

HORIZON 2020

WORK PROGRAMME 2014 – 2015

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

DRAFT

Approved by ICT "National Expert Group"

Pending Commission Decision

(European Commission Decision C(2013)XXX of 10 December 2013)

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Information and Communication Technologies Calls

H2020 - ICT - 2014
H2020 - ICT – 2015

Proposals are invited against the following topics:

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) and EPoSS (www.smart-systems-integration.org).

The first specific challenge addressed it to reinforce and expand Europe's leading industrial position in embedded systems and cyber-physical systems. The other two 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 making "smarter", more intelligent, more energy-efficient and more comfortable our transport systems, cars, factories, hospitals, offices, homes, cities and personal devices. Focus is on both reinforcing European industrial strengths as well as exploring new markets.

Often endowed with control, monitoring and data gathering functions, CPS need to comply with essential requirements like safety, privacy, 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 , smart buildings 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, suppliers of sub-systems, system integrators, auditors/certification bodies of systems and related academia and research institutes (including Social Sciences and Humanities).

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, privacy, reliability, energy efficiency and dependability features, and addressing security and privacy "by design" across all levels. 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. Innovation Actions will stimulate innovation and connect 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. Proposals should cover one or both of the following themes.

- **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, user involvement and validation in key application domains. Proposals requesting a Small contribution are expected.
- **Towards a "smart everywhere" society:** Support will go to 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 must **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 and foster collaboration and trust, as well as openness and pre-normative measures. Work should build on and be complementary to EU, national and regional activities such as pilot projects in ENIAC, ARTEMIS and ECSEL.

Proposals requesting a Large contribution are expected. The action may involve financial support to third parties¹. The consortium will define the selection process of additional users and suppliers running the experiments for which financial support will be granted (typically in the order of EUR 50.000 – 150.000² per party). Maximum 50% of the EU funding requested by the proposal should be allocated to this purpose.

- c. **Support Actions** for cross-sectorial platform-building, structuring of constituencies and road-mapping, dissemination of programme achievements and impact analysis, development of a strategic collaboration agenda for pre-competitive research on the foundations of 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 cyber-physical systems (e.g. human behaviour, social aspects, liability, security and privacy).

Expected impact:

- Reduction of development time for CPS by 30% as compared to the state-of-the-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 creating open innovation eco-systems and 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 with built-in security. 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 – A mix of proposals requesting *Small* and *Large contributions* is expected
- b. Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* is expected

¹ In view of the implementation of financial support to these third parties selected through open calls, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, the definition of the persons or categories of persons which may receive financial support, the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support and the maximum amount to be granted to each third party and the criteria for determining it.

² In line with the Rules for Participation Article 19 (7) the amounts referred to in Article 137 of the Financial Regulation may be exceeded where it is necessary to achieve the objectives of the action.

c. Coordination and Support Actions

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

ICT 2 – 2014: Smart System Integration

Specific Challenge: The aims are to develop the next generations³ 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 of topic ICT25.

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, electrochemical, 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.
- 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, including sensing, storing, processing, actuation and ultra-wideband communication.

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.

³ According to EPoSS (European Technology Platform for Smart Systems Integration) Strategic Research Agenda

- 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 enabling the take-up and deployment of lab on chip based technology developments 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. Research & Innovation 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, telecom, consumer, safety and security, 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. Pre-commercial procurement action**
 - Increased awareness, access and adoption of innovative solutions by European public procurers in healthcare.
- d. Coordination and Support Actions**
 - More coordinated R&I activities in smart systems integration in Europe; increase awareness, education and training skills.

Types of action:

- a. Research & Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* are expected
- b. Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* are expected

- c. Pre-Commercial Procurement (PCP) Cofund actions – Proposals requesting a *Small contribution* are expected
- d. Coordination and Support Actions

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

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 in large area electronics 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. Research & Innovation Actions⁴

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, photonics 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 Actions⁵

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

⁴ Research & Innovation actions on OLEDs are addressed under ICT 29 as a joint LEIT ICT and NMP action.

⁵ Manufacturing of predominantly OLED products is addressed under ICT28.

(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 Europe⁶.

c. Technology Take-up and Innovation Support actions

Access services⁷ 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

Enabling the take-up and deployment of electronic and photonic textile technology developments 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.

c. Technology Take-up and Innovation and support Actions

- Reinforced innovation effectiveness of TOLAE excellence centres and innovation clusters in particular towards SMEs.
- Broad take-up of TOLAE technologies in innovative products by at least 40 SMEs substantially improving their innovation capacity and time-to-market and with demonstrable revenue growth.
- Increased awareness and education and training skills in TOLAE.

6 Wherever appropriate, they could 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.

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

d. Innovation support through pre-commercial public procurement actions

- Wide diffusion of innovative and cost-effective electronic and photonic textile technology developments 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 – Proposals requesting a *Small contribution* are expected
- b. Innovation Actions – Proposals requesting a *Large contribution* are expected
- c. Research & Innovation Actions – One proposal requesting a *Small contribution* is expected to be selected
- d. Pre-Commercial Procurement (PCP) Cofund actions; any remaining funds will be transferred to types of action a and b.

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

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 in the *Excellent Science* pillar under Research Infrastructures and FET (actions on High Performance Computing).

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 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. Research & Innovation Actions should cover one or both of 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, using cutting-edge technologies like, for example, optical interconnects, 3D integrated system on chip, innovative power management, which can be deployed across the full spectrum of home, embedded, and business applications. Focus is on integration of hardware and software components into fully working prototypes and including validation under real-life workloads from various application areas. Specific emphasis is given on low-power, low-cost, high-density,

secure, reliable, scalable small form-factor datacentres ("datacentre-in-a-box"). Proposals requesting a Large contribution are expected.

- **New cross-layer programming approaches** empowering developers to effectively master and exploit the full potential of the next generations of computing systems based on heterogeneous parallel architectures and 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 intrinsically parallel code 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. Proposals requesting a small contribution are expected.

b. Innovation Actions: Activities aim at stimulating broad adoption of customised low power computing technologies. They should cover one or both of 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 be use-case driven and 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. Proposals requesting a small contribution are expected.
- **Connecting innovators across value chains:** Driven by the requirements of users, application experiments must 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 centres of excellence to achieve critical mass and to better exploit EU-added value. Proposals requesting a Large contribution are expected. The action may involve financial support to third parties⁸. The consortium will define the selection process of additional users and suppliers running the experiments for which financial support will be granted (typically in the order of EUR 50.000 – 150.000⁹ per party). Maximum 50% of the EU funding requested by the proposal should be allocated to this purpose.

c. Support Actions for cross-sectorial platform-building, for clustering of related research projects, for structuring the European academic and industrial research communities, for dissemination of programme achievements and impact analysis and for constituency building and road-mapping for future research and innovation agendas.

⁸ In view of the implementation of financial support to these third parties selected through open calls, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, the definition of the persons or categories of persons which may receive financial support, the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support and the maximum amount to be granted to each third party and the criteria for determining it.

⁹ In line with the Rules for Participation Article 19 (7) the amounts referred to in Article 137 of the Financial Regulation may be exceeded where it is necessary to achieve the objectives of the action.

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; increased public trust in embedded applications due to secure and reliable architectures.

Types of action:

- a. Research & Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* is expected
- b. Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* is expected
- c. Coordination and Support Actions

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

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 also benefiting from the geospatial capabilities of the Future Internet.

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 – 2014: Smart Networks and novel Internet Architectures

Specific Challenge: The 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 business models, processes, 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 bring computer architectures and network architectures closer for greater efficiency.

Multiple approaches have been researched: Information Centric Networks, Named Data Networking, Publish Subscribe information Networking, opportunistic and Disruption Tolerant 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 and privacy, 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:

- 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 related International developments, e.g. with the US NSF Future Internet Architecture programme follow up and with similar programmes in Asia, notably Korea and Japan, supporting global views on open standards and interoperability.
- Migration/deployment strategies and roadmaps validated by key industrial players (operators/service providers) and the other stakeholders (regulators, policy makers) taking an active part in the development of the internet.
- Strengthen European industry for closer integration of datacom and telecom.
- Contribution towards at least one large scale validation trial.

Type of action:

Research & Innovation Actions – Proposals requesting a *Small contribution* are expected

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

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"¹⁰. Finally,

¹⁰ COM(2012) 478 final

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.

Scope:

a. Research & Innovation actions: proposals are expected to cover one or both of 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 and management of optical network resources within and across operator's domains for lower cost and more flexible use of resources; ii) the ubiquitous delivery of very high speed access at 10 Gbps per user within 10 years and 100 Gbps later (including visible light communication); iii) the architectural limitations of inter and intra datacenter connectivity; iv) the limitations of current optical transmission technologies. Attention must be given to ensuring compatibility with legacy infrastructures and access unbundling regulation as well as to cost- and energy-efficiency.
- **Focus on wireless networks** - It addresses the lack of dynamic control of wireless network resources through disruptive new "femtocell" like paradigms where end-users play the role of "prosumers" of wireless connectivity. Optimised spectrum use; energy efficiency and new usages are targeted. More flexible use of spectrum may be addressed from an architectural perspective including cognitive radio and spectrum aggregation, usage of higher bands up to 90 GHz, advanced modulation and coding, adaptive beam forming techniques. Hybrid combination of terrestrial and satellite infrastructures to address complete coverage, optimised spectrum use and network resilience are also in scope.

b. 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.
- Support metro and core networks with Pb/s throughput and Tb/s interface speeds.

- Enable managed and automated cross domain optical resources and foster emergence of industry open standards.
- Reach higher spectrum efficiency, target 10 fold increase.
- 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.

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 – Proposals requesting a *Small contribution* are expected
- b. Coordination and Support Actions

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

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 actions:** 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 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, configuration and management 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" concept¹¹ that requires interoperable, reusable modules for public service functionalities. These are likely to be cross-institutional, cross-sector, easily used, re-used and combined dynamically¹² to address specific needs.
 - **Cloud security:** Mechanisms, tools and techniques to increase trust, security and transparency of cloud infrastructures and services, including data integrity, localisation and confidentiality, also when using third party cloud resources.
- b. Innovation Actions: 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.

¹¹ Concept launched and tested in the CIP ICT PSP calls

¹² Study on cloud and service-oriented architectures for e-government 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 – A mix of proposals requesting *Small* and *Large contributions* is expected
- b. Innovation Actions – Proposals requesting a *Small contribution* are expected
- c. Coordination and Support Actions

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

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 related to procurement, trustworthiness, 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, reliable and integrated 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 Strategy¹³ and in particular on the work undertaken by the project C4E¹⁴. If relevant and justified, activities can develop on cloud computing initiatives at local, national and international levels. Dissemination and best practice activities must 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. 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 Strategy¹⁵, 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 must provide an appropriate benchmarking for the claimed impacts.

Type of action:

- a. Pre-Commercial Procurement (PCP) Cofund actions – Proposals requesting a *Large contribution* are expected
- b. Public Procurement for Innovative solutions Cofund actions– Proposals requesting a *Large contribution* are expected.

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

13 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>)

14 <http://www.cloudforeurope.eu/>

15 See previous reference

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 of the themes identified below.

- **Software tools and methods for large, complex and data-intensive systems:** Tools and methods for incorporating integrity, robustness, reliability and resilience into evolving software systems across the complete software lifecycle, especially for complex and secure business-critical systems. Innovative means to manage the complexity of large software and data-intensive systems, including simulation, testing and verification.
- **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 and sensors.

Expected impact:

- A significant and substantiated productivity increase in the development, testing, verification, 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 be effectively and securely tackled.
- At macro level, evidence of potential for productivity gains through appropriate use cases in EU industry.

Types of action:

Research & Innovation Actions – Proposals requesting a *Small contribution* are expected

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

ICT 10 – 2015: 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, through participation and interaction, to adopt more sustainable individual and collective behaviours and lifestyles. The challenge includes the deployment at larger scales of digital social platforms for multi-disciplinary groups developing innovative solutions to societal challenges.

Scope:

a. 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 distributed social networks, sensor networks and knowledge co-creation networks. Such scalable experiments and prototypes are expected to gain evidence and better understanding on the processes about collective awareness.

These pilots should be grounded on recent developments in open data, open source, distributed social networking and open hardware. Pilots must seize the full potential of existing mobile communications, 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 crowdsourcing/crowdfunding solutions and new mechanisms for social innovation whose expected return goes beyond GDP measures and traditional success indicators¹⁶.

Pilots should be user-driven, involving existing communities of people, and possibly addressing a combination of sustainability areas. Participants should 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 (Internet Science)

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, (user-centric) 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, visualisation of social interactions and trends.

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.

¹⁶ Concrete examples of areas and topics can be found at <http://ec.europa.eu/digital-agenda/en/collectiveawareness> ."

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

c. Digital Social Platforms (DSP)

Digital Social Platforms will facilitate the transposition of existing or emerging participative and inclusive societal solutions to larger transnational scales through:

- engagement of additional stakeholders so far excluded from the innovation process (removing barriers for users at risk of exclusion and for those who consider themselves unsuited for participation),
- creation of concrete incentives for cooperation across countries and across domains, and
- raising awareness, at societal, political and technological levels, about the effectiveness and best practices of such solutions.

They can build on established and open multi-stakeholder networks and communities, such as European Innovation Partnerships, and apply a suitable ICT-enabled cooperative environment to support their expansion and governance, accelerating knowledge creation and innovation. Work should address bottom up innovation activities.

Proposals must address critical factors for successful demand-driven societal innovation, including new collaborative business models across established disciplines and borders. Findings should be transferable and scalable to other communities in different domains and 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 a rich 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.
- (mostly for objective c:) Definition of new concepts and models for the development of digital social platforms, as well as their 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, collaborative journalism, 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), new democracy models 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 and collaborative consumption patterns, new lifestyles, and innovative product and service creation and information delivery.

Types of action:

- a. Research & Innovation Actions – The Commission considers that proposals requesting a contribution from the EU between EUR 0.5 million and EUR 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.
- b. Research & Innovation Actions – Proposals requesting a *Small contribution* are expected
- c. Research & Innovation Actions – Proposals requesting a *Small contribution* are expected
- d. Coordination and Support Actions

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

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, services, 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. Real-world prototyping and experimenting environments are needed in certain cases for innovation creation. 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, 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 across all communication layers, 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 must allow ad hoc, on demand federation and reconfiguration of facilities and platforms, in order to serve the researcher and development requirements and provide tools for reporting, benchmarking and monitoring. The action may involve financial support to third parties¹⁷. The consortium will define the selection process of additional users, experimenters and suppliers for which financial support will be granted (typically in the order of EUR 50.000 – 150.000¹⁸ per party). At least 50% of the EU funding should be allocated to this purpose.

- b. Innovation Actions**

Proposals for a collaborative project that would identify, evaluate and select ideas for prototyping and 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 and the setting would be in real world environments, where applicable.

- 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.

¹⁷ In view of the implementation of financial support to these third parties selected through open calls, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, the definition of the persons or categories of persons which may receive financial support, the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support and the maximum amount to be granted to each third party and the criteria for determining it.

¹⁸ In line with the Rules for Participation Article 19 (7) the amounts referred to in Article 137 of the Financial Regulation may be exceeded where it is necessary to achieve the objectives of the action.

- 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.
- Development of common architectures across the various prototypes and experiments across a variety of settings and/or application areas.
- 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 or environments.
- 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 – Proposals requesting a *Large contribution* are expected
- b. Innovation Actions – Proposals requesting a *Large contribution* are expected
- c. Coordination and Support Actions

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

ICT 12 – 2015: Integrating experiments and facilities in FIRE+

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' and users' 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.

The action may involve financial support to third parties¹⁹. The consortium will define the selection process of additional users, experimenters and suppliers for which financial support will be granted (typically in the order of EUR 50.000 – 150.000²⁰ per party). At least 50% of the EU funding should be allocated to this purpose.

b. Innovation Actions

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

Expected impact:

- A set of more than ten open, 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. These facilities may include ecosystems and real world settings in experimental activities.

¹⁹ In view of the implementation of financial support to these third parties selected through open calls, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, the definition of the persons or categories of persons which may receive financial support, the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support and the maximum amount to be granted to each third party and the criteria for determining it.

²⁰ In line with the Rules for Participation Article 19 (7) the amounts referred to in Article 137 of the Financial Regulation may be exceeded where it is necessary to achieve the objectives of the action.

- Further economies of scale in terms of infrastructure and its management by promoting the utilization of existing shared experimental facilities and platforms by experiments in 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 – Proposals requesting a *Small contribution* are expected
- b. Innovation Actions – Proposals requesting a *Small contribution* are expected

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

ICT 13 – 2014: Web Entrepreneurship

Specific Challenge:

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 innovation.

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. These platforms are expected to go beyond technologies and applications, to include necessary conditions for collaborative innovation.

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 actors, e.g. 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.

Proposals may include actions to highlight the most valuable initiatives in a European context, e.g. 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 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. This action should as well cover actions beyond the technological, e.g. training, legal and financial aspects.

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 Massive Open Online Courses (MOOCs) for web entrepreneurship skills.

Expected impact:

- To support the emergence of dynamic European ecosystems for web entrepreneurs that also contribute to shaping future web entrepreneurship specific policies, in particular for the implementation of Startup Europe EU initiative²¹.
- To provide new, innovative environments including services that will help web entrepreneurs in their process of starting up and scaling up their start-ups.
- A European environment, fora and stakeholders, for web entrepreneurs to reflect and share experiences, easily replicate successful example, consider failures as valuable experience and where web start-ups 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 for entrepreneurship.

Types of action:

- a. Innovation Actions – Proposals requesting a *Small contribution* are expected
- b. Coordination and Support Actions

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

²¹ <http://ec.europa.eu/digital-agenda/en/startup-europe>

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 ubiquitous 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. Research & Innovation 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/caching requirements. Reduction of energy consumption, significant bandwidth increase in current mobile bands and end-to-end latency are key drivers.
- Versatile low cost ubiquitous radio access infrastructure equally supporting low rate IoT and very high rate ($\gg 1\text{Gbit/s}$) access, enabling service access capability over radio links similar to those of fixed access and a fixed-mobile seamless access continuum, and integrating satellite access where appropriate;
- Flexible and efficient radio, optical or copper based backhaul/fronthaul 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 a ubiquitous access continuum composed of cooperative, cognitive 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 and support of new business models must be 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 domains, with analysis of risks and vulnerabilities, definition of threat models and authentication mechanisms across multiple domains. Intelligence driven security and 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. Open source approach may be considered.

- 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, also covering more efficient use of licensed spectrum;
- 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. Research & Innovation 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 an ubiquitous access to a wider spectrum of applications and services offered at lower cost, with increased resilience and continuity, 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).
- Ubiquitous 5G access including in low density areas .
- 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).
- Trustworthy 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, China) 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 – Proposals requesting a *Large contribution* are expected
- b. Innovation Actions – Proposals requesting a *Large contribution* are expected
- c. Coordination and Support Actions

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

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 innovative multilingual products and services based on digital content and data, addressing well identified industry and consumer market needs. 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 multilingual data products and services and solving fundamental and applied, market driven 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 enabling the full deployment of the Single Digital market;
- 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, multilingual verbal and non-verbal communication.

ICT 15 – 2014: Big data and Open 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 multilingual data products and services, in order to turn large data volumes into semantically interoperable data assets and knowledge. 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.
- One collaborative project establishing a European open data integration and reuse **incubator** for **SMEs** to foster the development of **open data supply chains** and to educate and assist new users. 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 or to integrate open data with their own private data as the basis for innovative applications.
- Attract and manage SMEs interested in business or technology innovation in particular on open data.
- Link to and reuse data from the European Union Open Data Portal²² or other local, regional or national Open Data portals, as well as to the CEF programme²³.
- Where appropriate, link to and expand the activities of existing national/regional open data incubators.

The action may involve financial support to third parties²⁴. The consortium will define the process of SME selection for which financial support²⁵ will be granted. Minimum 70% of the EU funding requested by the proposal should be allocated to this purpose.

- Collaborative projects focused on **innovation and technology transfer in multilingual data harvesting and 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 (including those controlled by the data subject) 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 the last bullet point of activity a), 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.

²² <http://open-data.europa.eu/>

²³ <https://ec.europa.eu/digital-agenda/en/connecting-europe-facility>

²⁴ In view of the implementation of financial support to these third parties selected through open calls, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, the definition of the persons or categories of persons which may receive financial support, the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support and the maximum amount to be granted to each third party and the criteria for determining it.

²⁵ In line with the Rules for Participation Article 19 (7) the amounts referred to in Article 137 of the Financial Regulation may be exceeded where it is necessary to achieve the objectives of the action.

- 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 multilingual 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.
- 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 – A mix of proposals requesting *Small* and *Large contributions* are expected
- b. Coordination and Support Actions

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

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 privacy-aware machine learning, language understanding, data mining and visualization). Special focus is on industry-validated, user-defined challenges like predictions, and rigorous processes for monitoring and measurement.

Scope:

- a. **Research & Innovation Actions:** proposals are expected to cover one or both of the themes identified below.
 - Collaborative projects to develop novel data structures, algorithms, methodology, software architectures, optimisation methodologies and language understanding technologies for carrying out data analytics, data quality assessment and improvement, 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, multimodal 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 portal²⁶ and/or other European open data sources, including data coming from EU initiatives like Copernicus and Galileo.

- 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 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 and optimization 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 – A mix of proposals requesting *Small* and *Large contributions* are expected
- b. Coordination and Support Actions

²⁶ <http://open-data.europa.eu/>

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

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.²⁷

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 arising from well documented market needs, for example in pan-European online services. The pilots should focus on areas where multilingualism contributes to competitiveness and user-friendliness and 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.

²⁷ <http://www.meta-net.eu/whitepapers/e-book/english.pdf>, p. 31

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 – Proposals requesting a *Small contribution* are expected
- b. Innovation Actions – Proposals requesting a *Small contribution* are expected
- c. Coordination and Support Actions

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

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** to support the creative industries SMEs in leveraging emerging ICT technologies (e.g. 3D, augmented reality, advanced user interfaces, visual computing) for the development of innovative products, tools, applications and services with high commercial potential. Beyond the driving participation of creative industry SMEs and the participation of ICT technology providers, the involvement of research and innovation

centres is encouraged. Proposals should be clearly driven by user-needs and demonstrate the market demand for the solution and the innovation potential. Solutions should be cost-effective, market-ready and target international markets.

- 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, where beneficial, investor readiness support (e.g. explaining investors' requirements, assisting in the development of business plans ...).
- connect creative industries SMEs with appropriate sources of funding (e.g. loans, venture capital, business angels investment, crowd-funding ...) and with international business networks.
- increase the market access 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. 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. 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 – The Commission considers that proposals requesting a contribution from the EU between EUR 0.5 million and EUR 1 million for a period between 6 and 18 months would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts or duration.
- b. Coordination and Support Actions

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

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

Specific Challenge: The demand is growing for high-quality content and new user experiences. 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 and interaction offer

a number of opportunities and challenges, also for the creative and media industries. In order to keep pace with the trends and remain competitive, those industries need to explore new ways of creating and accessing content. The opportunity to establish new forms of content and user engagement could be transformative to many businesses in creative and media industries.

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

a. Research & Innovation Actions:

Research in new technologies and tools to support creative industries in the creative process from idea conception to production. The proposed tools should explore the potential of technology to enhance the human creative process from the expression of ideas to experiment solutions. Where possible, collaboration and user-community interaction should be improved based on research leading to a deeper understanding of the dynamics of co-creative processes. The tools should be cost effective, intuitive, and be demonstrated in real-life environments relevant 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 so 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 responding 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:

Research & Innovation Actions

- Validated novel ICT technologies and tools supporting the creation process and 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 – Proposals requesting a *Small contribution* are expected
- b. Innovation Actions – Proposals requesting a *Small contribution* are expected
- c. Coordination and Support Actions

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

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 in close cooperation with academia to defining the frameworks and interoperability requirements for the building blocks of a digital ecosystem for learning (including informal learning) that develops and integrates tools and systems that apply e.g. adaptive learning, augmented cognition technologies, affective learning, microlearning, game-based learning and/or virtual environments/virtual worlds to real-life learning situations. This challenge also encourages public procurement of innovative solutions to address the needs of the digital learning ecosystem in making better use of educational cloud solutions, mobile technology, learning analytics and big data, and to 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, natural interaction technologies) 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, (including automated measurement of human-system interaction) non-linear approaches to adaptive learning and remediation technologies and cognitive artefacts (including toys) for effective and efficient human learning. Gender differences in ICT-based learning attitudes should be considered.

a. Research & Innovation actions

Research experimentations on smart learning environments providing students with adaptive and personalised learning and assessment, including through multi-modal/multi-sensory interaction technologies and advanced interfaces. Activities should facilitate networking and capacity building. Research must be inherently multidisciplinary, building on advances on neuroscience, pedagogical and learning theories, educational psychology

as well as artificial intelligence. Application scenarios include formal and informal education, including workplace learning.

b. Research & Innovation actions

Establishing a technology platform to provide a framework and roadmap for stakeholders, led by industry in collaboration with academia, 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.

c. 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, and supporting engagement of teachers, learners and parents. 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/validation through smart and business intelligence applications.

d. Public procurement of innovative devices and software (PPI)

Coordinate the development of joint specifications and procuring innovative devices and software for the application of technology mediated scenarios for learning and teaching in educational settings.

Expected impact:

- Reinforce European leadership in adaptive learning technologies for the personalisation of learning experiences. This must 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.
- Contribute to the objectives of the "Opening up Education" initiative.
- 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 – Proposals requesting a *Small contribution* are expected
- b. Research & Innovation Actions – Proposals requesting a *Small contribution* are expected
- c. Innovation Actions – Proposals requesting a *Large contribution* are expected

- d. Public Procurement for Innovative solutions Cofund actions – Proposals requesting a *Large contribution* are expected.

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

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, emergent narrative, virtual characters, interaction systems and alternative human-machine interfaces, 3D, textures, models for simulations, game design, learner profiles, emotional models, etc.) produced by and for the traditional digital game industry but applied into wider scenario of use in non-leisure contexts. Activities must 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 will focus on learning and skills acquisition in formal and informal education, in workplace learning and in policy making and collective social and public processes.
- 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 from a wide area of application contexts.
- Increase the effectiveness of digital games for professionals and researchers, intermediaries and social actors dealing with people with disabilities or at risk of exclusion (socially, physically or technologically disadvantaged groups) and of those who consider themselves unsuited for education.

Types of action:

- a. Research & Innovation Actions – Proposals requesting a *Large contribution* are expected
- b. Innovation Actions – Proposals requesting a *Small contribution* are expected

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

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 should 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 and gestural interaction, 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; how multimodal (including nonverbal) interaction is used in ambient environments. 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 domains such as those of the creative industries 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 from 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 within the creative industries by providing directly usable solutions addressing their specific needs.
- Provide a large 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 & Innovation Actions – Proposals requesting a *Small contribution* are expected
- b. Research & Innovation Actions – Proposals requesting a *Small contribution* are expected
- c. Innovation Actions – Proposals requesting a *Small contribution* are expected

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

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: Research implementing the Strategic Research Agenda established by the euRobotics AISBL (the private partner in the future Public-Private partnership in Robotics²⁸) will be essential to attain a world-leading position in the robotics market. Driven by the applications needs identified in this Strategic Research Agenda (SRA), challenging R&D problems will have to be addressed, to make substantial progress in robots capabilities and improve the Technology Readiness Levels (TRL) 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.

²⁸ This Strategic Research Agenda is publicly available on the euRobotics AISBL website (<http://www.eu-robotics.net/ppp/downloads/>); 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.eu-robotics.net/ppp>.

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 market needs and that are expected to produce step changes in abilities.

a. Research & Innovation Actions

- RTD to advance abilities and key technologies relevant for industrial and service robotics
 - In terms of market domains, the priorities are: manufacturing, commercial, civil, agriculture
 - The primary goal is to significantly improve the level of industrial and service robotics abilities in the context of the above mentioned market domains by addressing: adaptability, cognitive ability, configurability, decisional autonomy, dependability, flexibility, interaction capability, manipulation ability, motion capability, perception ability.
 - To reach this ambitious goal, key robotics technologies need to be advanced in the particular fields of cognition, human-robot interaction, mechatronics, navigation, perception. This includes technology combinations such as grasping and dexterous manipulation, physical HRI, mobile manipulation, reactive planning and other combinations, in particular those that connect the key technologies above.
 - To prove the exploitation potential of the results the project outcome is to be shown in market domain-relevant demonstrations proving an increased TRL.
- It will be essential for the deployment of robots to establish systems development processes (from requirement analysis to testing and validation) and to develop techniques and technologies for system design, engineering, architecture, integration, system of systems, modelling and knowledge engineering which are applicable across market domains.
- 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: (a) mechanisms for sharing; (b) harmonisation of system design practice; (c) the definition of standards; and (d) 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 in real-world conditions. 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 public safety and monitoring of environment and infrastructures.

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, and 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 & Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* are expected
- b. Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* are expected
- c. Pre-Commercial Procurement (PCP) Cofund actions – Proposals requesting a *Large contributions* are expected

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

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 priorities in this

specific challenge are based on input from the Public-Private partnership in Robotics²⁹, 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. Research & Innovation Actions to advance key technologies relevant for industrial and service robotics

In terms of market domains, the priorities are: healthcare, consumer, transport.

The primary goal is to significantly improve the level of industrial and service robotics abilities in the context of the above mentioned market domains by addressing: adaptability, cognitive ability, configurability, decisional autonomy, dependability, flexibility, interaction capability, manipulation ability, motion capability, perception ability.

To reach this ambitious goal, key robotics technologies need to be advanced in the particular fields of cognition, human-robot interaction, mechatronics, navigation, perception. This includes technology combinations such as grasping and dexterous manipulation, physical HRI, mobile manipulation, reactive planning and other combinations, in particular those that connect the key technologies above. The priority market domains cover also enabling robotics technologies for disabled people; this applies in particular for people with upper, lower limb disabilities and/or amputees allowing them to gain functionalities with exoskeletons or prostheses.

To prove the exploitation potential of the results the project outcome is to be shown in market domain-relevant demonstrations proving an increased TRL.

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

The aim is to gear up and accelerate 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 experiments with industrial platforms. Proposals are expected to demonstrate technology transfer in professional or service robotics, in application areas such as manufacturing, commercial, civil, agriculture, healthcare, consumer or transport.

Activities are expected to be clustered to facilitate a sectorial structured dialogue and to substantially improve overall impact. The action may involve financial support to third parties³⁰. In such case, the consortium will define the selection process for additional

²⁹ The input comes from the Strategic research agenda of the PPP that is publicly available on the euRobotics AISBL website (<http://www.eu-robotics.net/ppp/downloads/>); 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.eu-robotics.net/ppp>.

³⁰ In view of the implementation of financial support to these third parties selected through open calls, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, the definition of the persons or categories of persons which may receive financial support, the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support and the maximum amount to be granted to each third party and the criteria for determining it. In line with the Rules for Participation Article

academic/research organisations, industry or end-users as appropriate to carry out the experiments in order to reach the objectives defined in the proposals.

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 the healthcare sector.

e. Coordination Actions: Community building and Robotic competitions

- Supporting the European robotics community with respect to networking, education, outreach, public awareness, 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 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.

19 (7) the amounts referred to in Article 137 of the Financial Regulation may be exceeded where it is necessary to achieve the objectives of the action.

- 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 & Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* are expected
- b. Innovation Actions – Proposals requesting a *Large contribution* are expected
- c. Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* are expected
- d. Pre-Commercial Procurement (PCP) Cofund actions – Proposals requesting a *Large contribution* are expected
- e. Coordination and Support Actions

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

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, with particular focus on photonic pilot production lines paving the way to the manufacturing of ICT KETs in Europe. 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'³¹ 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 TRLs 2 to 4; please see part G of the General Annexes. 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.

³¹ The scope of the JTI covers micro- and nanoelectronics, embedded and smart systems

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 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 mm², with minimum features approaching 10 nanometers or per mm³ 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 & Innovation Actions – Proposals requesting a *Small contribution* are expected
- b. Innovation Actions – Proposals requesting a *Small contribution* are expected
- c. Coordination and Support Actions

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

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 investments are required for sustaining Europe's industrial competitiveness and leadership in photonic market sectors where Europe is strong (communications, lighting, laser-based manufacturing, 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. Research & Innovation Actions

Application driven core photonic technology developments for a new generation of photonic devices (including components, modules and sub-systems): Actions should also address the related materials, manufacturability, 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 strategies, 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 detection of diseases (such as cardiovascular, cancer, neurodegenerative, skin or lung diseases, 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 civil 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 μm) 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, plasmonics, metamaterials, or non conventional wavefront shaping), 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 SSL based intelligent lighting systems. Actions should address specific lighting requirements in relation to the intelligent system control network, cost-effective installation (easy commissioning), safety and security issues, as well as the development of related electronic/photonic devices. Proposed architectures should allow interchangeability of the lighting modules 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 Photonics²¹ stakeholders and other relevant communities for strategic technology road-mapping and for coordination with national and regional photonics activities.
- The wide uptake of SSL technologies³²: 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. ERA-NET Cofund Action

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

Expected impact:

a. Research & Innovation 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.

³² These actions are in line with the Green Paper "Lighting the Future", COM(2011) 889 final.

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.

d. ERA-NET Cofund action

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

Types of action:

- a. Research & Innovation Actions – Proposals requesting a *Small contribution* are expected
- b. Innovation Actions – One proposal requesting a *Large contribution* is expected to be selected
- c. Coordination and Support Actions
- d. ERA-NET Cofund Action, any remaining funds will be transferred to action type a. above.

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

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. Research & Innovation Actions

Application driven core photonic technology developments for a new generation of photonic devices (including 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); novel technologies and devices for beam delivery and for processing of multiple beams from laser source arrays; high-performance optical devices and systems; 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-performance or high-density modules.

All RTD actions should address also the related materials, manufacturability, 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 strategies, and cover the value/supply chain as appropriate.

b. Innovation support through public procurement actions³³

Pilot deployment of software-defined optics in backbone networks: Equip the networks of Public network operators (e.g., NRENs) with novel Software Defined Optical Networking technologies (from component level to system and 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

Actions driven by the key stakeholders in photonics and targeting:

- 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 in order to address the needs of SMEs.

³³ Wherever appropriate, actions could 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.

d. ERA-NET Cofund action

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

Expected impact:

a. Research & Innovation 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 optical 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. ERA-NET Cofund action

- 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 & Innovation Actions – Proposals requesting a *Small contribution* are expected
- b. Public Procurement of Innovation (PPI) Cofund actions; any remaining funds will be transferred to action type a. above.
- c. Coordination and Support Actions
- d. ERA-NET Cofund Action, any remaining funds will be transferred to action type a. above.

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

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 or monitoring of disease and patient status (clinical trials are excluded) or the food sector for quality, safety and process control. They should include substantiated business cases for the targeted products with strong commitment to industrialise them in Europe.

b. Pilot lines for 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 Europe³⁴. 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 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.

³⁴ Wherever appropriate, actions could 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.

- **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 monitoring of disease and patient status, the prevention and treatment 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, safety and processing.

b. Pilot lines for 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 accelerated 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. Innovation Actions, TRL 5 and 6 (please see part G of the General Annexes) – Proposals requesting a *Small contribution* are expected
- b. Innovation Actions, TRLs 5-7 (please see part G of the General Annexes). Minimum one pilot line per area is expected to be selected for funding. The Commission considers that proposals requesting a contribution from the EU of up to EUR 14 million each would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts
- c. Coordination and Support Actions

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

ICT 29 – 2014 Development of novel materials and systems for OLED lighting³⁵

Specific Challenge: In the last 10 years, European industry (both SMEs and large companies) has made significant investments in OLED technologies, i.e., materials, devices and manufacturing processes. However, major S&T progress and research and innovation (R&I) investments are required in OLEDs, in particular for the realisation of flexible, high brightness light sources over large areas. The further technological development of OLEDs is expected to give Europe a leading position on the world general lighting market and create new manufacturing jobs for novel consumer products. Moreover, the move to OLEDs would help in reducing the amount of electricity consumed by lighting and limiting carbon dioxide emissions.

Scope:

Research & Innovation Actions should focus on materials, process and device technology for OLED lighting. 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 100 lm/W, considering also improved out-coupling efficiency. The materials have to allow for a competitive lifetime for all colours and white light (lifetime of several hundred hours at 97% of the original intensity). Attention should be paid to recyclability issues and the environmental impact of the materials and systems as appropriate. Proposals should involve material suppliers, OLED manufacturers or suppliers and OLED system integrators.

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.
- Improved business opportunities and value creation in Europe in lighting by reinforced cooperation along the value chain.

Type of Action:

Research & Innovation Actions – *Proposals requesting a Small contribution* are expected

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

³⁵ This topic is jointly supported by LEIT ICT and NMP.

ICT Cross-Cutting Activities

ICT 30 – 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, cyber-physical systems, 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 (e.g. ehealth, energy, food chain, intelligent transport and systems, environmental monitoring 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 generations of devices, embedded systems and 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, dependability, cognitive capabilities and distributed decision making, cost and energy-efficiency, ergonomic and 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 and methodology 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 and should be driven by use cases.

a. Research & Innovation 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 and integration platforms for "Connected Smart Objects" covering multiple technologies and multiple intelligent artefacts, potentially

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.
- Methods for flexible, reliable and interoperable APIs supporting the development of use cases and allowing application developers to produce new added value across multiple systems, including partial opt-out capabilities.

Reference implementations including proof-of-concept, large-scale demonstrations and validation driven by innovative use scenarios, also leveraging on platforms developed elsewhere in the programme³⁶. Smart homes, workplaces, public spaces, context aware commercial environments and smart cities are targeted and potential use scenarios include health, energy, mobility and commercial services amongst others.

Proposals requesting a Large contribution are expected. The action may involve financial support to third parties³⁷. The consortium will define the selection process of additional users and suppliers for which financial support will be granted (typically in the order of EUR 50.000 – 150.000³⁸ per party). Maximum 30% of the EU funding requested by the proposal should be allocated to this purpose.

b. Support Measures

Measures for development of ecosystems driven by European players 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 must stimulate the collaboration between selected projects and between the potential platforms. It will also derive exploitation strategies, on how to make successful ecosystems emerge, to involve the user in the development process and to respond to the societal challenges for Europe.

³⁶ In that context, proposers may want to consider the "FIRE" experimental platform developed in ICT11 and ICT12 as one possible platform supporting large scale experiments, where applicable, as well as relevant developments in the robotics domain, in ICT23 and ICT24.

³⁷ In view of the implementation of financial support to these third parties selected through open calls, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, the definition of the persons or categories of persons which may receive financial support, the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support and the maximum amount to be granted to each third party and the criteria for determining it.

³⁸ In line with the Rules for Participation Article 19 (7) the amounts referred to in Article 137 of the Financial Regulation may be exceeded where it is necessary to achieve the objectives of the action.

Expected impact:

- Emergence of a 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 turnkey solutions in a variety of application fields.
- Dissemination and availability of results for technology transfer and pre-normative activities e.g. in standardisation fora , open source initiatives and/or relevant bodies like the EIT.
- Facilitation of platforms for co-creation of products and services in open innovation ecosystems including all relevant stakeholders.

Types of action:

- a. Research & Innovation Actions – Proposals requesting a *Large contribution* are expected
- b. Coordination and Support Actions

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

ICT 31 – 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. There is a need for exploring the two-way interactions between technology and society in order to lay foundations for future thinking in ICT and for future regulatory and policy-making activities in the DAE areas.

Scope:

- a. The **Research & Innovation Actions** should aim at in-depth exploration of the development of fundamental notions such as identity, privacy, relationships, culture, reputation, motivations, responsibility, attention, safety 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 for responsible research and innovation. They should provide concrete incentives and motivations for cross-disciplinary collaborations. Coordination actions are invited to coordinate and support responsible research and innovation through ICT and within ICT R&D&I areas on different parts of the H2020 Work programme, notably by efficient exchange of results between SSH research, on-going R&D&I projects and relevant areas of policy making and regulatory activities.

Expected impact:

- a. The **Research & Innovation 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).
 - provide support for take-up and establish best practices for responsible research and innovation in different areas of ICT Work programme.

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 & Innovation Actions – Proposals requesting a *Small contribution* are expected
- b. Coordination and Support Actions

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

ICT 32 – 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. Research & Innovation 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 and business services. Special attention has to be paid to the interaction of the layers and to a holistic approach. 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, with or without the possibility to adapt the cryptographic primitives which are used;
- Post-quantum cryptography for long term security;
- Quantum key distribution (QKD) systems and networks for long-term security by design, as well as networks supporting information theoretic cryptographic primitives, including but not restricted to the integration into existing optical networks (e.g. trusted nodes and/or using multiplexing), addressing:
 - i. low cost components for short-distance, low-bit-rate quantum key-distribution;
 - ii. high-bit rate QKD systems that are tolerant to noise and loss.

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.
- evaluation and verification of cryptographic protocols and algorithms.
- 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 and implementation 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.
- improved protection of the user's privacy, in compliance with applicable legislation.
- more resilient critical infrastructures and services.

At research and 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.
- ICT solutions allowing the user to monitor if her/his rights-online are respected and in compliance with the EU regulation.
- simplify the implementation of cryptographic primitives.
- ICT technology that is proofed to be more secure than ICT designed the traditional way.

Instrument, funding level and budget

- a. Research & Innovation Actions – A mix of proposals requesting *Small* and *Large contributions* are expected
- b. Coordination and Support Actions

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

ICT 33 – 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-NET Cofunds, JTI, 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

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

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 34 – 2015: ICT contribution to pilot for co-investments by business angels in innovative ICT firms

This is a contribution from the ICT in LEIT to a pilot scheme that will co-finance investments by business angels in innovative SMEs and small midcaps that are aiming to commercialise new ICT-related products and services. Potential co-investors with business angels can include family offices and equity crowd-funders. The domains of photonics, microelectronics, microsystems and robotics, and also the ICT-related creative industries, will receive particular attention. The scheme might operate through a fund set up as a dedicated investment vehicle. Co-financed investments, made as a rule on the basis of an equal sharing of risks and rewards, will take the form of equity and, potentially, other forms of risk capital. ICT-related investments should represent at least 50% of the total investments made. The Commission will incentivise the entity entrusted with implementing the pilot to make a particular effort, including targeted awareness-raising, to ensure that a significantly higher proportion of investments are ICT-related.

Expected impact:

Development of co-investments and cross-border investments by business angels, and improved access to risk finance by innovative ICT firms. Indicators and targets will be set during negotiations with the entrusted entity who may potentially implement the pilot scheme.

Indicative timetable:

This instrument is likely to be available in 2015.

Selection procedure:

Under discussion with the entity who may be entrusted with implementing the pilot scheme.

Indicative budget:

EUR 15 million from ICT in LEIT contributing to a total of EUR 30.0 million from the 2015 budget³⁹.

³⁹ EUR 15.00 million from the budget line for 'Access to Risk Finance', and EUR 15.00 million from the budget line for 'Leadership in Enabling and Industrial Technologies / ICT'. These amounts will be included in the financial decision for 2015. If there is a significant lack of take-up by 30 June 2015, remainder funds will be reallocated to these budget-lines.

ICT 35 – 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 objective is to define 8 to 12 inducement prize competitions. This includes 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 must engage into an open dialogue with all potential stakeholders, including other procurers and end-users. EPPs must 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 must 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 must 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. EPPs must undertake dissemination activities to share results and raise awareness about PCP and PPI across Europe.

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.

Types of action:

- a. b. c. Innovation Actions – Proposals requesting a *Small contribution* are expected
d. Coordination and Support Actions
e. Coordination and Support Actions
f. Coordination and Support Actions

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

ICT 36 – 2015: Pre-commercial procurement open to all areas of public interest requiring new ICT solutions

Specific Challenge: This specific challenge addresses the lack of public demand driven innovation in Europe needed to close the gap between supply and demand for innovative ICT solutions. It targets consortia of procurers with similar procurement needs of common European interest, to drive innovation from the demand side and reduce fragmentation of public sector demand in Europe, by together challenging the market to develop innovative ICT based solutions. Joint pre-commercial procurement enables consortia of procurers to share the costs of procuring high-tech R&D and to speed up the time-to-market for promising research outcomes that can provide best value for money and solutions for concrete public sector needs. The aim of engaging in such more forward looking R&D procurement strategies is to modernize the provision of public services faster whilst creating opportunities for industry and researchers in Europe to take international leadership in new markets.

Scope: The objective is to bring radical improvements to the quality and efficiency of public services by encouraging the development and validation of breakthrough solutions through Pre-Commercial Procurement. This specific challenge is open to proposals requesting EU cofunding for pre-commercial procurement in all areas of public sector interest requiring innovative ICT based solutions, complementary to PCP Cofund 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:

- 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:

Pre-Commercial Procurement (PCP) Cofund actions – The Commission considers that proposals requesting a contribution from the EU of about EUR 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

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

ICT 37 – 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 in the ICT sector. Focus will be on SME proposing innovative ICT concept, product and service applying new sets of rules, values and models which ultimately disrupt existing markets.

The objective of the ODI is threefold:

- Nurture promising innovative and disruptive ideas;
- Support their prototyping, validation and demonstration in real world conditions;
- Help for wider deployment or market uptake.

Proposed projects should have a potential for disruptive innovation and fast market up-take in ICT.

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

The ODI objective will support the validation, fast prototyping and demonstration of disruptive innovation bearing a strong EU dimension.

Scope: ODI will be implemented through 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 must be developed verifying the technological/practical as well as economic viability of an innovation idea/concept with considerable novelty to the industry sector in which it is presented (new products, processes, services and technologies or new market applications of existing technologies). The activities could, for example, comprise risk assessment, market study, user involvement, Intellectual Property (IP) management, 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 must be detected and analysed during phase 1 and addressed during phase

2 to increase the return in investment in innovation activities. The proposal should contain an initial business plan based on the proposed idea/concept.

The proposal should give the specifications of the elaborated business plan, which is to be the outcome of the project and the criteria for success.

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

In phase 2, innovation projects 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) to industrial readiness and maturity for market introduction, but may also include some research. For technological innovation a Technology Readiness Levels of 6 or above (or similar for non-technological innovations) are envisaged; please see part G of the General Annexes.

Proposals shall be based on an elaborated business plan either developed through phase 1 or another means. Particular attention must be paid to IP protection and ownership; applicants will have to present convincing measures to ensure the possibility of commercial exploitation ('freedom to operate').

Proposals shall contain a specification for the outcome of the project, including a first commercialisation plan, and criteria for success.

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

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.

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

Expected impact:

- Enhancing profitability and growth performance of SMEs by combining and transferring new and existing knowledge into innovative, disruptive and competitive solutions seizing European and global business opportunities.
- Market uptake of ICT innovations.

- Increase of private investment in innovation, notably through private co-investments and/or follow-up investments in successfully supported SMEs.
- The expected impact should be clearly substantiated in qualitative and quantitative terms (e.g. on turnover, employment, market seize, IP management, sales, return on investment and profit).

Types of action:

SME Instrument (70%)

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

DRAFT

Fast track to Innovation – pilot

Fast track to Innovation Topic

It is noted that the following information is provided at this stage only to facilitate the familiarisation with this topic. The European Commission will provide in due course full details, together with the announcement of the relevant calls, on the Fast track to Innovation Topic.

The general aspects of this topic are as follows:

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.

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.

<i>International Cooperation actions</i>

ICT 38 – 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 meetings⁴⁰, 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 Cofund), 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)

⁴⁰ 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

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

ICT 39 – 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 countries⁴¹ 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

⁴¹ See World Bank country classification.

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, 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 – Proposals requesting a *Small contribution* are expected

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

Conditions for these calls

For all topics within the two ICT calls, the following apply:

If indicated in the specific challenge description, the Commission considers that proposals requesting a contribution in the brackets indicated below for *Small* or *Large* would allow the specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts:

- *Small contribution:* Contribution from the EU of between EUR 2 million and EUR 4 million
- *Large contribution:* Contribution from the EU of between EUR 5 million and EUR 8 million

The projects funded under this area will participate in the Pilot on Open Research Data in Horizon 2020 in line with Commission's policy on open access to research data. Further information on the Open Research Data Pilot can be found here: [*link to the future Guidelines on Open Access in Horizon 2020*].

H2020-ICT-2014

Publication date: 11 December 2013.

Opening: 11 December 2013 except topic ICT37 that opens on 01/03/2014⁴² for phase 1 and phase 2 and topic ICT14 that opens on 15 July 2014.

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 ⁴³			
ICT14a, ICT14.b, ICT14.c	25 November 2014 ⁴⁴			
ICT37 [SME instrument]	Phase 1	Phase 2	Phase 1	Phase 2

⁴² The Director-General responsible may delay this date by up to two months.

⁴³ The Director-General responsible may delay this deadline by up to two months.

⁴⁴ The Director-General responsible may delay this deadline by up to two months.

HORIZON 2020 – WORK PROGRAMME 2014-2015

LEIT – Information and Communication Technologies

Open call cut-off dates	18/06/2014	XX/10/2014	18/03/2015	18/03/2015
	24/09/2014	XX/12/2014	17/06/2015	17/06/2015
	17/12/2014		17/09/2015	17/09/2015
			16/12/2015	16/12/2015

Overall indicative budget: EUR 703.5 million, of which EUR 694.5 from the LEIT-ICT part 2014 budget⁴⁵ and EUR 9 million from the LEIT-NMP part 2014 budget⁴⁶ and EUR 170 million from the LEIT-ICT part 2015 budget⁴⁷

<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	
	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	24	
Smart optical and wireless network technologies	ICT6.a	29	
	ICT6.b	1	
Advanced Cloud Infrastructures and Services	ICT7.a	66	
	ICT7.b	5	
	ICT7.c	2	
Tools and Methods for Software Development	ICT9	25	
FIRE+ (Future Internet Research & Experimentation)	ICT11.a	25	
	ICT11.b	5	
	ICT11.c	1.5	
Web Entrepreneurship	ICT13.a	6	
	ICT13.b	4	

⁴⁵ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

⁴⁶ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

⁴⁷ The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

Advanced 5G Network Infrastructure for the Future Internet	ICT14.a		98
	ICT14.b		25
	ICT14.c		2
Big Data and Open 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	
Development of novel materials and systems for OLED lighting	ICT29	18 ⁴⁸	
Human-centric Digital Age	ICT31.a	6	
	ICT31.b	1	
Cybersecurity, Trustworthy ICT	ICT32.a	37	
	ICT32.b	1	
Trans-national co-operation among National Contact Points	ICT33	4	
Innovation and Entrepreneurship Support	ICT35.a.b.c	4	
	ICT35.d	1.5	
	ICT35.e	0.5	
	ICT35.f	1	
Open Disruptive innovation Scheme (ODI)	ICT37 [SME instrument]	45 of which 10% for phase1 88% for phase2 2% for mentoring & coaching support and phase 3.	45 of which 10% for phase1 88% for phase2 2% for mentoring & coaching support and phase3.

⁴⁸ EUR 9M from the LEIT-ICT part 2014 budget and EUR 9M from the LEIT-NMP part 2014 budget

Eligibility and admissibility conditions: The conditions are described in parts B and C of the General Annexes to the work programme, with the following exceptions:

ICT37 [SME instrument]	A proposal for phase 2 shall include a first commercialisation plan.
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Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in part H of the General Annexes to the work programme, with the following exceptions:

ICT37 [SME instrument]	The criterion Impact will be evaluated first, then Excellence and Implementation. If the proposal fails to achieve the threshold for a criterion, the evaluation of the proposal will be stopped. For phase 1 the threshold for individual criteria will be 4. The overall threshold, applying to the sum of the three individual scores, will be 13. For phase 2 the threshold for the criterion Impact will be 4. The overall threshold, applying to the sum of the three individual scores, will be 12. The final consensus score of a proposal will be the median of the individual scores of the individual evaluators; and the consensus report will comprise a collation of the individual reports. There will be no Panel Review. Applicants can request during the electronic proposal submission that, due to competitive or other concerns, up to three specific persons should not act as an evaluator in the evaluation of their proposal⁴⁹.
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Evaluation procedure: The procedure for setting a priority order for proposals with the same score is given in part H of the General Annexes.

The full evaluation procedure is described in the relevant guide associated with this call.

- Indicative timetable for evaluation and grant agreement:

	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 except ICT37 (SME instrument)	Maximum 5 months from the final date for submission	-	Maximum 3 months from the date of informing applicants

⁴⁹ If any of the persons identified is an independent expert participating in the evaluation of the proposals for the call in question, they may be excluded from the evaluation of the proposal concerned, as long as it remains possible to have the proposal evaluated.

ICT37 [SME instrument]	Two months after the corresponding cut-off date set out above for phase 1 and four months after the corresponding cut-off date set out above for phase 2.		One month from the date of informing applicants in phase 1 and two months from the date of informing applicants in phase 2.
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Consortia agreements: In line with the Rules for Participation and the Model Grant Agreement, participants in Research and Innovation Actions, in Innovation Actions and, in the case of two or more SMEs submitting a proposal, also participants to SME Instruments proposals are required to conclude a consortium agreement prior to grant agreement.

Financial support to third parties:

ICT1.b, ICT11.a, ICT15.a	In view of the implementation of financial support to third parties, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: - a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, - the definition of the persons or categories of persons which may receive financial support, - the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support, - the maximum amount to be granted to each third party and the criteria for determining it. Projects must publish widely their open calls and adhere to H2020 standards with respect to evaluation, conflict of interest and confidentiality.
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H2020-ICT-2015

Publication date: 15 October 2014⁵⁰

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

For all topics	[21 April 2015] ⁵¹
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⁵⁰ The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication.

⁵¹ The deadlines provided in brackets are indicative and subject to a separate financing decision for 2015.

Overall indicative budget: EUR 583 million from the 2015 budget⁵²

<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	28
	ICT20.d	10
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	ICT30.a	50
	ICT30.b	1
ICT contribution to pilot for co-investments by business angels in innovative ICT firms	ICT34	15

⁵² The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

Pre-Commercial Procurement open to all areas of public interest requiring new ICT solutions	ICT36	4
International partnership building and support to dialogues with high income countries	ICT38	3
International partnership building in low and middle income countries	ICT39	11

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

Evaluation criteria:

all topics except ICT28.b	Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in part H of the General Annexes to the work programme.
ICT28.b	Proposals will be evaluated in line with the Commission 'Guidelines on Submission of Proposals and the related Evaluation, Selection and Award procedures'. Criteria are: 1. Excellence • Clarity and importance of the objectives; • Soundness of the concept, including trans disciplinary considerations; • Credibility of the proposed approach; • Readiness of the technology for implementing the pilot; • Progress beyond the state of the art in production; 2. Impact⁵³ The extent to which the outputs of the project could contribute at the European and/or International level to: • The expected impacts listed in the work programme under the relevant topic; • Soundness of the business cases and business plans and commitment to first exploitation / manufacturing; • Evidence of the market potential and of the competitive technology advantage that will be gained through the pilot line; • Potential of creating jobs in Europe • Effectiveness of the proposed measures to communicate the project, and disseminate the project results ,including appropriate management of IPR; • Contribution, where appropriate, to standards and to skills and educational training. 3. Quality and efficiency of the implementation • Coherence and effectiveness of the work plan, including appropriateness of the allocation of tasks and resources; • Coverage of the value chain (RTOs, materials, equipment and technology suppliers and end-users); • Competences, experience and complementarity of the individual participants, as well as of the consortium as a whole;* • Appropriateness of the management structures and procedures, including risk

⁵³ The score for the criterion “impact” will be multiplied by 1.5.

	management.
	Evaluation scores will be awarded for the criteria, and not for the sub-criteria. Each criterion will be scored out of 5. The threshold for individual criteria will be 3. The overall threshold, applying to the sum of the three individual scores, will be 10.
	Priority order in case of proposals with tied scores: 1. Impact 2. Excellence 3. Quality and efficiency of the implementation
	Operational Capacity (selection criteria) * As a separate step in the evaluation, experts must indicate whether the members of the consortium possess at least the minimum competences needed to carry out the proposed work.

Evaluation procedure: The procedure for setting a priority order for proposals with the same score is given in part H of the General Annexes.

The full evaluation procedure is described in the relevant guide associated with this call.

- Indicative timetable for evaluation and grant agreement:

	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 except ICT37 (SME instrument)	Maximum 5 months from the final date for submission	-	Maximum 3 months from the date of informing applicants	
ICT37 [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 three 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: In line with the Rules for Participation and the Model Grant Agreement, participants in Research and Innovation Actions or in Innovation Actions are required to conclude a consortium agreement prior to grant agreement.

Financial support to third parties:

ICT4.b, ICT12.a, ICT24.b, ICT30.a	In view of the implementation of financial support to third parties, the proposal shall clearly detail the objectives and the results to be obtained and include at least the following elements: - a fixed and exhaustive list of the different types of activities for which a third party may receive financial support, - the definition of the persons or categories of persons which may receive financial support, - the criteria for awarding financial support and the criteria for calculating the exact amount of the financial support, - the maximum amount to be granted to each third party and the criteria for determining it. Projects must publish widely their open calls and adhere to H2020 standards with respect to evaluation, conflict of interest and confidentiality.
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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.

Proposals are invited against the following topics:

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 – The Commission considers that proposals requesting a contribution from the EU of EUR 1,5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

Coordination and Support Actions

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

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

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

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 –The Commission considers that proposals requesting a contribution from the EU of max EUR 1,5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

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

<i>Conditions for this call</i>
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H2020-EUB-2015

Publication date: 15 October 2014⁵⁴

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

All topics	[21 April 2015] ⁵⁵	
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⁵⁴ The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication.

⁵⁵ The deadlines provided in brackets are indicative and subject to a separate financing decision for 2015.

Overall indicative budget: EUR 7 million from the 2015 budget⁵⁶

<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 and admissibility conditions: The conditions are described in parts B and C of the General Annexes to the work programme, with the following exceptions:

- Additional eligibility criterion:

Proposals submitted to this call which do not include coordination with a Brazilian proposal will be considered ineligible.

The proposed project duration shall not exceed 36 months

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

Evaluation procedure: The procedure for setting a priority order for proposals with the same score is given in part H of the General Annexes.

The full evaluation procedure is described in the relevant guide associated with this call.

- Indicative timetable for evaluation and grant agreement:

	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	Maximum 5 months from the final date for submission	-	Maximum 3 months from the date of informing applicants	

⁵⁶ The deadlines provided in brackets are indicative and subject to a separate financing decision for 2015.

⁵⁶ The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

Consortia agreements: In line with the Rules for Participation and the Model Grant Agreement, participants in Research and Innovation Actions or in Innovation Actions are required to conclude a consortium agreement prior to grant agreement.

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.

Proposals are invited against the following topics:

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 –The Commission considers that proposals requesting a contribution from the EU of EUR 1,5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

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

EUJ 2 – 2014: Optical communications

Specific Challenge: The research activity focuses on technologies of optical communication 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 –The Commission considers that proposals requesting a contribution from the EU of EUR 1,5 million would allow this specific challenge to be

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

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

EUJ 3 – 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 – The Commission considers that proposals requesting a contribution from the EU of EUR 1,5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

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

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 –The Commission considers that proposals requesting a contribution from the EU of EUR 1,5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

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

Minimum one proposal per theme is planned to be funded.

Conditions for this call

H2020-EUJ-2014

Publication date: 7 January 2014⁵⁷

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

All topics	10 April 2014 ⁵⁸	
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Overall indicative budget: EUR 6 million from the 2014 budget⁵⁹

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

Eligibility and admissibility conditions: The conditions are described in parts B and C of the General Annexes to the work programme, with the following exceptions:

- **Additional eligibility criteria:**

Proposals submitted to this call which do not include coordination with a Japanese proposal will be considered ineligible.

The proposed project duration shall not exceed 36 months.

The Japanese authorities can consider non-eligible proposals with participation of partners from third countries (countries other than Japan, EU and Associated states). Consultation to MIC or NICT representatives is highly advisable before submitting proposals involving third country organisations.

Proposals will only be selected on the condition that their corresponding coordinated Japanese project will be funded by MIC or NICT.

⁵⁷ The Director-General responsible for the call may publish it up to one month prior to or after the envisaged date of publication.

⁵⁸ The Director-General responsible may delay this deadline by up to two months.

⁵⁹ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

Coordination agreements:

Participants in the EU Collaborative Projects are required to conclude a coordination agreement with the participants in the coordinated project funded by MIC or NICT. A final draft of these agreements has to be provided with the proposal.

Evaluation criteria, scoring and threshold: The criteria, scoring and threshold are described in part H of the General Annexes to the work programme. In addition the following apply to all topics:

• Criterion 3 "Quality and efficiency of the implementation": additional evaluation sub-criterion: Balanced effort between the two coordinated projects and a research plan properly involving coordinated research activities between Europe and Japan, that ensure a more genuine EU-Japan cooperation and represent an added value to the activities.
• Criterion 2 "Impact": additional evaluation sub-criterion: Standards are an important element in the field of international cooperation. Beyond access to additional research capability, international cooperation in the context of industrial research should have global consensus and standards as a main target. Contribution to the elaboration of new standards or adoption of standards through implementation of research results.

Evaluation procedure: The procedure for setting a priority order for proposals with the same score is given in part H of the General Annexes.

The full evaluation procedure is described in the relevant guide associated with this call.

- Indicative timetable for evaluation and grant agreement:

	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	Maximum 5 months from the final date for submission	-	Maximum 3 months from the date of informing applicants	

Consortia agreements: In line with the Rules for Participation and the Model Grant Agreement, participants in Research and Innovation Actions or in Innovation Actions are required to conclude a consortium agreement prior to grant agreement.

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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 12.7 million from the 2014 budget⁶⁰ and EUR 15 million from the 2015 budget⁶¹

2. Inducement prizes⁶²

This action will call for two inducement prizes in the area of *Smart optical and wireless network technologies*.

The two prizes foreseen are:

- **"breaking the optical transmission barriers in the core network "** with focus on optical networks, and the objective to reward the design and demonstration of novel solutions allowing a major increase in optical fibre transmission capacity in the core, exceeding 1 Tb/s per channel and increasing global fiber capacity of the channels multiplex, as it will be required in medium to long term.
- **"collaborative sharing of spectrum"** with focus on wireless networks, with the objective to reward excellence in demonstrating one or several novel methods providing empowerment of local user communities with decentralised spectrum management capabilities (i.e. without the need for a reference data base) through "collaborative spectrum sharing".

The expected impact of these actions is as follows:

- 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;

⁶⁰ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

⁶¹ The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

⁶² Implementation details for the Inducement prizes are still under preparation

- Contribute to addressing the lack of ICT engineer skills in Europe by advertising scientific careers to youngsters.

Type of action: Prize

Date of publication of the contest: expected Q3 2014

Date of opening of the contest: expected Q4 2014

Deadline to submit applications: expected Q4 2015

Indicative budget: EUR 1 million from the 2015 budget⁶³, 0.5 million per prize

3. 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 the ICT conference and the organisation of an ICT proposers' day. DG CNECT plans to conclude service contracts in 2014, and also use existing Framework Contracts for this purpose. The events are expected to take place in the 4th calendar quarter of 2015 and in the 3rd calendar quarter of 2014 respectively. Indicative budget in 2014: EUR 5.5 million.
- The organisation of Digital Agenda Assemblies 2014 and 2015. DG CNECT plans to organise a stakeholder conference both in 2014 and in 2015. This will be done using service contracts or existing Framework Contracts. 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 indicatively 40 study contracts before the end of 2015. The calls for tenders are expected to be launched in the 2nd and 3rd calendar quarter of 2014 and 2015. Indicative budget in 2014: EUR 4 million. Indicative budget in 2015: EUR 4.7 million.
- EUROSTAT subvention for benchmarking ICT Take up by households and by enterprises. Indicative budget in 2014: EUR 2 million. Indicative budget in 2015: EUR 2 million
- Policy support activities, including benchmarking activities, evaluation and impact assessments, the development of ad hoc support software, possibly using existing Framework Contracts. DG CNECT plans to procure via framework contracts and calls for tender indicatively 10 contracts before the end of 2015. Indicative budget in 2014: EUR 2.5 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.

⁶³ The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015

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 budget⁶⁴ and EUR 10.1 million from the 2015 budget⁶⁵.

Eurostat, on the basis of cross delegation, will coordinate the Households and Enterprises surveys that will be conducted by the national statistical institutes and other competent national authorities of the Member States and associated countries where appropriate. To perform these surveys, grants will be awarded to the national statistical institutes⁶⁶ and other competent national authorities in accordance with Article 5 of Regulation (EC) No 223/2009 on European Statistics."

Budget

Calls	2014⁶⁷ Budget EUR million⁶⁸	2015⁶⁹ Budget EUR million
Call H2020-ICT-2014 Information and Communication Technologies	703.50 <i>of which 694.50 from 09.04.02.01 and 9 from 08.02.02.01</i>	170.00
Call H2020-ICT-2015 Information and Communication Technologies		583.00 <i>from 09.04.02.01</i>
Call H2020-EUB-2015 EU-Brazil Research and Development Cooperation in Advanced Cyber Infrastructure		7.00 <i>from 09.04.02.01</i>

⁶⁴ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

⁶⁵ The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

⁶⁶ In line with Regulation (EC) No 808/2004 of the European Parliament and of the Council of 21 April 2004 concerning Community statistics on the information society (OJ L 286, 31.10.2009, p. 31) and Regulation (EC) No 223/2009 of the European Parliament and of the Council of 11 March 2009 on European statistics (OJ L 87, 31.3.2009, p.164).

⁶⁷ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

⁶⁸ The budget figures given in this table are rounded to two decimal places.

⁶⁹ The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

HORIZON 2020 – WORK PROGRAMME 2014-2015

LEIT – Information and Communication Technologies

Call H2020-EUJ-2014 EU-Japan Research and Development Cooperation in Net Futures	6.00 <i>from 09.04.02.01</i>	
Contribution from LEIT ICT to call 'H2020-FoF-2014/2015' (under Part 5.ii of the work programme)	34.00 <i>from 09.04.02.01</i>	68.00

Other Actions	2014⁷⁰ Budget EUR million⁷¹	2015⁷² Budget EUR million
Experts (expert evaluators, experts groups, monitors)	12.70 <i>from 09.04.02.01</i>	15.00
Inducement Prizes		1.00 <i>from 09.04.02.01</i>
Conferences	6.40 <i>from 09.04.02.01</i>	0.90
Publications	1.50 <i>from 09.04.02.01</i>	1.50
Public procurement for policy support (studies etc)	9.00 <i>from 09.04.02.01</i>	7.70

Horizontal activities (08.020403)	2014⁷³ Budget EUR million⁷⁴	2015⁷⁵ Budget EUR million
Dissemination activities (see Part 17 of the work programme)	0.76 <i>from 09.04.02.01</i>	—
Corporate communication (see Part 17 of the work programme)	0.40 <i>from 09.04.02.01</i>	—
Estimated total budget	774.26	854.1

⁷⁰ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

⁷¹ The budget figures given in this table are rounded to two decimal places.

⁷² The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

⁷³ Subject to the availability of the appropriations provided for in the draft budget for 2014 after the adoption of the budget for 2014 by the budgetary authority or if the budget is not adopted as provided for in the system of provisional twelfths.

⁷⁴ The budget figures given in this table are rounded to two decimal places.

⁷⁵ The budget amounts are indicative and will be subject to a separate financing decision to cover the amounts to be allocated for 2015.

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