of specific interest is the real time cross-stream analysis of very large numbers of diverse, and, where appropriate, multilingual, data streams. The availability for testing and validation purposes of extremely large and realistically complex European data sets and/or streams is a strict requirement for participation as is the availability of appropriate populations of experimental subjects for human factors testing in the domain of usability and effectiveness of visualizations. Explicit experimental protocols and analyses of statistical power are required in the description of usability validation experiments for the systems proposed. Proposals are expected, where appropriate, to make best possible use of large volumes of diverse open data from the European Union Open Data portal<sup>16</sup> and/or other European open data sources.
  - Collaborative projects to define relevant benchmarks in domains of industrial relevance, assemble the data resources and infrastructure necessary for administering and validating the benchmarks and organise evaluation campaigns with a commitment to producing public reports on the performance of participants against the defined benchmarks. Since the goal is to create big data analysis and prediction benchmarking environments of sufficient general usefulness to be able to become self-sustaining

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<sup>16</sup> <http://open-data.europa.eu/>

after the end of funding, proposals will have to provide detailed and convincing exit strategies.

- b. Support actions** to define challenges and prize schemes for verifiable performance in tasks requiring extremely large scale prediction and deep analysis. Compact consortia are required to organise and run well-publicised fast turn-around prediction competitions based on European datasets of a significant size. Proposals in this category are expected to be short in duration and are not required to provide sustainability strategies past the end of the project.

Expected impact:

- Ability to track publicly and quantitatively progress in the performance of very large scale data analytics technologies in a European ecosystem consisting of hundreds of companies; the ability to track this progress is crucial for industrial planning and strategy development;
- Advanced real-time and predictive data analytics technologies thoroughly validated by means of rigorous experiments testing their scalability, accuracy and feasibility and ready to be turned over to thousands of innovators and large scale system developers;
- Demonstrated ability of developed technologies to keep abreast of growth in data volumes and variety by validation experiments;
- Demonstration of the technological and value-generation potential of the European Open Data documenting improvements in the market position and job creations of hundreds of European data intensive companies.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Coordination and Support Actions

**ICT 17 – 2014: Cracking the language barrier**

Specific Challenge: This topic aims to facilitate multilingual online communication for the benefit of the digital single market which is still fragmented by language barriers that hamper a wide penetration of cross-border commerce, social communication and exchange of cultural content. Current machine translation solutions typically perform well only for a limited number of target languages, and for a given text type.

The aim of this challenge is to launch interdisciplinary work leading to a new paradigm in overcoming the language barrier and progressively, to reach high quality for all language combinations and translation directions, and cater for the most demanded text types and use contexts. Systems and solutions that are intended to overcome the language barriers, are expected to deal with huge volumes, high variety of languages and text styles, and deliver results in reasonable time (in most cases, instantly). Where the methods require automatic learning from language resources, the availability and suitability of the latter need to be addressed. Special focus is on the 21 EU languages (both as source and target languages) that have "fragmentary" or "weak/no" machine translation support according to the META-net language white papers.<sup>17</sup>

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<sup>17</sup> <http://www.meta-net.eu/whitepapers/e-book/english.pdf>, p. 31

Scope:

- a. **Research & Innovation Actions** to kick off a multidisciplinary research path to develop a new paradigm leading to radically improved quality and coverage (in terms of languages and text types) of machine translation. Special focus is on issues where current methods fall short in quality or fail to adapt to different languages and different needs of translation, or where further improvement with current methods becomes very expensive or requires such amounts of training data that are not available. The projects should use existing and emerging structures (in particular, those developed under action c) below) for testing, validating and evaluating the novel methods against agreed benchmarks.
- b. **Innovative Actions** in view of optimizing translation quality and language/topical coverage in demanding, realistic use situations, for example in pan-European online services. The pilots should optimize, evaluate and test performance improvements with languages that are poorly served by current machine translation systems. The pilots should make use of and contribute to existing and emerging platforms and infrastructures for pooling, building, and adding value to language resources and tools.
- c. **Coordination actions** to promote benchmarking and competitive evaluation of machine translation, as well as the optimal use of language resources from various sources, in view of federating the sources and repositories towards a single access mechanism, respecting appropriate standards of interoperability and metadata.

Expected impact:

- Initiating a programme of ground-breaking actions that will deliver, by 2025, an online EU internal market free of language barriers, delivering automated translation quality, equal to currently best performing language pair/direction, in most relevant use situations and for at least 90% of the EU official languages.
- Significantly improving the quality, coverage and technical maturity of automatic translation for at least half of the 21 EU languages that currently have "weak or no support" or "fragmentary support" of machine translation solutions, according to the META-NET Language White Papers referenced before.
- Attracting a community of hundreds of contributors of language resources and language technology tools (from all EU Member States and Associated Countries) to adopt and support a single platform for sharing, maintaining and making use of language resources and tools; establishing widely agreed benchmarks for machine translation quality and stimulating competition between methods and systems.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding level)
- c. Coordination and Support Actions

**ICT 18 – 2014: Support the growth of ICT innovative Creative Industries SMEs**

Specific Challenge: SMEs represent 85% of all actors in the creative industry sector. They co-exist with global players and often face difficulties in adopting state of the art ICT technologies and accessing finance. Moreover, they operate on fragmented and localised target markets and have to bear high market costs which affect their international

competitiveness. In this context, ICT tools and technological innovation are fundamental for the creative industries and their competitiveness. They widen creative possibilities and improve efficiency in all sectors.

The goal is to increase the competitiveness of the European creative industries by stimulating ICT innovation in SMEs, by effectively building up and expanding a vibrant EU technological ecosystem for the creative industries' needs and by fostering exchanges between the creative industries SMEs and providers of ICT innovative solutions.

Scope: The scope is to stimulate the adoption and deployment of innovative ICT solutions by the creative industries SMEs. This can be achieved through collaboration with ICT providers and by accelerating and supporting the growth of European creative industries.

The topic should be addressed by the following actions:

- a. Innovation Actions** establishing European creative industries SMEs incubators to foster the development of innovative products, tools, applications or services with high commercial potential leveraging on advanced ICT technologies.

Proposals are expected to:

- Foster exchanges between the creative industries SMEs and providers of ICT innovative solutions.
- Allocate at least 80% of the EU funding to the small scale projects, to be funded for a period between six and twelve months.
- Support these small scale projects developing cost-effective and market-ready innovative products, tools, applications or services that should target international markets.

The selection process and the partners to be involved in the management of the incubator are to be defined from the outset. Partners involved in the small scale projects should be identified through open calls.

- b. Coordination and support actions** to stimulate the growth of European creative industries exploiting advanced ICT for the development of new products and services and ICT SMEs innovating in the field of creative industries.

Activities should:

- include investor readiness support;
- connect creative industries SMEs with sources of funding and with international business networks;
- support the scaling up of creative industries SMEs across borders;

The proposals should encompass a broad geographical coverage, stimulating innovation not only in the leading regions of Europe.

Expected impact:

**a. For the Innovation Actions**

- Tens of innovative solutions with high market potential ready to be deployed by European creative industries SMEs.
- Stronger collaboration between ICT innovative technologies providers and creative industries SMEs to improve the competitive position of the European creative industries.

**b. For the Coordination and support actions**

- An established sustainable network of ICT-driven innovation multipliers active in the creative industries sectors with proven record of stimulating innovation.
- Tens of examples of fruitful business relations enabled by the network.

Types of action:

- a. Innovation Actions (70% funding level)
- b. Coordination and Support Actions

**ICT 19 – 2015: Technologies for creative industries, social media and convergence.**

Specific Challenge: The demand for high-quality content and the emergence of new user experiences is growing. At the same time, thanks to ubiquitous technology adoption, widespread use of mobile devices, broadband internet penetration and increasing computing power the consumption of content anywhere, anytime and on any device is becoming a reality. Consequently, developments related to content creation, access, retrieval, interaction and distribution offer a number of opportunities and challenges, also for the creative and media industries. To keep pace with the trends and remain competitive those industries need to explore new ways of producing, using, distributing content and of engaging their users. The opportunity to establish new forms of content and content creation, distribution and use could be transformative to many businesses in creative and media industries.

Scope: The focus is on research, development and exploitation of new emerging technologies (e.g. 3D and augmented reality technologies) for digital content creation, distribution and use to support the creative and media industries. The topic will be addressed by the following actions:

**a. R&I actions:**

Research in new technologies and tools to support creative industries in the creative process from idea conception to production. The tools should explore the potential of technology to enhance the human creative process from the expression of ideas to experiment solutions and where possible support collaboration and user-community interaction. The tools developed should be cost effective, intuitive, and be demonstrated in real environments for the creative industries (such as advertising, architecture, arts, design, fashion, films, music, publishing, video games, TV and radio).

**b. Innovation actions**

Demonstration of the viability of new technologies and validation of innovative solutions through large scale demonstrations, pilots or testing of use cases as to guarantee sustainable deployment that facilitate convergence and integration between broadcasting, broadband Internet-based services, audio-visual and social media. Multimodal and multidisciplinary approaches for searching technologies answering to the new demands from the content side (3D, user-generated, real-time media, social media,...) and from the user context (context-centric, semantic, relevant community feed-back,...).

This also includes new forms of experiencing environments (immersive, surrounding, multisensory and interactive, in any device, always connected).

**c. Coordination and Support Actions on Convergence and Social Media**

- Facilitate research and policy exchange in Convergence and Social Media: increased awareness of latest technological developments and research results among policy stakeholders and increased awareness of current and future policy and regulatory framework among researchers.
- Support R&D programmes/activities, dissemination of results and organisation of scientific and/or policy events in Convergence and Social Media. Analysis and development of research agendas and roadmaps, pre-standardisation initiatives and stakeholder coordination in Convergence and Social Media

Expected impact:

**R&I actions**

- Validated novel ICT technologies and tools supporting the creation process, delivering measurable benefits for the creative industries as regards time and resource investment, and quality of output.

**Innovation and support actions**

- Development of new services as a consequence of the convergence of broadband, broadcast and social media.
- Further development of user experience in immersive environments and social media, especially in any device and mobile environments.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Innovation Actions (70% funding level)
- c. Coordination and Support Actions

**ICT 20 – 2015: Technologies for better human learning and teaching**

Specific Challenge: The development and integration of robust and fit-for-purpose digital technologies for learning are crucial to boost the market for and innovation in educational technologies. This requires an industry-led approach to defining the frameworks and interoperability requirements for the building blocks of a digital ecosystem for learning that develops and integrates tools and systems that apply adaptive learning, augmented cognition technologies, affective learning, game-based learning and virtual environments/virtual worlds to real-life learning situations. The digital learning ecosystem needs to make use of educational cloud solutions, mobile technology, learning analytics and big data, and facilitate the use, re-use and creation of learning material and new ways to educate and learn online.

Scope: Activities will focus on innovative technologies for learning, on the underpinning interoperability standards and on the integration of different components into smart learning environments. They should combine different technologies (e.g. mobile, augmented reality) and support composing, re-using and distributing interactive educational content and services, with assessment and feedback functionalities. Based on technological advances enabled by research carried out so far, activities will support networking, capacity building and experimentations in methodologies and tools for data-driven, non-linear approaches to adaptive learning and remediation technologies and cognitive artefacts (including toys) for

effective and efficient human learning. Gender differences in learning behaviour should be considered.

**a. R&I actions**

- Research experimentations on smart learning environments providing students with adaptive and personalised learning and assessment. Activities should facilitate networking and capacity building. Research must be inherently multidisciplinary, building on advances on neuroscience, educational psychology as well as artificial intelligence. Application scenarios include formal and informal education, including workplace learning. To suit technological evolution and identified scenarios proposers may consider the use of open calls for partners to build the consortium throughout the lifetime of the project.
- Establishing a technology platform to provide a framework and roadmap for stakeholders, led by industry, to develop innovative technologies for learning (adaptive solutions, learning analytics, augmented reality, mobile learning, etc.), address standards for interactive content (covering its composition, re-use and distribution) and its adaptations into learning scenarios.

**b. Innovation actions**

Support to large scale pilots (in real settings) that develop and integrate innovative digital educational tools, solutions and services for learning and teaching. They should aim at reducing the current restrictions of time and physical space in learning and teaching. They should foster greater connection between formal, non-formal and informal learning and remove obstacles for ubiquitous learning. The pilots should link all relevant stakeholders in educational technology. As part of piloting scenarios, a specific target group to address are children and adults with mental or physical disabilities who undergo general education, lifelong learning or vocational training. Activities for the latter could include work on skills recognition (badges) through smart and business intelligence applications.

**c. Coordination actions**

Coordinate the development of joint specifications and procuring innovative devices and software for digital learning and teaching.

Expected impact:

- Reinforce European leadership in adaptive learning technologies for the personalisation of learning experiences. This shall be measured by the number of excellence centres collaborating through specific joint research experimentations and technology transfers programmes.
- Enable faster ways of testing fundamental business hypothesis (including continuous development and testing with users) and increased skills capacity. Facilitate the emergence of new innovative businesses
- Facilitate the emergence of innovative businesses and create a digital learning ecosystem in Europe
- Speed up the rate of adoption on technologies for the modernization of education and training
- Enhance the development of digital learning and teaching resources, including for children and adults with mental or physical disabilities
- Increase the number of public-private partnerships addressing technological challenges for modernizing and improving education and training.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Research & Innovation Actions (100% funding)
- c. Innovation Actions (70% funding level)
- d. Public Procurement for Innovative solutions

**ICT 21 – 2014: Advanced digital gaming/gamification technologies**

Specific Challenge: Digital games and gamification mechanics applied in non-leisure contexts is an important but scattered industry that can bring high pay-offs and lead to the emergence of a prospering market. Digital games can also make a real change in the life of a large number of targeted excluded groups, enhancing their better integration in society. This requires however the development of new methodologies and tools to produce, apply and use digital games and gamification techniques in non-leisure contexts, as well as building scientific evidence on their benefits - for governments, enterprises and individuals.

Scope:

- a. Research & Innovation actions:** Multidisciplinary research experimentations and collaboration on advanced digital gaming technologies and components (including game engines, virtual characters, textures, models for simulations, game design, learner profiles, emotional models, etc.) produced by and for the traditional digital game industry but applied into a wider scenario of use in non-leisure contexts. Activities shall lead to the creation of a repository of core reusable, open components to enable publishers and game producers as well as user organisations and individual programmers to build specific games applications in non-leisure contexts. Application scenarios include learning and skills acquisition in formal and informal education, including workplace learning. To suit technological evolution and identified scenarios, proposers may consider the use of open calls for partners to build the consortium throughout the lifetime of the project.
- b. Innovation actions:** Stimulate technology transfer and new non-leisure applications by SMEs traditionally working on digital games through coordinating and incubating small scale experiments, thus underpinning new market developments on digital games for learning and skills acquisition, and for empowerment and social inclusion. The activities should also allow the accumulation of scientific evidence of the effectiveness of such approaches for specific target groups or problems.

Expected impact:

- Increase the number of collaborations between traditional digital game industry players and a broader research community (neurosciences, educational physiology, pedagogy, etc.), intermediaries (teachers, trainers) and users, in order to produce effective serious games.
- Increase the effectiveness of digital games for professionals and researchers, intermediaries and social actors dealing with people with disabilities.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)

## **ICT 22 – 2014: Multimodal and Natural computer interaction**

Specific Challenge: As devices and systems are becoming increasingly powerful, the interface between human and computer is often lagging behind and constitutes a bottleneck for seamless and efficient use. Leveraging on multidisciplinary expertise combining knowledge from both the technological and human sciences, new technologies need to offer interactions which are closer to the communication patterns of human beings and allow a simple, intuitive and hence more "natural" communication with the system.

Scope: The topic will be addressed by the following focused actions:

- a. Research & Innovation Actions:** Provide interactive information retrieval systems with more efficient and natural ways of delivering answers to users' queries especially in unexpected and/or difficult circumstances. This will be supported by research on knowledge-based autonomous human-like social agents that can handle and learn from conversational spoken and multimodal interaction as well as react proactively to new communicative situations. Systems should cope with spontaneous spoken dialogue, in multiple languages, and exhibit adequate communicative, conversational, affective and social capabilities in relation to the domain/task under consideration and the needs and abilities of the user. Technologies should be designed to match multiple delivery platforms and be demonstrated in real environments, while research is expected to be based on and/or produce freely available and re-usable resources.
- b. Research & Innovation Actions:** Develop novel multi-modal, adaptive interfaces, including Brain Computer Interfaces, assisting people with disabilities. Research should explore: how users interact and cooperate with (intelligent) systems, including user modelling aspects for the identification of necessary abilities for different functions and environments; how to detect behaviours, emotions and intentions of the user; how to sense and understand the environment and other context factors. Activities may cover also interoperability standards (for software and devices) as well as interaction and cooperation between machine intelligence in environments and human intelligence.
- c. Innovation Actions:** Develop and validate innovative multimodal interfaces to provide more efficient and natural ways of interacting with computers and improve users' experience. Leveraging on one or multiple smart devices and sensors with capabilities such as scene analysis, voice recognition, human position, gestures and body language detection capabilities, such systems must provide non-intrusive interaction with human where real and virtual content are blended. Built with a user centric approach, solutions should be cost effective; address clear market needs and be validated in the creative industry fields.

Expected impact:

- a. Research & Innovation Actions**
  - Improve multilingual speech processing and bridging the gap between recognition and synthesis, exploiting metadata and other contextual data.
  - Increase the automatic inferences capacities on rich context thanks to improved language understanding, sensed environments/objects, use of social media and agent's experience.

**b. Research & Innovation Actions**

- Advance the capacity of human-machine interaction technologies to enable disabled and elderly people to fully participate in society

**c. Innovation Actions**

- Enable better uses of ICT technologies to the creative industries by providing directly usable solutions addressing their specific needs
- Provide a clear spill over of the knowledge acquired to a maximum of European industries.
- Improve the competitive position of the European industries through the provision of cost effective, innovative and high-value products and services.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Research and Innovation Actions (100% funding)
- c. Innovation Actions (70% funding)

## ***Robotics***

The importance of robotics lies in its wide-ranging impact on Europe's capacity to maintain and grow a competitive manufacturing sector with millions of related jobs. But at least equally important, robotics also offers new solutions to societal challenges from ageing to health, security, energy and environment.

Smart automation and robotics are simply vital for maintaining manufacturing and associated services in higher-wage regions of the world. Today, large and core business sectors including automotive, aerospace, agro-food or microelectronics, representing more than 20 % of our GDP would quite simply disappear from Europe without intensive use of advanced robotics. By freeing workers from hard, repetitive jobs, robots help us meet the expectations of an increasingly skilled labour force and offer jobs in line with the aspirations for higher quality work conditions.

The potential of robotics expands far beyond the factory though. Service robots for professional or domestic use represent an emerging market with strong growth perspectives as robots become mainstream appliances and systems in many walks of life (work, home appliances, security, leisure, assistive technologies for physically disabled, medical equipment, etc). Robots are increasingly endowed with learning and adaptive capabilities that will have a broad impact on all future ICT systems in a wide range of products and services.

The potential economic and societal impact brought by robotics technology is therefore immense. Building on its strengths in industrial and professional service robotics and on the academic knowhow, Europe can play a leading role in future development of the sector.

To conquer new markets and enable large scale deployment of robots, it is essential to advance the current robot capabilities in terms of robustness, flexibility and autonomy to make them achieving useful tasks in an efficient manner while operating in real-world environments.

### **ICT 23 – 2014: Robotics**

Specific Challenge: Roadmap-based research will be essential to attain a world-leading position in the robotics market. Driven by the applications needs identified in the Roadmap established by the euRobotics AISBL (the private partner in the future Public-Private partnership in Robotics<sup>18</sup>), challenging R&D problems will have to be addressed, to make substantial progress in robots capabilities and improve the "Technology Readiness Levels" of robotics R&D. In addition, a dedicated effort is necessary to close the innovation gap, allow large scale deployment of robots and foster market take-up. Robotics is very broad, both in terms of technologies and disciplines it involves, but also in terms of markets and stakeholders. It is therefore essential to address the inherent fragmentation.

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<sup>18</sup> This roadmap is publicly available on the euRobotics AISBL website; its content results from continuous consultation of the whole European robotics community. The prioritisation of the topics follows a formal procedure established by the euRobotics AISBL, whose membership is open to all European stakeholders in Robotics – <http://www.eurobotics-project.eu/robotics-ppp/>.

The roadmap will be updated taking into account the evolution of the market, end-user needs and technology which might result in changed priorities between the Year 1 and Year 2 calls.

Scope: The aim is to develop a new generation of industrial and service robots and underpinning technologies, in particular enabling robotic systems to operate in dynamic real-world environments, reaching measurable improvements of abilities such as autonomy and adaptability and interacting in safe ways with humans.

Collaborative projects will cover multi-disciplinary R&D and innovation activities like technology transfer via use-cases and industry-academia cross fertilisation mechanisms. Pre-Commercial Procurement (PCP) will further enable prototype development and stimulate deployment of industrial and service robotics.

Projects are strongly encouraged to optimise synergies (e.g: use of shared resources for PCP of R&D&I projects or use cases, collaboration with on-going initiatives). Priority is given to projects driven by industrial or future market needs.

**a. Research & Innovation Actions**

- RTD to advance key technologies relevant for industrial and service robotics
  - The primary goal is to significantly improve the level of industrial and service robotics abilities in each of the following areas: configurability, adaptability, interaction capability, dependability, motion capability, manipulation, perception, decisional autonomy, cognitive ability.
  - To reach this ambitious goal, key robotics technologies need to be advanced following the prioritisation from the Roadmap.
  - In addition, it will be essential for the deployment of robots to develop and establish commonly adopted systems development techniques and technologies (system design, engineering, architecture, integration).
- Shared resources and assessment
  - One goal will be to define common hardware and software platforms (e.g.: real world test-beds, software libraries and simulators) taking advantage of existing initiatives and facilities. This will require mechanisms for sharing as well as the definition of standards, high quality validation, maintenance and documentation.
  - Furthermore, activities will be supported by a benchmarking initiative to provide means for technology assessment and transfer, performance evaluation as well as of paving the way to certification of new robotics systems.

**b. Innovation Actions: Technology transfer - Robotics use cases**

Using leading edge science and technology, including results from EU-funded projects, a targeted effort will aim at introducing, testing and validating promising and innovative robotics solutions. The focus will be on the robust operational deployment of these robotic solutions, based on performance objectives, metrics, and user needs. The strong involvement of stakeholders such as robotics industry, system integrators and end-users is essential.

**c. Pre-commercial procurement in robotics**

In addition, demand-driven innovation actions will be pursued in areas of public interest, including pre-commercial procurement of innovative robotics solutions for the healthcare sector.

Expected impact:

- Increase Europe's market share in industrial robotics to one third of the market and maintain and strengthen Europe's market share of 50% in professional service robotics by 2020;

- Increase Europe's market share in domestic service robots to at least 20% by 2020 including with new companies and start-ups in the field;
- Improve the competitiveness of Europe's manufacturing sector, in particular SMEs, address pressing technological challenges and the effect of an aging workforce;
- Increase Industry-Academia cross-fertilisation and tighter connection between industrial needs and academic research via technology transfer, common projects, scientific progress on industry-driven challenges;
- Deploy robotics technologies in new application domains;
- Improve "Technology Readiness Levels" of robotics technologies
- Improve performance evaluation and certification of new robotic systems;
- Create and maintain world class research in Europe and achieve excellent standards of publications and research outputs;
- Ensure sufficient numbers of well-trained professionals required by the growth of the industry;
- Ensure wide use of shared resources.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Pre-Commercial Procurement, funding level 70%

**ICT 24 – 2015: Robotics**

Specific Challenge: Continuous and consistent support to roadmap-based research will be essential to attain a world-leading position in the robotics market. The focus will follow the evolution of the priorities established by the Roadmap<sup>19</sup>, also building on the results of previous calls.

Collaborative projects will cover multi-disciplinary R&D and innovation activities like technology transfer via use-cases and industry-academia cross fertilisation mechanisms. PCP will further enable prototype development and stimulate deployment of industrial and service robotics.

Scope:

**a. R&I Actions to advance key technologies relevant for industrial and service robotics**

The primary goal is to significantly improve the level of industrial and service robotics abilities in each of the following areas, specifically where they are identified as deployment barriers: configurability, adaptability, interaction capability, dependability, motion capability, manipulation, perception, decisional autonomy, cognitive ability.

To reach this ambitious goal, key robotics technologies need to be advanced following the prioritisation from the Roadmap. One of the relevant sub-activities highlighted in the

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<sup>19</sup> This roadmap is publicly available on the euRobotics AISBL website; its content results from continuous consultation of the whole European robotics community. The prioritisation of the topics follows a formal procedure established by the euRobotics AISBL, whose membership is open to all European stakeholders in Robotics – <http://www.eurobotics-project.eu/robotics-ppp/>.

The roadmap will be updated taking into account the evolution of the market, end-user needs and technology which might result in changed priorities between the Year 1 and Year 2 calls.

roadmap covers enabling robotics technologies for disabled people, in particular for people with upper, lower limb disabilities and/or amputees allowing them to gain functionalities with exoskeletons or prostheses.

In addition, it will be essential for the deployment of robots to develop and establish commonly adopted systems development techniques and technologies (system design, engineering, architecture, integration).

**b. Innovation Actions: Technology transfer - Industry-academia cross-fertilisation**

Gearing up and accelerating cross-fertilisation between academic and industrial robotics research to strengthen synergies between their respective research agendas through joint industrially-relevant scenarios, shared research infrastructures and joint small- to medium-scale experimentation with industrial platforms.

**c. Innovation Actions: Technology transfer - Robotics use cases**

Using leading edge science and technology, a targeted effort will aim at introducing, testing and validating promising and innovative robotics solutions in industrial and service sectors. The focus will be on the robust operational deployment of these robotic solutions, based on performance objectives, metrics, and user needs. The strong involvement of all relevant stakeholders in the value chain is essential.

**d. Pre-commercial procurement in robotics**

Demand-driven innovation actions will be pursued in areas of public interest, including pre-commercial procurement of innovative robotics solutions for public safety and environmental monitoring.

**e. Coordination Actions: Community building and Robotic competitions**

- Supporting the European robotics community with respect to networking, roadmapping, education, outreach, technology watch, standardisation, and industry-academia collaboration as well as building links to national programmes and initiatives. Also, ethical, legal, societal and economical aspects of robotics will be addressed to ensure wider take up of the technology by citizens and businesses.
- Support International cooperation, where the impact of the action is demonstrated and matching resources are provided from cooperating parties.
- Coordinating work on the next generation of cognitive systems and robotics to reinforce the links between the different research disciplines and with the roadmap-based research, ensuring transfer of knowledge and community building.
- Coordination and support actions for organising robotic competitions will be called for to speed up progress towards smarter robots.

Expected impact:

- Increase Europe's market share in industrial robotics to one third of the market and maintain and strengthen Europe's market share of 50% in professional service robotics by 2020;
- Increase Europe's market share in domestic service robots to at least 20% by 2020;
- Improve the competitiveness of Europe's manufacturing sector, in particular SMEs, address pressing technological challenges and the effect of an aging workforce;
- Improve "Technology Readiness Levels" of robotics technologies
- Increase Industry-Academia cross-fertilisation and tighter connection between industrial needs and academic research via technology transfer, common projects, scientific progress on industry-driven challenges;

- Deploy robotics technologies in new application domains;
- Contribute to an inclusive society through robotic technologies (e.g. exoskeleton, advanced prosthesis);
- Address ethical, legal and societal issues and engage the wider public;
- Create and maintain world class research in Europe and achieve excellent standards of publications and research outputs;
- Ensure sufficient numbers of well-trained professionals required by the growth of the industry;
- Ensure wide use of shared resources;
- Contribute to the community building of the European robotics community.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Innovation Actions (70% funding)
- d. Pre-Commercial Procurement
- e. Coordination and Support Actions

### ***Micro- and nano-electronic technologies, Photonics***

Topics in this area address research and innovation in the two ICT Key Enabling Technologies (KETs), *micro- and nanoelectronics and photonics*. The objective is to take advantage of Europe's S&T excellence in these two ICT KETs to strengthen the competitiveness and market leadership of the related industries and develop innovative solutions to societal challenges. The challenge also includes activities enabling the cross-fertilisation of the ICT KETs. The challenge is structured as follows:

The micro- and nanoelectronics part will be implemented by the Joint Technology Initiative (JTI) on 'Electronic Components and Systems'<sup>20</sup> and through this Work Programme.

- Implementation through the JTI on 'Electronic Components and Systems': The JTI will facilitate multi-disciplinary industry-driven research and innovation along the full innovation and value chain, covering Technology Readiness Levels (TRLs) 2 to 8. Focus is on large federating projects including manufacturing pilot lines, technology platforms and application experiments. These are areas in which resources must be pulled from Member States and regions. The Annual Work Programme will be developed within the JTI. It will be based on the multi-annual Strategic Research Agenda elaborated by industry.
- Implementation through this Work Programme: Generic Technology Development on micro- and nanoelectronics focused on advanced research and lower TRLs. Activities should be of direct industrial relevance and have a medium time to market.

The photonics topics cover research and innovation activities under the photonics public private partnership (PPP). The activities will address the whole research and innovation value chain – from materials through equipment and devices, to manufacturing and to products and services, and from advanced RTD to pilot lines.

### **ICT 25 – 2015: Generic micro- and nano-electronic technologies**

Specific Challenge: The objective is to keep Europe's position at the forefront of advanced micro- and nano-electronic technologies developments. This is essential to maintain Europe's global position in the area and to ensure strategic electronic design and manufacturing capability in Europe avoiding dependencies from other regions. Advanced micro- and nano-electronics technologies enable innovative solutions to societal challenges.

Scope: The focus will be on the grand technological challenges in information processing and communications based on memory and logic devices, circuits and architectures for advanced CMOS technologies. It will also be on the exploration of new alternative information processing devices and microarchitectures for existing or new functions. The objective is to sustain the historical integrated circuit scaling cadence and reduction of cost/function into future decades.

#### **a. Research & Innovation Actions**

- Extending MOSFET to the end of the ITRS roadmap and making "Beyond and Extended CMOS" devices compatible with CMOS (integration, systemability and

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<sup>20</sup> The scope of the JTI covers micro- and nanoelectronics, embedded and smart systems

manufacturability). Focus will be on high mobility substrates for performance improvement, new switch architectures for reduced energy dissipation, 3D approaches, new information carriers, emerging memory devices and on interconnecting nanoscale objects and novel interconnect architectures. The projects may include activities related to modelling and simulation: e.g. quantum and atomic scale effects. Exploratory research on Graphene devices will be handled under the Graphene Flagship and therefore not included under this objective.

- Integration of functionalities in a system-on-chip (SoC) or system-in-package (SiP) by using nanostructures and/or nanodevices.
- New computing paradigms like quantum computing and neuromorphic computing with a focus on their future integration with Si technologies.
- Design for advanced nanoelectronics technologies. Focus will be on design-technology solutions for energy efficiency, high reliability and robustness.

**b. Innovation Actions** targeted to provide access for academia, research institutes and SMEs to advanced design tools and IC fabrication, including access to technology platforms for piloting small series of advanced products. Actions should include training. Assessment for technology suppliers in nano-electronics to evaluate novel equipment, processes and building blocks with potential customers, including tools and methods for metrology and characterisation. This last area is open to international cooperation.

**c. Coordination and support actions**

- International cooperation with USA and Asia in the areas of standardisation including in manufacturing (450 mm wafers); improved assessment of the potential impact on workers of the manipulation of nano-materials in the semiconductor fabrication process.
- Development of common roadmaps; early technology benchmark/identification on promising novel technologies.
- Awareness actions targeted at young students.

Expected impact:

- Regain market shares of the European electronic sector and reverse the declining EU market share in electronic components. Maintain the European manufacturing base and prepare the industry for future developments of the electronic landscape
- At the economic level, secure the availability of essential parts in the value chain in Europe to design and manufacture innovative electronic components and systems.
- At technological level, sustain the historical integrated circuit scaling cadence and reduction of cost/function and strengthen the interaction between design and technology development; continue to increase the number of devices per mm<sup>2</sup>, with minimum features approaching 10 nanometers or per mm<sup>3</sup> by developing 3D approaches, to maintain the industry pace of a doubling of transistor density every 18 months.
- At innovation level, facilitate the easy access to design tools and advanced IC manufacturing for academia, research institutes and SMEs, and for European equipment industry to validate their innovative equipment.
- Improved coordination in identified areas. Ensure that young people understand the fundamental nature and the importance of micro and nano-electronics technology for our future and want to work in this area.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Coordination and Support Actions

**ICT 26 – 2014: Photonics KET**

Specific Challenge: Europe's photonics industry is facing fierce global market competition and has to cope with a very high speed of technological developments in the field. Further major S&T progress and research and innovation (R&I) investments are required for sustaining Europe's industrial competitiveness and leadership in photonic market sectors where Europe is strong (communications, lighting, medical photonics, or safety & security) and to exploit new emerging market opportunities.

Moreover, Europe is experiencing the existence of many fragmented and rather uncoordinated developments between many different national and regional players. Europe suffers also from a slow innovation process for turning many good R&D results achieved into innovative products ('Valley of Death'). Finally, Europe needs to better exploit the large enabling potential of photonics in many industrial sectors and in solutions addressing major societal challenges such as health and well-being, energy efficiency or safety.

Scope:

**a. R&I Actions**

Application driven core photonic technology developments for a new generation of photonic devices (i.e. components, modules and sub-systems): Actions should also address the related materials, validation of results for the target applications, and standardisation activities, as appropriate. They should demonstrate strong industrial commitment, be driven by user needs and concrete business cases supported by strong exploitation plans, and cover the value/supply chain as appropriate. Focus is on the following topics:

- Biophotonics for screening of diseases: Mobile, low-cost point-of-care screening devices for reliable, fast and non- or minimally-invasive diagnosis of diseases (such as cardiovascular, cancer, neurodegenerative, etc.). Actions should be driven by medical end-user needs and include a validation in real settings. Clinical trials are excluded.
- Sensing for safety and security: Breakthrough advances in cost-effective, high-performance, multi-band optoelectronic devices (including sources) for near- and mid-infrared sensing applications (spectral range of 0.7 to 50  $\mu\text{m}$ ) representing high-volume markets. Device cost in volume production should not exceed 10 times the related cost of devices for the visible domain.

Disruptive approaches in sensing: Proof-of-concept for photonic sensing devices offering breakthrough advances in sensitivity or specificity enabled by new technology, new device concepts (e.g. based on quantum optics or quantum technologies), new materials or non-conventional light-matter interaction from the research lab. Actions should demonstrate the feasibility of industrially relevant devices through a functional prototype.

**b. Innovation Actions**

Open system architectures for Solid State Lighting (SSL): Development and validation in real settings of new open system architectures (hardware and software level) for LED and OLED based intelligent lighting systems. Actions should address specific lighting requirements in relation to the intelligent system control network, easy commissioning,

safety and security issues, as well as the development of related electronic/photonics devices. Proposed architectures should allow interchangeability of the lighting components with focus on the standardisation of interfaces. Actions should involve microelectronic and SSL manufacturers or suppliers and include strong commitment for industrialising targeted products in Europe.

**c. Coordination and support actions**

Actions driven by the key stakeholders in photonics and targeting:

- *Strategic coordination and networking of* Photonics<sup>21</sup> stakeholders and other relevant communities for strategic technology road-mapping and for coordination with national and regional photonics activities.
- *The wide uptake of SSL technologies*<sup>21</sup>: Bringing together European cities to share information, testing facilities and procurement and deployment experiences on SSL; networking European SSL test facilities to ensure LED product quality in the European market place; training the public procurers in SSL technologies.
- *EU-wide outreach* for promoting photonics to young people, entrepreneurs and the general public.

**d. ERANET actions**

A joint call for proposals on a photonics topic of strategic interest, to be funded through an ERANET action between national and regional grant programmes.

Expected impact:

**a. R&I Actions**

For application driven core photonic technology developments:

- Secured and reinforced industrial technology leadership and substantially increased market presence in diagnostics and in safety & security.
- Improved business opportunities and value creation in Europe by reinforced cooperation along the value chain.
- Substantially improved screening of diseases for a more effective treatment.
- Substantially improved sensing solutions for high-volume safety and security markets.

For disruptive approaches in sensing:

- Secured industrial technology leadership in novel sensing systems targeting applications of high industrial and/or societal relevance.

**b. Innovation Actions**

- Reinforced industrial leadership in intelligent lighting systems and related devices fabricated in Europe.
- Major benefits for the users through the wide market introduction of intelligent lighting systems based on open system architectures and standardised interfaces.

**c. Coordination and support actions**

- Reinforced value chains and deployment of photonics technologies by closer cooperation of key photonics stakeholders and users in areas of common interest.
- Demonstrable improvement of awareness, and support of/for EU cities for widely deploying solid-state lighting with measurable benefits for the citizens.
- Demonstrable increased awareness and recognition of photonics by the wide public.

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<sup>21</sup> These actions are in line with the Green Paper "Lighting the Future", COM(2011) 889 final.

**d. ERANET actions**

Closer cooperation and greater pooling of resources between regional, national and EU-wide research programmes in strategic photonics R&I areas.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Coordination and Support Actions
- d. ERANET, funding level 33% of the total public contribution with an upper limit

**ICT 27 – 2015: Photonics KET**

Specific Challenge: Further major S&T progress and R&I investments are required for sustaining Europe's industrial competitiveness and leadership in photonic market sectors where Europe is strong. Europe needs also to strengthen its manufacturing base in photonics to safeguard the further potential for innovation and value creation and to maintain jobs. Finally, Europe needs to better exploit the innovation capacity of the more than 5000 existing photonics SMEs and the innovation leverage potential of the more than 40 existing innovation clusters and national platforms.

Scope:

**a. R&I Actions**

*Application driven core photonic technology developments* for a new generation of photonic devices (i.e. components, modules and sub-systems). Focus is on the following topics

- *Optical communication for data centres:* Low-cost, energy-efficient photonic devices supporting radically new system and network architectures driven by the emergence of exa-scale cloud datacentres. Actions should focus on optical inter- and intra-data centre transmission, switching and interconnects facilitating Tb/s interface speeds and Pb/s network throughput.
- *High-throughput laser-based manufacturing:* High-power, high-efficiency laser sources (both continuous wave and pulsed); high-performance optical components and systems, novel technologies and devices for beam delivery and for processing of multiple beams from laser source arrays; fast synchronisation of laser source and high-speed scanning devices.

*PIC technology:* Device, circuit and fabrication technology for PICs (Photonics Integrated Circuits), suited for cost-effective volume manufacturing on semiconductor or dielectrics based photonic integration platforms. Actions may cover also electronic-photonic integration, as well as heterogeneous and hybrid integration technologies for PIC-based high-density modules.

All RTD actions should address also the related materials, validation of results for the target applications, and standardisation activities, as appropriate. They should demonstrate strong industrial commitment, be driven by user needs and concrete business cases supported by strong exploitation plans, and cover the value/supply chain as appropriate.

**b. Innovation support through public procurement actions**

Pilot deployment of software-defined optics in backbone networks: Equip the networks of Public network operators (e.g., NREs) with novel Software Defined Optical Networking technologies (component, system, network level) using first commercial hardware and software to transport high traffic volumes to demanding customers in a dynamic way.

**c. Coordination and Support actions**

Open access of Researchers and SMEs to advanced design, fabrication and characterization facilities fostering the development of novel photonics solutions through the use of new materials, unconventional approaches and light-matter interaction.

Cooperation of photonic clusters and national technology platforms to stimulate the innovation potential of SMEs, based on business cases demonstrating a clear potential for sales and deployment growth.

Actions should link with on-going support actions providing access to advanced R&I services and capabilities with the aim to make them also accessible to Researchers or to establish a network of innovation multipliers providing a broader technological, application, innovation, and regional coverage of such services and capabilities addressing the needs of SMEs.

**d. ERANET actions**

A joint call for proposals on a photonics topic of strategic interest, to be funded through an ERANET action between national and regional grant programmes.

Expected impact:

**a. R&I Actions**

- Improved business opportunities and value creation in Europe by reinforced cooperation along the value chain.
- Secured and reinforced industrial technology leadership and substantially increased market presence in high-bitrate communications for data centres and in laser-based manufacturing of high-quality products.
- At least 10-factor reduction of power consumption and cost in communication technologies for (exa-scale) data centres.
- Significant productivity increase and substantial leverage effects to many industries using laser-based manufacturing.
- Measurable productivity increase in the manufacturing of complex PICs and sustained break-through innovations in new photonic products fabricated in Europe.

**b. Innovation support through public procurement actions**

- Faster and wider roll-out and deployment of software defined optical networking technologies and deployment of value-added services and applications in Europe.

**c. Coordination and Support actions**

- Demonstrable value generation of novel photonics approaches by researchers and SMEs through enhanced access to advanced fabrication and characterisation facilities.
- Reinforced innovation effectiveness of cluster networks in particular towards SMEs with measurable value creation for SMEs in terms of number of business collaborations stimulated, penetration of new markets and/or new application areas close to the market, etc.

**d. ERANET actions**

- Closer cooperation and greater pooling of resources between regional, national and EU-wide research programmes in strategic photonics R&I areas.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Innovation Actions (70% funding)
- c. Coordination and Support Actions
- d. ERANET, funding level 33% of the total public contribution with an upper limit

**ICT 28 – 2015: Cross-cutting ICT KETs**

Specific Challenge: Europe is facing fierce global competition to maintain its technological leadership in KETs. However, while Europe has excellent R&D results in individual KETs, it often fails to turn those timely into highly innovative products. In particular, Europe fails to bring stakeholders from the different KETs together around new value chains and new business collaborations. These will create value above and beyond the mere addition of individual technologies and are essential for Europe to develop multi-disciplinary technological capabilities and bring into the market new, high value-added products that are manufactured in Europe. By investing more on innovation and in particular on KET deployment projects and integration platforms as well as on KET pilot lines, in particular around micro-nano-electronics, photonics and manufacturing, there will be a direct impact on Europe's global competitiveness – in particular for the SMEs – as well as on Europe's capability to offer new solutions for some of the major societal challenges it faces.

Scope:

**a. Innovation Actions**

ICT-KET integrated platforms for the healthcare and food sectors: Further development and validation in real settings of reliable, low-cost micro-nano-bio and bio-photonics systems driven by users. Actions should target the health sector for early or fast diagnosis and monitoring (clinical trials are excluded) or the food sector for quality and safety. They should include substantiated business cases for the targeted products with strong commitment to industrialise them in Europe.

**b. Pilot lines for producing advanced KET products**

Set-up and validation of pilot production for advanced products. Actions may include also the development of fabrication processes, process qualification, and further process engineering. They should be open access and be driven by the key stakeholders able to set-up and run such pilot lines. Proposals should also include business plans for the further industrialisation of the production processes and, if applicable, for specific planned products, with strong commitment to manufacturing in Europe<sup>22</sup>. Actions should address the following topics:

Pilot line for OLEDs on flexible substrates: Focus is on introducing volume fabrication (sheet to sheet, roll to sheet and roll to roll) of reliable OLEDs on flexible substrates with

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<sup>22</sup> Wherever appropriate, actions should seek synergies and co-financing from relevant national / regional research and innovation programmes, e.g. structural funds addressing smart specialisation. Actions combining different sources of financing should include a concrete financial plan detailing the use of these funding sources for the different parts of their activities.

low material utilisation. Actions may include also the upgrading of current research pilot lines.

*Pilot line for analytical mid-infrared (MIR) micro-sensors*: A pilot line providing foundry services targeting in particular SME needs. Focus is on fabricating processed wafers and mounted / packaged chips for MIR micro-sensor systems addressing high-impact applications, and introducing lower-cost, more reliable and efficient MIR materials in the fabrication process. Open access should be facilitated through appropriate support services and tools, to be validated through pre-commercial pilot runs for external users.

*Pilot line for PIC fabrication on III-V and/or dielectric based platforms* providing foundry services for the fabrication of complex PICs (Photonic Integrated Circuits) based on generic fabrication processes. The foundry offer should meet in particular the needs of SMEs. Open access should be facilitated through appropriate support services and tools (e.g. design support, design kits and tools; PIC characterisation and packaging). The foundry offer should be validated through pre-commercial pilot runs for external users.

**c. Coordination and Support actions**

Cooperation of scientists, technology developers and providers, and end users for accelerating the deployment of bio-photonics and micro-nano-bio solutions in the health sector.

Expected impact:

**a. Innovation actions**

- Measurable progress in the effectiveness, cost-performance and speed of medical diagnosis, the prevention of major diseases and/or the quality controls in the food sector.
- Wide market introduction of micro-nano-bio and bio-photonics systems for healthcare and food quality.

**b. Pilot lines for producing advanced KET products**

- Cost-performance breakthroughs for OLEDs, making OLED competitive with existing LED based solutions; for reliable MIR sensing products; or for reliable PIC fabrication.
- Effective market introduction of new and highly competitive OLEDs and MIR sensing products.
- Measurable productivity increase in PIC manufacturing; and, measurable new, high added-value product propositions in a wide range of photonics market segments enabled by advanced manufacturing capabilities and/or added value services in PICs.
- Improved value creation in Europe through stronger value and supply chains involving relevant industrial stakeholders.

**c. Coordination and Support actions**

- Reinforced value chains and deployment of micro-nano-bio and bio-photonics solutions in the health sector through closer cooperation of the key stakeholders and users.

Types of action:

- a. Research and Innovation Actions (100% funding), TRL 5 and 6
- b. Innovation Actions (70% funding), TRLs 5 -7
- c. Coordination and Support Actions

## *ICT Cross-Cutting Activities*

### **ICT 29 – 2015: Internet of Things and Platforms for Connected Smart Objects**

Specific Challenge: The evolution of the Internet of Things embedded in Smart Environments and Platforms forming a web of "everything" has been identified as one of the next big concepts to support societal changes and economic growth at an annual rate estimated at 20%. The overall challenge is to deliver an Internet of Things (IoT) extended into a *web of platforms for connected devices and objects*. They support *smart environments, businesses, services and persons with dynamic and adaptive configuration capabilities*.

The biggest challenge will be to overcome the fragmentation of vertically-oriented closed systems, architectures and application areas and move towards open systems and platforms that support multiple applications. The challenge for Europe is to capture the benefits from developing consumer-oriented platforms that require a strong cooperation between the telecom, hardware, software and service industries, to create and master innovative Internet Ecosystems.

This topic cuts across several LEIT-ICT challenges (smart systems integration, smart networks, big data) and brings together different generic ICT technologies (nano-electronics, wireless networks, low-power computing, adaptive and cognitive systems) and their stakeholder constituencies. Their applicability across multiple application domains (ehealth, food chain, intelligent transport and systems and logistics) bridges the gap to applications-specific developments under the H2020 Societal Challenges.

Scope: The scope is to create ecosystems of "Platforms for Connected Smart Objects", integrating the future generation of devices, network technologies and other evolving ICT advances. These environments support citizen and businesses for a multiplicity of novel applications. They embed effective and efficient security and privacy mechanisms into devices, architectures, service and network platforms, including characteristics such as openness, dynamic expandability, interoperability, distributed decision making, cost and energy-efficiency, ergonomic, user-friendliness. Such Smart Environments may be enriched through the deployment of wearable /ambulatory hardware to promote seamless environments. The Smart Environment(s) will provide a basis for developer's communities to test and validate in large-scale experiments low cost applications of e.g. wireless networks such as WSNs, M2M, and networked objects and spaces, as well as heterogeneous deployments.

**a. R&I Actions** are focussed on the following:

Architectural concepts and concepts for semantic interoperability for "Platforms for Connected Smart Objects", which can cover multiple use cases whilst responding to specific requirements in terms of security, dependability, cognition and prioritised event processing.

- Dynamically configured infrastructure platforms for "Connected Smart Objects" covering multiple technologies, multiple devices including robots, and heterogeneous integration levels; dynamically configured information representation and interpretation leading to an extended Internet of Things. Developments include aspects such as:

- Efficient integration of the next generation of smart devices into self-adaptive, robust, safe, intuitive, affordable and interconnected smart network and service platforms. This includes Dynamic Spectrum Access and Network Management techniques to solve the connectivity challenges to enable tens of billions on new wireless connections for the IoT.
- Provisioning of information processing/reasoning, potentially covering self-organising systems and autonomous behaviour.
- APIs supporting the development of use cases allowing application developers to produce new added value across multiple systems.

Reference implementations including proof-of-concept, large-scale demonstrations and validation driven by innovative use scenarios, also leveraging on platforms developed elsewhere in the programme<sup>23</sup>. Smart homes, public spaces and context aware commercial environments are targeted and potential use scenarios include health, energy, mobility and commercial services.

To allow for dynamic expansion of the consortia according to the evolving needs, the mechanism of open competitive calls during the action may be used for up to 30% of the total budget.

**b. Support Measures**

Measures for development of ecosystems around the platforms e.g. communities of open API developers for low cost applications, networking of stakeholders, contribution to pre-normative activities and to standardisation, development of business models, innovation activities which aim at stimulating platform adoption (e.g. pre-commercial procurement), and activities to increase societal acceptance and foster specific education.

One Co-ordination and Support Action shall stimulate the collaboration between selected projects and between the potential platforms. It will also derive exploitation strategies, on how to make successful ecosystems emerge and be socially accepted in Europe.

Expected impact:

- Emergence of an European offer for integrated IoT systems and platforms with identified players capable of acting as technology and infrastructure integrators across multiple application sectors.
- Availability of architectures and methodologies that can be used by integrators and SME's to provide IoT turn key solutions in a variety of application fields.
- Dissemination and availability of results in standardisation fora and relevant bodies like the EIT.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Coordination and Support Actions

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<sup>23</sup> In that context, proposers may want to consider the "FIRE" experimental platform developed under Challenge 3 as one possible platform supporting large scale experiments, where applicable, as well as relevant developments in the robotics domain, under Challenge 5.

## **ICT 30 – 2014: Human-centric Digital Age**

Specific Challenge: Technologies, networks and new digital and social media are changing the way people behave, think, interact and socialize as persons, citizens, workers and consumers. Understanding the nature and consequences of these changes in order to better shape the digital future is a key success factor for the values and competitiveness of the European society.

### Scope:

**a.** The **R&I Actions** should aim at in-depth exploration of the development of fundamental notions such as identity, privacy, reputation, motivations, responsibility, attention, and fairness, in the hyper-connected age where the limits between offline and online are blurred in numerous ways. Gender, generational and cultural differences in behaviours should also be considered where relevant.

Examples of relevant research topics include:

- How do humans cope with information overload and attention scarcity? How do ICT environments and processes affect the ways individuals deal with information flows and focus their attention?
- How does the blurring between online and offline world affect the way people experience their different settings (work, leisure, family)? How can smart and connected environments support individuals and society?
- What are the norms and behaviours that should be considered for behaving ethically and being fair to each other in a hyper-connected digital world? How should their adoption in the digital culture be fostered?

**b.** The **coordination and support activities** should facilitate community building between ICT developers, researchers in SSH and other disciplines, and stakeholders. They should efficiently exchange results between SSH research, on-going R&D&I projects and relevant areas of policy making, and provide concrete incentives and motivations for cross-disciplinary collaborations.

### Expected impact:

**a.** The **R&I Actions** supported under this objective are expected to:

- provide new knowledge of the ways by which individuals and communities work, think, learn, behave, and interact in the new hyper-connected environments and of how these new developments affect people's perceptions of self, services, entrepreneurship, democracy, and governance.
- provide well-founded transferable results, including innovative concepts and proved functional models, which can be exploited in the future research, policy and regulatory agendas.

**b.** The **coordination and support activities** are expected to provide support to the ongoing and future ICT projects by establishing an efficient and effective collaboration ground between ICT developers, researchers in multiple disciplines, and a broad stakeholder base (including society, industry, policy makers).

All successful projects should establish broad and durable constituencies, which support results take up and further work beyond the lifetime of the project.

Types of action:

- a. Research and Innovation Actions (100% funding)
- b. Coordination and Support Actions

**ICT 31 – 2014: Cybersecurity, Trustworthy ICT**

Specific Challenge: The fast evolution of ICT technology together with the uses that are made of it are exponentially introducing new threats, vulnerabilities and risks. There is a growing consensus that the state-of-the-art approach to secure ICT is becoming obsolete and, in addition, the walled-garden concept for security is becoming invalid.

The challenge is to find solutions guaranteeing end-to-end security that withstands progress for the lifespan of the application it supports, regardless of improvements in attacker hardware or computational capabilities.

Scope:

**a. R&I Actions**

- **Security-by-design for end-to-end security**

Security-by-design paradigms have to be developed and tested, to providing end-to-end security, across all hardware and software layers of an ICT system and application. Special attention has to be paid to the interaction of the layers. Platform independent solutions are needed to provide context aware and self-adaptive security in highly connected, complex and interoperable networks.

Automated security policy governance for such environments has to be addressed, allowing for run-time verification, customisation and enforcement between operators or virtual entities, in multi-layer and multi-service systems, spanning multiple domains or jurisdictions.

Open and dynamically reconfigurable environments need special attention, as well as environments where the user or provider has to rely on other providers, not necessarily of trustworthy origin.

The developed security-by-design solutions are expected to be usable in their deployment and implementation in order to decrease the security risks associated with improper use or misconfiguration and thereby allowing the user to trust devices and services intuitively.

- **Cryptography**

Research projects have to address the key challenges to guarantee the security for the lifespan of the application it supports, to stay ahead of the evolution of the ICT environment and keep pace with the performance increase of ICT technology. The challenges to be addressed include:

- Resource efficient and highly secure technology for hardware based real-time cryptography;
- Resource efficient, real-time, highly secure fully homomorphic cryptography;
- Distributed cryptography including functional cryptography;
- Cryptographic tools for securely binding applications to software, firmware and hardware environments;
- Post-quantum cryptography for long term security;

- Low cost components for short-distance, low-bit-rate quantum key-distribution systems and integration into existing optical network architectures (e.g. trusted nodes);
- High-bit rate quantum key distribution systems and networks supporting information theoretic cryptographic primitives.

Projects have to demonstrate a net increase in performance, or reduction in energy or power consumption, compared to state-of-the-art approaches and have to validate the proposed technology in realistic application scenarios, taking into account the current trends in ICT like cloud, mobile, IoT, etc Activities may include methods for provable security against physical attacks, as well as research toward security certification.

**b. Activities supporting the Cryptography Community**

To complement the research activities in cryptography support and coordination actions should address the following aspects:

- ensure a durable integration and structuring of the European cryptography community, involving academia, industry, law enforcement and defence agencies;
- strengthen European excellence in this domain;
- provide technology watch, joint research agendas and foresight studies;
- identify technology gaps, market and implementation opportunities
- provide technical expertise to the cybersecurity and privacy communities;
- contribute to the development of European standards, including for the public sector;
- solve training needs and skill shortage of academia and industry;
- organize open competitions with security and implementation benchmarking;
- dissemination and outreach, strengthening the link with institutional stakeholders.

Expected impact:

At macro level:

- a new paradigm for the design of ICT technology;
- ICT designed in Europe offering a higher level of security and/or privacy compared to non-European ICT products and services;
- ICT products and services compliant with Europe's security and privacy regulation;
- ICT with a measurably higher level of security and/or privacy, at marginal additional cost compared to ICT technology following the traditional designs (i.e. implementing security as add-on functionality).

At societal level:

- increase user trust in ICT and online services;
- improve users' ability to detect breaches of security and privacy;
- more resilient critical infrastructures and services.

**At innovation level:** a new generation of ICT systems, applications and services that

- empowers users to take control over their data and trust relations;
- provides security and privacy as a built-in feature, simpler to understand and manage for the user compared to traditional ICT;
- CT solutions allowing the user to monitor if his rights-online are respected and in compliance with the EU regulation;

- ICT technology that is proofed to be more secure than ICT designed the traditional way.

**Instrument, funding level and budget**

- a. Research & Innovation Actions (100% funding)
- b. Coordination and Support Actions

**ICT 32 – 2014: Trans-national co-operation among National Contact Points**

Specific Challenge: Enforcing the effectiveness of National Contact Points (NCP) for ICT in H2020 by supporting trans-national cooperation within this network and strengthening collaboration with other R&I support networks at the European level.

Scope: The action will focus on establishing mechanisms for effective cross border partnership searches, identifying, understanding and sharing good practices ensuring this target. This may entail benchmarking of services and support mechanisms, joint workshops and collaboration with other H2020 NCPs, training, twinning schemes, elaboration of relevant training and information material for proposers and the operation of an effective partner search mechanism across the network of NCPs. Practical initiatives to benefit cross-border audiences may also be included, such as trans-national brokerage events. The specific approach should be adapted to the nature of the theme and to the capacities and priorities of the NCPs concerned. A degree of collaboration and networking with similar projects in parallel themes – especially in the context of joint/coordinated calls will be encouraged. Special attention should be given to helping less experienced NCPs to access the know-how accumulated in other countries and to apply it in a locally relevant and efficient manner. The ICT NCP network should develop information and support services along the full research and innovation value chain for all ICT clients, in particular new target groups in H2020 (e.g. SME, public authorities).

Proposals are expected to include or enable the active participation of all NCPs which have been officially appointed by the relevant national authorities in the EU and associated countries. In special cases the NCPs can decide to subcontract this activity to specialist agencies. Proposals from other organisations in the EU and Associated States are ineligible. If certain NCPs wish to abstain from participating, this fact should be explicitly documented in the proposal. The action may also involve official ICT H2020 contacts from third countries. The Commission expects to receive a single proposal under this heading. It is expected that the project should last for a period of four years.

Expected impact:

- An improved more homogeneous NCP service across Europe and beyond, helping to establish cross border consortia, simplify access to H2020 calls, lowering the entry barriers for newcomers, and raising the quality of submitted proposals.
- A more consistent level of NCP support services across Europe, closely integrated with other NCP networks, ERA-Nets, JTIs, related European programs and EEN services.
- More effective participation of organizations from third countries, alongside European organizations, in line with the principle of mutual benefit.

**Instrument, funding level and budget**  
Coordination and Support Action

### ***Horizontal ICT Innovation actions***

The overall strategic objective for the actions proposed for the first two years of H2020, is to ensure best leverage of innovation actions across the challenges and ensure that ICT research and innovation in Horizon 2020 delivers the intended impact on European growth and competitiveness.

#### **ICT 33 – 2015: Support for access to finance**

Specific Challenge: The challenge is to provide sufficient access to financial services to Europe's entrepreneurs for both early growth and growth stage investments. This challenge is coordinated with the corresponding challenge in the "Access to risk finance" work-programme that will provide matching budget.

Scope: The aim is to launch a pilot action for Business Angels co-investment in ICT innovative companies implemented by EIF to support co-investment by Business Angels in innovative ICT companies. Co-investments can cover other types of private investors such as family offices or VC as well as the use of crowd-funding platforms where appropriate.

Particular attention will be on cross border and potential long term investments in technological domains including Photonics, Micro-electronics, Microsystems, Robotics and the ICT related Creative Industries.

A budget of 15 M€ is reserved for this action.

This amount is conditioned by the top up of matching budget from the "Access to risk finance" budget. The pilot will concern ICT related investment only.

In case of no commitment or insufficient demand for support, a reduction of the same amount for the Financial Instruments can be decided and the funds would be reallocated to the relevant challenges. The decision to launch such a procedure shall be made by June 2015.

#### Expected impact:

- Increased commercialisation of results of R&I projects.
- Higher investment readiness and better access to investors for R&I actors in particular for innovative SMEs and entrepreneurs participating in EU ICT programmes.
- Developing Business Angels co-investment for mobilising more significant investments in key ICT sectors/fields for high innovative ICT start-ups and SME at early stage.

#### Types of action:

Financial contribution for topping-up measures implemented through H2020 financial instruments.

## **ICT 34 – 2014: Innovation and Entrepreneurship Support**

Specific Challenge: The challenge is to improve the framework conditions of the European ICT innovation ecosystem so that it offers the best conditions for innovators to capture the full potential of innovation to transform ideas to the market for sustaining growth and jobs.

### Scope:

#### **a. ICT business idea contests in Universities and High schools**

Organise and promote ICT business idea contests addressed to University and high-school students. ICT business ideas contests should be organised at national and subsequently European level. A participation of at least 10 Member States or Associated Countries in the first year (up to all Member States and Associated Countries) should be sought. The first selection takes place at Campus level and will continue gradually up to the European level with a final event Support will go to a well-focused consortium which members should have demonstrated capacity in mobilising students and having experience with similar large scale events.

#### **b. ICT Entrepreneurship Summer Academy**

The creation of a European wide system of Summer Academies for university and last year high school students entirely focused on ICT entrepreneurship. The summer academies will be action oriented and include activities such as ICT and entrepreneurial skills development; experimenting, mentoring; support for business planning and setting up your company; matchmaking; generation and development of ICT-related business ideas. The project will complement, extend and enrich similar existing actions while focusing on the ICT sector and excellence.

#### **c. ICT Entrepreneurship Labs**

Bring entrepreneurs, students, researchers and companies together in experimental spaces to foster innovation driven entrepreneurship. The aim is to foster team-based entrepreneurial activities and deepen interaction between students, entrepreneurs, designers, universities and professors. Activities should combine exploring entrepreneurship as career through classes, workshops, learning by doing, co-working spaces, experimental activities like testing and prototyping, access to resources, coaching and sharing experience with other entrepreneurs, including serial entrepreneurs and successful founders. Particular focus should be on new initiatives that widen participation, including twinning to share experience and best practices, on sustainability and support for scaling up.

#### **d. Campaign on Entrepreneurship culture in innovative ICT sector**

Develop a public campaign focused on promoting entrepreneurship and the culture of risk-taking attitude in Europe with a focus on ICT sector. The campaign will address messages like "I've tried and I've failed", "I've tried and I succeeded" and role models that Europeans can relate and feel encouraged to become entrepreneurs. The objective is to boost the entrepreneurship by changing the perception towards risk aversion in Europe. The accent will be put on lessons learned. The campaign should be promoted through channels at national and European level. In order to make the testimonials relevant enough for all potential entrepreneurs across Europe, the campaign should be promoted in minimum 2/3 of Member States and Associated Countries. This campaign should be part of a long term plan to change the culture of entrepreneurship in Europe.

**e. Support for definition and implementation of Inducement Prizes (or Challenges)**

The CSA funded in this area is to deliver support to the EU in definition of 8 to 12 inducement prize competitions. Definition of 8 to 12 Prize competitions to include delivery of a validated analysis for multiple ICT thematic areas of technological or societal challenges that potential competitions will solve; development of a list of prize concepts and size of associated prize fund appropriate for addressing the challenges; identification of underlying market failures that each prize seeks to address; definition of success criteria; and, drafting prize competition rules, developing plans for evaluations and operations.

**f. European networks of procurers (European Procurers Platforms)**

The objective is to support the creation of European wide networks of procurers that define together an innovation procurement roadmap, identifying shared procurement needs in the near term (relevant for PPI) as well as mid-to-long term (relevant for PCP) in areas of common European interest.

EPPs actions shall engage into an open dialogue with all potential stakeholders, including other procurers and end-users. EPPs shall publish their perceived procurement needs online, in a way that enables the research and innovation community to comment and submit ideas to make suggestions for future PCPs or PPIs relevant to the focus domain of the EPP. EPPs shall also undertake activities that investigate the feasibility and facilitate the concrete preparation of a cross-border PCP or PPI for at least one shared common procurement need.

EPPs shall contain a critical mass of public procurers responsible for the acquisition and/or regulatory strategy for innovative solutions in areas of public interest that are large potential customers for ICT LEIT technologies. The EPP shall be open to and actively encourage procurers from all over Europe that are providing services of public interest to join. EPPs shall undertake dissemination activities to share results and raise awareness about PCP and PPI across Europe.

**g. Pre-commercial procurement**

The objective is to bring radical improvements to the quality and efficiency of public services by supporting the development and validation of breakthrough solutions through Pre- Commercial Procurement. It is open to proposals in all areas of public sector interest requiring innovative ICT based solutions in complementarity with actions foreseen under other challenges in ICT LEIT. 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.

Expected impact:

For all activities focus should be on actions with real impact rather than theoretical models and studies. Reuse and pooling of resources, including existing (web) platforms are highly desired. Equal access of women and men to all the activities should also be fostered.

- a.** Increased awareness and perception of ICT entrepreneurship among young people in Europe; Development of entrepreneurship skills and exploitation of e-skills.
- b.** Increased practical entrepreneurial skills amongst students that will allow them to pursue their entrepreneurial aspirations, to start and grow your business or use them in their career.
- c.** Increased entrepreneurship, increased number of offered opportunities for entrepreneurs, new initiatives that would have not been started without EC intervention, increased

collaboration in respective communities between different actors of the entrepreneurial ecosystem.

- d. Modify the perception of the barriers faced by ICT entrepreneurs and decrease the fear of starting a business. Changing the attitude towards risk-taking will spur innovative ICT-based ventures and should produce a positive effect on the number of new entrepreneurs.
- e. Comprehensive prize design delivered by a consortium with experience in designing inducement prizes. Identification of inducement prize with highest impact and chance of mobilising the stakeholders to engage and participate. Awareness of potential of inducement prizes raised beyond the community typically active in the competition area.
- f. More forward-looking, concerted approach to develop common answers to challenges faced by the public sector in a number of countries. Increased opportunities for the supply side to present the demand side the potential of innovative solutions to address concrete public sector challenges. Reduced fragmentation of public sector demand through definition of common specifications and preparation of cross-border procurements.
- g. Reduced fragmentation of demand for innovative solutions by enabling public procurers to collectively implement PCPs in areas, which due to their nature are better addressed jointly, or which they would not have been able to tackle independently. 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 to remove barriers for introduction of PCP innovations into the market.

Types of action:

- a. b. c. Innovation Actions (70% funding)
- d. Coordination and Support Actions
- e. Coordination and Support Actions
- f. Coordination and Support Actions, on the coordinator's budget, maximum 30% of the budget can be planned to enable future participants (in particular procurers not yet identified at the time of the proposal) to join the action.
- g. PCP action, funding level: 70%

**ICT 35 - 2014-15: Open Disruptive Innovation Scheme (implemented through the SME instrument)**

Specific Challenge: The challenge is to provide support to a large set of early stage high risk innovative SMEs for fast prototyping and replication of innovative ideas.

The objective of the ODI is threefold:

- Nurture promising innovative ideas and enable co-creativity in innovative solutions;
- Support their development and demonstration;
- Help for wider deployment or market uptake.

Scope: The ODI scheme is specifically designed to foster innovative bottom-up ideas through continuously open calls so as to enhance the disruptive innovation potential and market uptake.

In particular it will be interesting for entrepreneurs and young innovative companies that are looking for swift support to their innovative ideas.

The scheme intends to fund innovative SMEs<sup>24</sup> possibly but not necessarily with agile consortia through the dedicated SME instruments.

The ODI scheme is open in terms of non-prescriptive topic/areas and in terms of timing for submission, with an open call throughout the year with a few cut off dates and by specific evaluation processes enabling short time to grant.

Support actions will be used to support exploitation and commercialization.

The ODI objective will support the validation, fast prototyping and demonstration of disruptive innovation bearing a strong EU dimension. The ODI scheme will be implemented through the SME instrument, where applications are restricted to SMEs, including startups and entrepreneurs.

The ODI scheme seeks to (i) Nurture and mature innovations; (ii) Support their validation and demonstration; and (iii) Provide help for wider deployment or market uptake.

#### Expected impact:

The expected impact is to accelerate the market up-take of such innovations having commercial potential across Europe and/or at international level within (up to) 3 years.

#### Types of action:

SME Instrument: Phase 1; Phase2 and Phase3

- Part1: lump sum of 50 k€ per project
- Part2: 0.5 to 2 M€ per project; funding level: 70% of eligible costs
- Part3: budget up to 1 M€ for one CSA to support all projects participating in ODI/SME instrument to help for business development, investment readiness, access to finance and other support services in view of giving more visibility to those disruptive innovations and facilitating the exploitation and commercialisation

This objective trials a new and lighter submission process, aims at a faster evaluation and a simpler project implementation. It applies a submission scheme and specific eligibility and evaluation criteria (see Conditions for the call below).

The submission will be continuously open, with three cut-offs dates per year.

The SME instrument consists of three separate phases and a coaching and mentoring service for beneficiaries. Participants can apply to phase 1 with a view to applying to phase 2 at a later date, or directly to phase 2.

**In phase 1**, a feasibility study shall be developed verifying the technological/practical as well as economic viability of an innovation idea with considerable novelty to the industry sector in which it is presented (new products, processes, services and technologies or new market applications of existing technologies). The activities could, for example, comprise risk assessment, market study, user involvement, Intellectual Property management, innovation strategy development, partner search, feasibility of concept and the like to establish a solid high-potential innovation project aligned to the enterprise strategy and with a European dimension. Bottlenecks in the ability to increase profitability of the enterprise through innovation shall be detected and analysed during phase 1 and addressed during phase 2 to increase the return in investment in innovation activities.

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<sup>24</sup> An SME is an enterprise which has fewer than 250 employees, has an annual turnover not exceeding 50M€, and/or has an annual balance-sheet total not exceeding 43M€. Possible relationships with other enterprises must be taken into account when calculating these data of the enterprise. Research Centres, research institutes, contract research organisations or consultancy firms are not eligible SMEs for the purpose of the ODI scheme.

**In phase 2**, innovation projects will be supported that address the specific challenge – ODI – and that demonstrate high potential in terms of company competitiveness and growth underpinned by a strategic business plan. Activities should focus on innovation activities such as demonstration, testing, prototyping, piloting, scaling-up, miniaturisation, design, market replication and the like aiming to bring an innovation idea (product, process, service etc) close to deployment and market introduction, but may also include some research

In addition, **in phase 3**, SMEs can benefit from indirect support measures and services as well as access to the financial facilities supported under Access to Risk Finance of this work programme. [[Link to the Access to Risk Finance Part](#)]

In addition to the specific support for the ODI available via the CSA, successful beneficiaries will be offered coaching and mentoring support during phase 1 and phase 2. This service will be accessible via the Enterprise Europe Network and delivered by a dedicated coach through consultation and signposting to the beneficiaries. The coaches will be recruited from a central database managed by the European Commission and have all fulfilled stringent criteria with regards to business experience and competencies. Throughout the three phases of the instrument, the Network will complement the coaching support by providing access to its innovation and internationalisation service offering. This could include, for example, depending on the need of the SME, support in identifying growth potential, developing a growth plan and maximising it through internationalisation; strengthening the leadership and management skills of individuals in the senior management team and developing in-house coaching capacity; developing a marketing strategy or raising external finance.

## **Fast Track for Innovation Call**

Under this Fast Track to Innovation (FTI) pilot, proposals for innovation actions linked to any technology field will be invited, on the basis of a continuously open call (with its first cut-off date in 2015) and a bottom-up-driven logic.

[Any legal entity may participate and proposals may be submitted at any time. The Commission shall initiate three cut-off dates per year to evaluate proposals. Time between a cut-off date and signature of the grant agreement or notification of the grant decision shall not exceed six months. No more than 5 legal entities shall participate in an action. The amount of the grant shall not exceed EUR 3 million.

Proposals shall be ranked according to the impact, quality and efficiency of implementation and excellence, with the criterion of impact given a higher weighting. Factors such as time sensitivity and the international competitive situation shall be taken into sufficient account when evaluating the impact of a proposal, to allow for flexibility according to the various specificities within different fields of applied research.]

### ***International Cooperation actions***

#### **ICT 36 – 2015: International partnership building and support to dialogues with high income countries**

Specific Challenge: The challenge is to provide for discussions with third countries on areas of common interest and to provide support to collaboration within the ICT research and innovation domains.

Scope: The twofold target is

- to support dialogues between the European Commission/the EU and strategic high income partner countries and regions,
- and
- to foster cooperation with strategic high income third country organisations in collaborative ICT R&D both within the EU's Framework Programmes (Horizon 2020) and under relevant third country programmes.

Proposals must cover these two aspects which could include in particular:

- the organisation of events synchronised with dialogue meetings<sup>25</sup>, providing timely input and follow-up for example on common R&D priorities and future cooperation opportunities, assisting in focusing dialogue meetings as well as increasing their visibility,
- enhance cooperation on ICT policy and regulation through monitoring of the targeted region/country, workshops or any other relevant activity,
- strengthening of cooperative research links through the set-up of sustainable cooperative mechanisms or platforms between European organisations and relevant leading third country organisations, with the aim of establishing mutually beneficial partnerships based on synergies to be identified between the Digital Agenda for Europe's (DAE) international agenda and third countries/regions' ICT strategies,
- reinforcement of industrial cooperation on ICT research and development, notably through a better networking between European ICT Technology Platforms and relevant associations in third countries,
- increased co-ordination at EU level with horizontal Framework Programme instruments to promote international cooperation (such as BILAT, INCO-NET and ERA-NET), as well as relevant EU Member State and Associated Countries programmes.

Proposals should build upon the achievements by similar past or ongoing projects, in countries/or regions where applicable, while avoiding duplication of that effort in this Call.

#### **Targeted high income countries/regions**

- a) Subgroup 1: North America (Canada, USA)

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<sup>25</sup> This includes Information Society Dialogues (organised by DG CONNECT), meetings under S&T Agreements (organised by DG RTD), and other relevant meetings (e.g. Senior Officials or Ministerial level regional meetings).

b) Subgroup 2: East Asia/Oceania (Australia, Japan, Korea, New Zealand, Singapore, Taiwan)

It is expected that each targeted area will be covered by one or two projects, and that duplication of effort in an area is avoided (i.e., if more than one proposal / area should be retained, preference will be given to proposals with different and/or additional country(ies) coverage).

Activities under this objective should be covered in balanced partnership with relevant and highly qualified third country organisations, including governmental actors (third country research ministries/agencies), relevant industry associations, and academic partners (research centres/universities).

Measureable performance indicators should be included (e.g. minimum numbers of events to be organised, participants, number of proposals submitted/new consortia created triggered by the events organised, European organisations/individuals supported in accessing third country programmes, etc.).

Expected impact:

- Reinforcement of strategic partnerships with key third countries and regions in areas of mutual interest and added value in jointly addressing important issues.
- Increased visibility for EU ICT R&D activities and research excellence.
- Increase visibility for EU ICT policy and regulations
- Support provided for European organisations/individuals in accessing third country programmes.

Types of action:

Coordination and Support Actions

**ICT 37 – 2015: International partnership building in low and middle income countries**

Specific Challenge: To reinforce cooperation and strategic partnership with selected countries and regions in areas of mutual interest.

Targeted countries: Low and middle income countries<sup>26</sup> in sub-Saharan Africa

Scope: The aim is to launch a set of targeted collaborative research projects addressing the requirements of end-user communities in developing countries. Specific technological targets could include for example co-design, adaptation, demonstration and validation (e.g. pilots) of ICT related research and innovation in relevant thematic areas addressed by Horizon 2020 including Content Technologies and Societal Challenges.

Activities under this objective should be led by a clearly defined user need/market opportunity for the technology being adapted; they should in particular include requirements of developing countries, and where possible, have the potential for wider impact by involving a number of countries from the same region. Proposals should be submitted by a complementary partnership with a particular focus on the participation of relevant developing country innovation stakeholders and end-user community representatives (e.g. relevant public,

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<sup>26</sup> See World Bank country classification.

private, education and research, and societal sector organisations, Innovation Spaces and Living Labs).

Expected impact:

- Development of relevant technology responding to specific needs and conditions of the target country
- Reinforced international dimension of the ICT and Innovation aspects of Horizon 2020 and a higher level of international cooperation with low and middle income countries in ICT R&D and Innovation, focusing on areas that are beneficial to the target countries/region.

Types of action:

Research & Innovation Actions (100% funding)

***Conditions for this call and the prizes***

**H2020-ICT-2014**

Publication date: 11 December 2013<sup>27</sup>.

Deadline(s): at 17.00.00 Brussels time on the following dates

All Topics except ICT14.a, ICT14.b, ICT14.c, ICT35	23 April 2014 <sup>28</sup>			
ICT14a, ICT14.b, ICT14.c	23 September 2014 <sup>29</sup>			
ICT35 [SME instrument] Open call cut-off dates	Phase 1 15/03/2014 15/06/2014 15/09/2014 15/12/2014	Phase 2 15/6/2014 15/11/2014	Phase 1 15/03/2015 15/06/2015 15/09/2015 15/12/2015	Phase 2 15/03/2015 15/06/2015 15/09/2015 15/12/2015

Indicative budget: [[Link to the relevant option on "margin of manoeuvre"](#)]

Overall indicative budget: EUR 686.5 million from the 2014 budget<sup>30</sup> and EUR 170 million from the 2015 budget<sup>31</sup>

<i>All single stage</i>		2014 EUR million	2015 EUR million
Smart Cyber-Physical Systems	ICT1.a	37	
	ICT1.b	17	
	ICT1.c	2	
Smart System Integration	ICT2.a	35	

<sup>27</sup> The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication.

<sup>28</sup> The Director-General responsible may delay this deadline by up to two months.

<sup>29</sup> The Director-General responsible may delay this deadline by up to two months.

<sup>30</sup> Subject to the adoption of the draft budget 2014 by the Budgetary Authority without modifications of the appropriations foreseen on the corresponding budget line (09 04 02 01) or the availability of appropriations in 2014 under the rules of provisional twelfths referred to in Article 315 of TFEU.

<sup>31</sup> These amounts will be included in the financial decision for 2015.

**HORIZON 2020 – WORK PROGRAMME 2014-2015**

LEIT – Information and Communication Technologies

	ICT2.b	9	
	ICT2.c	3	
	ICT2.d	1	
Advanced Thin, Organic and Large Area Electronics (TOLAE) technologies	ICT3.a	17	
	ICT3.b	15.5	
	ICT3.c	3	
	ICT3.d	2.5	
Smart Networks and novel Internet Architectures	ICT5	23	
Smart optical and wireless network technologies	ICT6.a	29	
	ICT6.b	2	
	ICT6.c	1	
Advanced Cloud Infrastructures and Services	ICT7.a	66	
	ICT7.b	5	
	ICT7.c	2	
Tools and Methods for Software Development	ICT9	21	
FIRE+ (Future Internet Research & Experimentation)	ICT11.a	25	
	ICT11.b	5	
	ICT11.c	1.5	
Web Entrepreneurship	ICT13.a	6	
	ICT13.b	4	
Advanced 5G Network Infrastructure for the Future Internet	ICT14.a		98
	ICT14.b		25
	ICT14.c		2
Big Data Innovation and take-up	ICT15.a	39	
	ICT15.b	11	
Cracking the language barrier	ICT17.a	4	
	ICT17.b	10	
	ICT17.c	1	
Support the growth of ICT innovative Creative Industries SMEs	ICT18.a	14	
	ICT18.b	1	
Advanced digital gaming/gamification technologies	ICT21.a	9	
	ICT21.b	8	
Multimodal and Natural computer interaction	ICT22.a	7.5	
	ICT22.b	16	
	ICT22.c	7.5	
Robotics	ICT23.a	57	
	ICT23.b	12	
	ICT23.c	5	
Photonics KET	ICT26.a	28	
	ICT26.b	8	
	ICT26.c	5	
	ICT26.d	6	
Human-centric Digital Age	ICT30.a	6	
	ICT30.b	1	
Cybersecurity, Trustworthy ICT	ICT31.a	37	
	ICT31.b	1	

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Trans-national co-operation among National Contact Points	ICT32	4	
Innovation and Entrepreneurship Support	ICT34.a.b.c	4	
	ICT34.d	1.5	
	ICT34.e	0.5	
	ICT34.f	1	
	ICT34.g	4	
Open Disruptive innovation Scheme (ODI)	ICT35 [SME instrument]	45	45

Eligibility conditions:

all topics	The standard eligibility conditions apply. Please read carefully <a href="#">the provisions [Link to the annex on standard eligibility conditions] under Annex X</a> before the preparation of your application.
ICT35 [SME instrument]	The standard eligibility conditions for the SME instrument apply to this topic. <a href="#">[Link to the annex of the standard eligibility conditions for SME instrument]</a>
	Please read carefully the provisions under Annex X <a href="#">[Link to the annex on standard eligibility conditions]</a> before the preparation of your application.
ICT6.b [Prize]	The standard eligibility conditions apply. Please read carefully the provisions <a href="#">[Link to the annex on standard eligibility conditions] under Annex X</a> before the preparation of your application.

Evaluation criteria:

all topics	The standard evaluation criteria apply. Please read carefully <a href="#">the provisions [Link to the annex on standard evaluation criteria] under Annex X</a> before the preparation of your application.
ICT35 [SME instrument]	The specific award criteria for the SME instrument apply to this topic. <a href="#">[Link to the annex of the specific award criteria for SME instrument]</a>
	Please read carefully the provisions under Annex X <a href="#">[Link to the annex on standard evaluation criteria]</a> before the preparation of your application.
ICT6.b [Prize]	The specific award criteria for the prize apply to this topic <a href="#">[Link to specific criteria]</a>

Evaluation procedure: [\[Link to the annex on standard evaluation procedure\]](#)

- Proposal page limits and layout: [\[as appropriate\]](#)

All topics	NN pages
ICT35 [SME instrument]	Phase 1 :max. 10 pages
	Phase 2: max. 30 pages

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- Indicative timetable for evaluation and grant agreement<sup>32</sup>: *[as appropriate]*
  - *specify planned date to inform applicants of outcome of evaluation, and.*
  - *indicative date of signature of grant agreements or notification of grant decision*

	Information on the outcome of the evaluation ( <i>single or first stage</i> )	Information on the outcome of the evaluation ( <i>second stage</i> )	Indicative date for the signing of grant agreements
All topics	DDMMYYYY <i>Maximum 6 months after the deadline</i>	-	DDMMYYYY <i>Maximum 9 months after the deadline</i>
ICT35 [SME instrument]	Applicants will be informed of the outcome of the evaluation two months after the corresponding deadlines set out above for phase 1	Applicants will be informed of the outcome of the evaluation three months after the corresponding deadlines set out above for phase 2.	Grant agreements are planned to be signed within 3 months after the corresponding deadlines set out above for phase 1 and within 6 months after the corresponding deadlines set out above for phase 2.

Consortia agreements: *[as appropriate]*

[Standard sentence on climate change and/or sustainable development *[to be added as necessary]*

**H2020-ICT-2015**

Publication date: July 2014 (indicatively)

Deadline(s): at 17.00.00 Brussels time on the following dates

For all topics	20 January 2015 <sup>33</sup>
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<sup>32</sup> Should the call publication postponed, the dates in this table should be adjusted accordingly.

<sup>33</sup> The Director-General responsible may delay this deadline by up to two months.

Indicative budget: [[Link to the relevant option on "margin of manoeuvre"](#)]

Overall indicative budget: EUR 579 million from the 2015 budget<sup>34</sup>: [[Link to the relevant option on "margin of manoeuvre"](#)]

<i>All single stage</i>		2015 EUR million
Customised and low power computing	ICT4.a	37
	ICT4.b	17
	ICT4.c	3
Boosting public sector productivity and innovation through cloud computing services	ICT8.a	9
	ICT8.b	13
Collective Awareness Platforms for Sustainability and Social Innovation	ICT10.a	25
	ICT10.b	4
	ICT10.c	7
	ICT10.d	1
More experimentation for the Future Internet	ICT12.a	13
	ICT12.b	5
Big Data - research	ICT16.a	38
	ICT16.b	1
Technologies for creative industries, social media and convergence	ICT19.a	18
	ICT19.b	21
	ICT19.c	2
Technologies for better human learning and teaching	ICT20.a	9
	ICT20.b	5
	ICT20.c	23
	ICT20.d	15
Robotics	ICT24.a	50
	ICT24.b	12
	ICT24.c	12
	ICT24.d	5
	ICT24.e	4
Generic micro- and nano-electronic technologies	ICT25.a	40
	ICT25.b	7
	ICT25.c	3
Photonics KET	ICT27.a	30
	ICT27.b	5
	ICT27.c	3
	ICT27.d	6
Cross-cutting ICT KETs	ICT28.a	13
	ICT28.b	42
	ICT28.c	1
Internet of Things and Platforms for Connected Smart Objects	ICT29.a	50
	ICT29.b	1

<sup>34</sup> These amounts will be included in the financial decision for 2015..

**HORIZON 2020 – WORK PROGRAMME 2014-2015**

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Support for access to finance	ICT33	15
International partnership building and support to dialogues with high income countries	ICT36	3
International partnership building in low and middle income countries	ICT37	11

Eligibility conditions:

all topics	The standard eligibility conditions apply. Please read carefully <a href="#">the provisions [Link to the annex on standard eligibility conditions] under Annex X</a> before the preparation of your application.
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Evaluation criteria:

all topics	The standard evaluation criteria apply. Please read carefully <a href="#">the provisions [Link to the annex on standard evaluation criteria] under Annex X</a> before the preparation of your application.
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Evaluation procedure: [\[Link to the annex on standard evaluation procedure\]](#)

- Proposal page limits and layout: [\[as appropriate\]](#)

All topics	NN pages
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- Indicative timetable for evaluation and grant agreement<sup>35</sup>: [\[as appropriate\]](#)  
 - [specify planned date to inform applicants of outcome of evaluation, and.](#)  
 - [indicative date of signature of grant agreements or notification of grant decision](#)

	Information on the outcome of the evaluation ( <i>single or first stage</i> )	Information on the outcome of the evaluation ( <i>second stage</i> )	Indicative date for the signing of grant agreements
All topics	DDMMYYYY <a href="#">Maximum 6 months after the deadline</a>	-	DDMMYYYY <a href="#">Maximum 9 months after the deadline</a>

Consortia agreements: [\[as appropriate\]](#)

[Standard sentence on [climate change and/or sustainable development](#) [\[to be added as necessary\]](#)

<sup>35</sup> Should the call publication postponed, the dates in this table should be adjusted accordingly.

## **Factory of the Future Call**

*H2020 - FoF – 2014/2015*

### *Modernising Europe's Manufacturing Capabilities<sup>36</sup>*

The Public Private Partnership "Factories of the Future" (PPP FoF) builds on Europe's strengths in engineering and manufacturing technologies and supports the pan-European effort for re-industrialisation by uplifting the innovation capacity of manufacturing sector. ICT plays an essential role in innovating production systems in all sectors. It allows notably for a more personalized, diversified and mass-produced product portfolio and for rapid and flexible reaction to market changes.

In Horizon 2020 the PPP FoF is implemented in a complementary way under two pillars of the LEIT Programme: "Information and Communications Technologies" (ICT) and "Advanced Manufacturing and Processing". The calls support the 2013 Multi-Annual Roadmap for the PPP FoF, which was developed by the European Factories of the Future Research Association (EFFRA). The research activities in the FoF call also contribute to the implementation of the Strategic Research Agenda of the Public Private Partnership SPIRE (Sustainable Process Industry through Resource and energy Efficiency).

#### **FoF 1 - 2014: Process optimisation of manufacturing assets**

Specific Challenge: Today's manufacturing is increasingly challenged by uncertainties of continuously and rapidly -changing market conditions and increasingly shorter time-to-market requirements. Manufacturing value chains are distributed and dependent on complex information and material flow requiring new approaches inside and outside the factory both on process and product lifecycle level.

#### Scope:

**a. R&I Actions:** proposals are expected to cover one or more of the themes identified below, but not necessarily all of them.

**CPS-based process optimisation (Cyber-Physical Systems)** for adaptive and smart manufacturing systems bringing together novel concepts for CPS, progress in advanced control and new modelling and simulation technologies.

- Methods for Integrative Control and Optimization of Discrete and Continuous Processes supporting engineers in their aim of detecting, measuring and monitoring

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<sup>36</sup> The three Topics of this chapter correspond to the Challenge 1 objective 1.4 of the orientations and 1.3 of the budget table

the variables, events and situations which affect the performance, energy-use and reliability of manufacturing systems. Research should encompass progress in smart sensor technologies, smart system design, embedded systems and advanced control.

- Scalable CPS architectures for adaptive and smart manufacturing systems to dynamically enable the continuous design, configuration, monitoring and maintenance of operational capability, quality, and efficiency. Self-learning capabilities closing the feedback loop between production and design should be included as appropriate.

**Collaborative and mobile manufacturing:** Development of agile collaboration tools for process optimisation of manufacturing assets across the supply chain towards the Cloud-enabled Manufacturing Business Web. Research should address real-time architectures to master complexity of the supply network and underlying logistics resources.

**Towards zero-failure laser-based manufacturing:** Fast and accurate process monitoring systems allowing feedback control of laser process parameters in highly dynamic manufacturing processes. Actions should cover in particular the development of (in-line) process monitoring sensors, measurement and non-destructive testing tools including the related high speed data processing and reduction. Actions should include validation/demonstration elements and involve stakeholders covering the whole value chain.

#### **b. Support Actions**

Consensus building for a factory-wide interoperability framework for CPS engineering and manufacturing environments; concepts for a European smart specialisation strategy in manufacturing building on the model of virtual value chains; concept and roadmap building in relation to smart and safe workspaces for laser-based manufacturing.

#### Expected impact:

- Increased capability for better and faster reaction to market changes by being able to use holistic global and local optimization algorithms in a collaborative value chain.
- Reduced complexity of production systems by at least an order of magnitude through an interoperable de-centralised architecture approach and interoperability frameworks.
- Productivity increase of about 30% through the enhanced utilisation of resources and information taking a holistic view in a collaborative value chain.
- Strengthened market position of European producers of laser-based manufacturing equipment, their suppliers and of the users of the equipment.
- Reinforced capacity to manufacture high-quality and innovative products and to penetrate new application areas.

#### Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Coordination and Support Actions

### **FoF 2 - 2015: ICT-enabled modelling, simulation, analytics and forecasting technologies**

Specific Challenge: Simulating continuous and discrete manufacturing processes, forecasting the behaviour of manufacturing systems and processes, and designing products to an even larger extent through virtual mock-ups integrated in the design and production chain are key

enablers for Europe's future manufacturing sector. Advances in ICT in terms of high performance computing power and communication speed, smart sensor technologies for generating and exploiting "big data", the convergence of the embedded world and the Internet/Cloud world in cyber physical systems (CPS), multi-modal visualisation and interaction technologies, are leading to a new generation of modelling, simulation and forecasting methods and tools. These offer a huge potential for making the whole manufacturing chain more competitive.

Scope:

**a. R&I Actions:** proposals are expected to cover one or more of the themes identified below, but not necessarily all of them.

**Innovative modelling, simulation, analytics and forecasting tools for manufacturing at large**, building on advances in ICT. Projects should be driven by industrial use-cases and should include proof-of-concept demonstrations for validation. They should address as appropriate several of the following issues:

- Modelling and simulation methods involving multiple phenomena (physical, mechanical, energetic, chemical, energy, material characteristics, cost, ...); including multi-scale and integrated discrete/continuous models and multidisciplinary design optimisation tools taking a holistic approach; and/or integrating virtual and physical experiments building on the combination of simulated, experimental, and real world data in real time.
- Integrated knowledge-based systems covering the complete product life-cycle with advanced analytics and self-learning capabilities exploiting the availability of "big data" from smart sensors, historical process files, or human-authored data; and addressing aspects like interactivity, real-time, data-fusion, advanced visualisation, security and privacy.

**Integrated modelling, simulation and information management systems** benefiting from recent advances in ICT. Projects are expected to stimulate pre-normative or standardisation activities related to aspects such as information/knowledge exchange, data sharing, semantic technologies, tool integration, etc. Projects must include reference implementations and demonstration and validation in minimum two comprehensive and complementary industrial use cases. Focus is on:

- Integrated information management systems for product-process-production systems that are well embedded into their social, environmental and economic context.
- Advanced computer aided technologies (CAx), modelling and simulation toolboxes tailored for novel manufacturing processes like laser-based and additive manufacturing.

**b. Support Actions:** Road mapping and constituency building for novel ICT-enabled concepts in manufacturing supporting the wide adoption of virtual, integrated, scalable, semantic factory models; merging design and production models; and integrating novel ICT for creativity. Stimulating EU-US collaboration on R&I related to modelling and simulation.

Expected impact:

- Increased productivity during design and ramp-up phases and for higher mass customization capacity for big enterprises as well as SMEs through access to on-demand scalable manufacturing services and through agreed data standards.

- Improved cost efficiency and accuracy, reliability and speed of simulation techniques for manufacturing processes and/or full complex products.
- Reduced time to production and optimised supply chains enabled by increased tool interoperability and data integration.
- Enhanced interoperability of integrated product and factory design systems and global state monitoring enabling new type of services related to the data analysis, simulations and visualization techniques in each manufacturing stage.

Types of action:

- a. Research & Innovation Actions (100% funding)
- b. Coordination and Support Actions

**FoF 3 - 2015: ICT Innovation for Manufacturing SMEs (I4MS)**

Specific Challenge: For Europe's competitiveness in manufacturing, it is crucial that advances in ICT are taken up in engineering and manufacturing "at large" as soon as they have the appropriate maturity level.

Scope: As Phase 2<sup>37</sup> of I4MS this objective addresses the adoption of the next generation of ICT advances in the manufacturing domain. Focus is on emerging innovative technologies and processes, which need to be customised, integrated, tested and validated before being released on the market. Special emphasis is on strengthening European SMEs along the value chain by adopting new concepts and business models based on servitisation, for product operation, or for end-of-life use.

Two types of **innovation experiments** are supported: Driven by the requirements of first-time users, **Application Experiments** bring together all actors of the value chain and experts necessary to equip new users with novel products or services and assist them in customising and applying these in their respective environments. In **Equipment Assessment Experiments**, suppliers of innovative high-tech equipment install and assess their prototypes or products in production-like environments and validate them in a manufacturing line or in an industrial environment that is very close to manufacturing conditions.

Activities are expected to be clustered in larger projects to achieve critical mass and to better exploit EU-added value. Common tasks include: targeted dissemination; management of calls for new actions; exploitation of synergies across actions. To better cope with the speed of innovation in ICT, implementation must be flexible and fast. Part of the actions and partnership are to be defined from the outset, while additional experiments or users, may be identified through open calls during the action (max. 50% of the total budget).

- a. Three areas of technologies are targeted for the **Innovation actions**:
  - Highly flexible and near-autonomous robotics systems (application experiments).
  - HPC Cloud-based modelling, simulation and analytics services for modelling multiple interconnected phenomena; for integrating multiple tools across the process chain; for exploiting the dynamic availability of "big data"; for integrating novel mobile interfaces for data management and decision support; and/or for achieving real-time response (application experiments).

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<sup>37</sup> Information of Phase 1 available in [http://cordis.europa.eu/fp7/ict/computing/home-i4ms\\_en.html](http://cordis.europa.eu/fp7/ict/computing/home-i4ms_en.html)

- Integration of Cyber-Physical-System modules in manufacturing processes and process chains (application or assessment experiments) to increase sophistication and automation in production SMEs and to create novel value added services linked to process surveillance and maintenance.

**b. Support actions:** network of Innovation multipliers leveraging investment in research and innovation is to be reinforced:

To advance the European I4MS **innovation ecosystem**: The aim is to achieve broad coverage in technological, application, innovation, and geographic terms. Its tasks and services shall include maintaining a single innovation portal for newcomers; sharing of best practices and experiences; dissemination; brokering between users and suppliers in view of open calls; leveraging further investment by stimulating replication, by brokering access to venture capital or other private investment, and by exploiting regional funds in the context of the European strategy on "Smart Specialisation".

Expected impact:

- Attract a significant number of new users of **advanced ICT** in the **manufacturing sector**, in particular SMEs and the mid-caps.
- More **innovative and competitive technology suppliers**, in particular SMEs, both on the level of ICT and on the level of manufacturing equipment, able to supply manufacturers with new equipment, components, and tools for improved manufacturing and engineering operations.
- More competitive **European service providers** through provisioning of new types of services; through strengthening the presence on local markets.
- Exploration of new application areas for advanced ICT in manufacturing at large.

Types of action:

- a. Innovation Actions (70% funding)
- b. Coordination and Support Actions

**FoF 4 - 2015: Development of novel materials and systems for OLED lighting or displays<sup>38</sup>**

Specific Challenge: The further technological development of solid-state light sources (LEDs and OLEDs) and of energy efficient lighting systems is expected to give Europe a leading position on the world lighting market and create new manufacturing jobs for novel consumer products. Moreover, the move to solid-state lighting based on inorganic (LED) and organic (OLED) semiconductors constitutes an important factor in reducing the amount of electricity consumed by lighting and thus limiting carbon dioxide emissions. An important part of the research on lighting will also be relevant to advanced displays

Scope: **R&I Actions** should focus on materials, process and device technology for OLED lighting or for OLED displays. The aim is to realise OLED devices over larger surfaces, with higher brightness, larger uniformity and longer lifetimes. A demonstrator should be provided at the end of every project. A specific target for OLED lighting is energy efficacy of above

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<sup>38</sup> the presence of this topic in this section of the WP has to be finally confirmed

100 lm/W, considering also improved out-coupling efficiency; a specific target for OLED display materials is to enable brightness well above several kcd/m<sup>2</sup>. The materials have to allow sufficient life time for all colours and white light (lifetime of several hundred hours at 97% of the original intensity). Proposals should involve material suppliers and organic SSL/display manufacturers or suppliers.

Expected impact:

- Cost performance breakthroughs - lighting systems with production costs of 1€/100 lm.
- Secured and reinforced industrial technology leadership and substantially increased market presence in lighting and displays.
- Improved business opportunities and value creation in Europe in lighting and displays by reinforced cooperation along the value chain.

Type of Action:

Research & Innovation Actions (100% funding)

***Conditions for this call***

**H2020-FoF-2014/2015**

Publication date: 11 December 2013<sup>39</sup>.

Deadline(s): at 17.00.00 Brussels time on the following dates

FoF1	May 2014 <sup>40</sup>
FoF2, FoF3, FoF4	December 2014 <sup>41</sup>

Indicative budget: [[Link to the relevant option on "margin of manoeuvre"](#)]

Overall indicative budget: EUR 34 million from the 2014 budget<sup>42</sup> and EUR 77 million from the 2015 budget<sup>43</sup>

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<sup>39</sup> The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication.

<sup>40</sup> The Director-General responsible may delay this deadline by up to two months.

<sup>41</sup> The Director-General responsible may delay this deadline by up to two months.

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<i>All single stage</i>		2014 EUR million	2015 EUR million
Process optimisation of manufacturing assets	FoF1.a	32	
	FoF1.b	2	
ICT-enabled modelling, simulation, analytics and forecasting technologies	FoF2.a		31
	FoF2.b		1
ICT Innovation for Manufacturing SMEs (I4MS)	FoF3.a		35
	FoF3.b		1
Development of novel materials and systems for OLED lighting or displays	FoF4		9

Eligibility conditions:

all topics	The standard eligibility conditions apply. Please read carefully <a href="#">the provisions [Link to the annex on standard eligibility conditions]</a> under Annex X before the preparation of your application.
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Evaluation criteria:

all topics	The standard evaluation criteria apply. Please read carefully <a href="#">the provisions [Link to the annex on standard evaluation criteria]</a> under Annex X before the preparation of your application.
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Evaluation procedure: [\[Link to the annex on standard evaluation procedure\]](#)

- Proposal page limits and layout: [\[as appropriate\]](#)

All topics	NN pages
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- Indicative timetable for evaluation and grant agreement<sup>44</sup>: [\[as appropriate\]](#)

- [specify planned date to inform applicants of outcome of evaluation, and.](#)

- [indicative date of signature of grant agreements or notification of grant decision](#)

	Information on the outcome of the evaluation ( <i>single or first stage</i> )	Indicative date for the signing of grant agreements
all topics,	DDMMYYYY	DDMMYYYY

<sup>42</sup> Subject to the adoption of the draft budget 2014 by the Budgetary Authority without modifications of the appropriations foreseen on the corresponding budget line (09 04 02 01) or the availability of appropriations in 2014 under the rules of provisional twelfths referred to in Article 315 of TFEU.

<sup>43</sup> These amounts will be included in the financial decision for 2015.

<sup>44</sup> Should the call publication postponed, the dates in this table should be adjusted accordingly.

**HORIZON 2020 – WORK PROGRAMME 2014-2015**  
LEIT – Information and Communication Technologies

	<i>Maximum 6 months after the deadline</i>	<i>Maximum 9 months after the deadline</i>
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Consortia agreements: *[as appropriate]*

[Standard sentence on climate change and/or sustainable development *[to be added as necessary]*

## **EU-Brazil Research and Development Cooperation in Advanced Cyber Infrastructure**

*H2020 – EUB – 2015*

This topic is a major element for the implementation of EU-Brazil cooperation in the area of future networks and e-infrastructures. It sets the basis for further progress in three distinctive themes, with the objective of developing common positions, standards and interoperable systems for cloud computing, HPC and experimentation facilities for internet technologies. It aims as well at reinforcing the mechanisms for an efficient definition and implementation of joint R&D actions. Proposals with balanced participation of EU and Brazilian partners should make a substantial contribution to the identified themes indicating the benefits of a joint effort.

### **EUB 1 – 2015: Cloud Computing, including security aspects**

Specific Challenge: Data are motivating a profound transformation in the culture and conduct of scientific research in every field of science and engineering. Advancements in this area are required in terms of cloud-centric applications for big data, as well as in creating novel cloud technologies that provide effective utilization and optimization of heterogeneous resources (such as storage and communications) in big data scenarios, in particular addressing privacy, security and other Quality-of-Service issues.

#### Scope:

- The focus of the **joint research** will be the development of innovative technologies combining advanced Clouds and Big Data approaches to address the challenges stemming from different application domains in business and societal contexts. The technologies developed should take into account interoperability and data portability issues and aim towards future standardization.
- Coordinated and Support Actions

One CSA for the research coordination and policy activities, including research roadmapping and supporting further future common activities, i.e. dissemination, organisation of workshops, preparation of future coordinated call topics, etc.

#### Expected impact::

The joint EU-Brazil research will develop innovative technologies in the area of cloud based service provision by integrating approaches and aspects of distributed Clouds and Big data. This collaboration will facilitate policy coordination in the relevant areas between the EU and Brazil, subsequently to be expanded to other LAC partners. In particular:

- Facilitate the development of cloud enabled applications through robust standardized global technologies.
- Development of technologies integrating cloud and big data in terms of architecture, middleware and services.
- Joint contributions to International Standardization and/or Forum activities.

Types of action:

Research & Innovation Actions (100% funding)  
Coordination and Support Actions

**EUB 2 – 2015: High Performance Computing (HPC)**

Specific Challenge: The work aims at the development of state-of-the-art High Performance Computing (HPC) environment that efficiently exploits the HPC resources in both the EU and Brazil and advances the work on HPC applications in domains of common interest.

Scope: Specific focus will be on application work of HPC on societal challenges and in areas such as transport, energy, environment, climate, health and bio-sciences, prediction and simulation of natural disasters, disaster prevention and crisis management, urban development etc.

Expected impact:

Applications benefitting from this environment could have a direct impact in a number of fields of common interest such as climate change, natural resources management, bio and life sciences. Actions on this topic will increase efficiency in the usage of expertise and HPC e-Infrastructures that exploit the computational, communication and data resources existing on both sides of the Atlantic.

- Improved co-operation of EU-Brazil academia on advanced computing for HPC application development
- Improved sharing of information and expertise to solve societal problems with the use of advanced computing
- Enhanced co-operation of industries in the relevant application areas, in EU and Brazil
- Improvement in early warning of natural disasters

Types of action:

Research & Innovation Actions (100% funding)

**EUB 3 – 2015: Experimental Platforms**

Specific Challenge: The objective of cooperation in the area of Experimental Platforms is to enable and promote the federation of experimental resources irrespective of their localization in Brazil and in Europe, with a view towards global experimentation across heterogeneous networks, both wired and wireless, and a variety of end-systems.

Scope: The focus is on building upon current tools and platforms in support of end-to-end experimentation, creating a pool of, and giving open access to, shared experimental resources that complement and supplement those available in each continent.

Linking to existing FIRE facilities is a requirement.

Expected impact:

Improving access to, and broadening the scope of, experimental facilities, as well as promoting experimentally-driven research with end-user involvement.

Types of action:

Research & Innovation Actions (100% funding)

***Conditions for this call***

**H2020-EUB-2015**

Publication date: December 2014 (indicatively)

Deadline(s): at 17.00.00 Brussels time on the following dates

All topics	April 2015 <sup>45</sup>	
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Indicative budget: [\[Link to the relevant option on "margin of manoeuvre"\]](#)

Overall indicative budget: EUR 7 million from the 2015 budget<sup>46</sup>

<i>All single stage</i>		2015 EUR million
Cloud Computing, including security aspects	EUB1	3.5
High Performance Computing (HPC)	EUB2	2
Experimental platforms	EUB3	1.5

Eligibility conditions:

all topics	The standard eligibility conditions apply. Please read carefully <a href="#">the provisions [Link to the annex on standard eligibility conditions]</a> under Annex X before the preparation of your application.
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Evaluation criteria:

all topics	The standard evaluation criteria apply. Please read carefully <a href="#">the provisions [Link to the annex on standard evaluation criteria]</a> under Annex X before the preparation of your application.
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<sup>45</sup> The Director-General responsible may delay this deadline by up to two months.

<sup>46</sup> These amounts will be included in the financial decision for 2015.

Evaluation procedure: *[Link to the annex on standard evaluation procedure]*

- Proposal page limits and layout: *[as appropriate]*

All topics	NN pages
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- Indicative timetable for evaluation and grant agreement<sup>47</sup>: *[as appropriate]*

*- specify planned date to inform applicants of outcome of evaluation, and.*

*- indicative date of signature of grant agreements or notification of grant decision*

	Information on the outcome of the evaluation ( <i>single or first stage</i> )	Indicative date for the signing of grant agreements
all topics,	DDMMYYYY <i>Maximum 6 months after the deadline</i>	DDMMYYYY <i>Maximum 9 months after the deadline</i>

Consortia agreements: *[as appropriate]*

[Standard sentence on climate change and/or sustainable development *[to be added as necessary]*

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<sup>47</sup> Should the call publication postponed, the dates in this table should be adjusted accordingly.

## **EU-Japan Research and Development Cooperation in Net Futures**

*H2020 – EUJ – 2014*

This topic is a major element for the implementation of EU-Japan cooperation in the area of future networks. It sets the basis for further progress in four distinctive themes, with the objective of developing common positions, standards and interoperable systems for critical networks and computing platforms. It aims as well at reinforcing the mechanisms for an efficient definition and implementation of joint R&D actions. Proposals with balanced participation of EU and Japanese partners should make a substantial contribution to the identified themes indicating the benefits of a joint effort.

### **EUJ 1 – 2014: Technologies combining big data, internet of things in the cloud**

Specific Challenge: Big data, internet of things are trends which will influence and impact the future development of cloud computing systems. Information gathering, processing and computing of massive amounts of data generated from and delivered to highly distributed devices (e.g. sensors and actuators) creates new challenges, especially for services and data hosted and executed across borders including EU and Japan. These requirements will impact the underlying cloud infrastructure requiring efficient management of very large sets of globally distributed non-structured or semi-structured data that could be produced at very high rates (i.e. big data). A multi-cloud service platform supported by broadband networks needs to handle all these challenges and appear to the application environment as one uniform platform.

Scope: The focus of the joint research is the development of innovative global cloud platform technologies to meet the new challenges of big data, mobile and IoT. It should address requirements from business and industrial applications, such as robotics or factory automation and/or societal applications, such as health management for an aging society.

The outcome of the research will be a global, scalable and flexible service platform for developing real time services which can process, integrate and visualize Big Data over advanced integrated cloud and network infrastructures.

Future standardization requirements should be considered. The technologies developed should be validated through relevant use cases and demonstrations requiring the combination of real world sensors and/or actuators with “big data” infrastructures over clouds.

#### Expected impact:

- Credible demonstrations based on cross-border business and/or societal applications of robust interoperable technologies combining big data, IoT and mobile on cloud platforms.
- Concrete implementations of interoperable solutions that integrate big data, IoT and mobile that are candidates for standardisation.
- Potential for commercial application in business environments, expressed in the form of a credible international exploitation plan.

Types of action:

Research & Innovation Actions (100% funding)

**EUJ 2 – 2014: Access networks for densely located users**

Specific Challenge: The topic focus on technologies and system approaches to realize high speed/high capacity dense local networks, as may be encountered in very high density locations where many users use high-capacity broadband applications. The goal is to develop high-performance heterogeneous access network systems which have dynamic resource allocation capability.

Scope: As last-mile connection links, future network systems would comprise various broadband transmission media such as optical fibres, millimetre-wave links, etc. to add to current access technology. The objectives of this activity is to optimize link performance from points of views, such as CAPEX, OPEX, radio-wave resources and environmental constraints without compromising the applicability in wide variety of use cases such as dense business districts, conference sites, evacuation sites, schools, railway stations, etc. Research should include network architecture using service centric network control. Technological focus would be also on low-cost broadband link technologies designed for cross-layer control, and on reduction of power consumption in access networks. Life cycle assessment of hardware in the network would be a target in the topic.

Expected impact:

- Better exploitation of new broadband links for short range, very high capacity communication applications in dense environments.
- Key enabling technologies for the future generations of integrated/heterogeneous access network systems with improved economic, spectral and energy efficiency.
- Joint identification of standardization requirements and contribution to standardization bodies and fora.

Types of action:

Research & Innovation Actions (100% funding)

**EUJ 3 – 2014: Optical communications**

Specific Challenge: The research activity focuses on technologies of optical transport networks, which will allow coping with the expected significant traffic growth and meet the flexibility requirements imposed by major trends in the evolution of network usage, out of which cloud computing notably.

Scope: The proposed research should target at least one of two following topics:

- Programmable optical hardware

In order to allow more flexibility in the control and management of optical networks and enable the advent of software defined optical networking, further work in the development of flexible/programmable optical hardware is required.

- Super-capacity optical transport networks

The continuous increase in traffic demand calls for new approaches to transmission over optical fibres, so that progresses of several orders of magnitude can be achieved in the capacity of transport networks. Amongst these new approaches, one can notably mention Space Division Multiplexing.

Expected impact:

- Key enabling technologies that contribute to the emergence of new generations of optical transport networks, which will allow coping with the expected significant traffic growth and meet the flexibility requirements.
- Joint contributions to International Standardization and/or Forum activities.

Types of action:

Research & Innovation Actions (100% funding)

**EUJ 4 – 2014: Experimentation and development on federated Japan – EU testbeds**

Specific Challenge: Connecting, federating and sharing experimental platforms and testbeds in Europe with NICT's orchestrated Smart ICT testbed in order to carry-out global large-scale experimentations.

Scope: Research and developments targeting at least one of the following challenges:

- Enhancing the federation of existing Internet of Things and Smart ICT related testbeds and extending the research performed on them to new areas, such as distributed systems for economics, biology or mechanical engineering; multimedia collaboration; etc.
- Developing and implementing Internet of Things and Smart ICT open federated architectures for experimentation and performing, on top of them, joint research on innovative Smart ICT solutions for end-users (citizens, workers including home and mobile ones) in private or working environments. The solutions under experimentation should preferably address public services or applications for health, elderly, smart cities, smart buildings, energy management and should explore emerging concept, such as participatory sensing. They should also investigate the related interoperability, privacy and security issues.

Expected impact:

- Enlarging the scope and facilitating the access to Japanese and European experimental facilities to a larger community of researchers in both regions, in terms of quantity and research areas.
- Validating interoperable technologies for IoT and Smart ICT, addressing common social, economic and cultural aspects between Japan and Europe.
- Enabling very large experimentation and trials including end-users or citizens.

- Developing joint open architecture for federation of testbeds with world scale dimension in view of re-usability with other international experimental platforms.

Types of action:

Research & Innovation Actions (100% funding)

***Conditions for this call***

**H2020-EUJ-2014**

Publication date: 11 December 2013<sup>48</sup>.

Deadline(s): at 17.00.00 Brussels time on the following dates

All topics	May 2014 <sup>49</sup>	
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Indicative budget: [[Link to the relevant option on "margin of manoeuvre"](#)]

Overall indicative budget: EUR 6 million from the 2014 budget<sup>50</sup>

<i>All single stage</i>		2014 EUR million
Technologies combining big data, internet of things in the cloud	EUJ1	1.5
Access networks for densely located users	EUJ2	1.5
Optical communication	EUJ3	1.5
Experimentation and development on federated Japan – EU testbeds	EUJ4	1.5

Eligibility conditions:

all topics	The standard eligibility conditions apply. Please read carefully <a href="#">the provisions [Link to the annex on standard eligibility conditions] under Annex X</a> before the preparation of your application.
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<sup>48</sup> The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication.

<sup>49</sup> The Director-General responsible may delay this deadline by up to two months.

<sup>50</sup> Subject to the adoption of the draft budget 2014 by the Budgetary Authority without modifications of the appropriations foreseen on the corresponding budget line (09 04 02 01) or the availability of appropriations in 2014 under the rules of provisional twelfths referred to in Article 315 of TFEU.

Evaluation criteria:

all topics	The standard evaluation criteria apply. Please read carefully <a href="#">the provisions [Link to the annex on standard evaluation criteria]</a> under <b>Annex X</b> before the preparation of your application.
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Evaluation procedure: [\[Link to the annex on standard evaluation procedure\]](#)

- Proposal page limits and layout: [\[as appropriate\]](#)

All topics	NN pages
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- Indicative timetable for evaluation and grant agreement<sup>51</sup>: [\[as appropriate\]](#)

- [specify planned date to inform applicants of outcome of evaluation, and.](#)

- [indicative date of signature of grant agreements or notification of grant decision](#)

	Information on the outcome of the evaluation ( <i>single or first stage</i> )	Indicative date for the signing of grant agreements
all topics,	DDMMYYYY <a href="#">Maximum 6 months after the deadline</a>	DDMMYYYY <a href="#">Maximum 9 months after the deadline</a>

Consortia agreements: [\[as appropriate\]](#)

[Standard sentence on climate change and/or sustainable development [\[to be added as necessary\]](#)

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<sup>51</sup> Should the call publication postponed, the dates in this table should be adjusted accordingly.

## **Other actions (not subject to calls for proposals)**

### **1. External expertise**

This action will support:

- The use of appointed independent experts for the evaluation of project proposals and, where appropriate, for the reviewing of running projects.
- The setting up of groups of independent experts to advise on or support the design and implementation of EU research policy.

Type of action: Expert contracts

Indicative budget: EUR 15 million from the 2014 budget<sup>52</sup> and EUR 15 million from the 2015 budget<sup>53</sup>

### **2. ICT conferences, studies and other events**

In addition to calls for proposals, other actions are also expected to be undertaken on specific activities that the DG CNECT will support. These include:

- The organisation of an ICT proposers day. DG CNECT plans to conclude a service contract in the first semester of 2014, and also use existing Framework Contracts for this purpose. Indicative budget in 2014: EUR 0.5 million.

The organisation of the ICT conference. DG CNECT plans to conclude about 4 service contracts in 2014, and also use existing Framework Contracts for this purpose. Indicative budget in 2014: EUR 5 million.

– The organisation of Digital Agenda Assemblies 2014 and 2015. DG CNECT plans to conclude about 2 service contracts in the first semester of 2014 and 2 service contracts in the first semester of 2015, and also use existing Framework Contracts for this purpose. Indicative budget in 2014: EUR 0,9 million. Indicative budget in 2015: EUR 0,9 million.

– 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 CNECT plans to procure via framework contracts and calls for tender

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<sup>52</sup> Subject to the adoption of the draft budget 2014 by the Budgetary Authority without modifications of the appropriations foreseen on the corresponding budget line (09 04 02 01) or the availability of appropriations in 2014 under the rules of provisional twelfths referred to in Article 315 of TFEU.

<sup>53</sup> These amounts will be included in the financial decision for 2015.

indicatively 40 study contracts before the end of 2015. Indicative budget in 2014: EUR 6 million. Indicative budget in 2015: EUR 6,7 million.

– Policy support activities, including benchmarking activities, evaluation and impact assessments, the development of ad hoc support software, possibly using existing Framework Contracts. Indicative budget in 2014: EUR 3 million. Indicative budget in 2015: EUR 1 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 2014 and 2015. Indicative budget in 2014: EUR 1.5 million. Indicative budget in 2015: EUR 1.5 million.

Details will be provided in the texts of these calls for tender.

Type of action: Public Procurement

Indicative budget: EUR 16.9 million from the 2014 budget<sup>54</sup> and EUR 10.1 million from the 2015 budget<sup>55</sup>

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<sup>54</sup> Subject to the adoption of the draft budget 2014 by the Budgetary Authority without modifications of the appropriations foreseen on the corresponding budget line (09 04 02 01) or the availability of appropriations in 2014 under the rules of provisional twelfths referred to in Article 315 of TFEU.

<sup>55</sup> These amounts will be included in the financial decision for 2015.