HORIZON 2020

WORK PROGRAMME 2014 – 2015

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and

1. General Introduction

Important Notice on the First Horizon 2020 Work Programme

This Work Programme covers 2014 and 2015. Due to the launching phase of Horizon 2020, parts of the Work Programme that relate to 2015 (topics, dates, budget) are provided at this stage on an indicative basis only. Such Work Programme parts will be decided during 2014.

(European Commission Decision C (2013)8631 of 10 December 2013)
Including correction of clerical errors following Corrigendum C(2014)1509

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This table of contents lists all of the separate parts of the Horizon 2020 Work Programme (2014-2015).

1. General Introduction

1.1 Overview and Summary

This ‘General Introduction’ to the Horizon 2020 Work Programme explains the context in which the Work Programme was developed and the key drivers which it focuses on. Covering the period 2014-2015, the Work Programme sets out calls for proposals, each of which containing topics, and the other actions such as public procurements.

Through the Work Programme, Horizon 2020 will fund researchers and innovators at the cutting edge of their fields working on the latest breakthroughs; it will support projects across the cycle from research to innovation; it will create opportunities to build research teams in Member States where the innovation and research potential is underexploited; it will encourage the training of researchers including exchanges of researchers between industry and academia; and through a suite of financial instruments it will help to plug the gap between innovative research and its exploitation.

In determining the contents of this Work Programme in line with the Horizon 2020 Specific Programme, the Commission has taken a new approach described here in the

General Introduction, underpinned by a strategic programming process where the aim is to increase impact through an integrated, coherent, evidence-based implementation.

This integrated approach is particularly important for areas of activity that cut across different challenges, also in many cases linking key enabling technologies to their application in addressing societal challenges. Such areas are referred to as 'focus areas', the key characteristics of which in a general sense are explained further in section 1.3.1, with each being described in detail in section 1.7.

Each focus area has been translated into a call in the societal challenges parts of the Work Programme (parts 8-14). Thus, the 12 focus areas represent around 15% of the total number of calls covered by the Work Programme.

This is not about reprioritising. It is about adding value and maximising the impact of EU funding by ensuring that the programming responds to new developments, covers the full research and innovation cycle, and contributes significantly towards the EU's overall policy objectives, such as the Europe 2020 strategy, the Annual Growth Survey, the Innovation Union and other flagship initiatives.

For development of subsequent Work Programmes, further iterations of the strategic programming process will take into account new intelligence on scientific, technological, economic, market, and social trends and foresight, as well as emerging policy needs. This will be combined with extensive consultations, notably through the Horizon 2020 programme committee and advisory structures.

The Horizon 2020 Work Programme overall comprises 18 sections, which set out the funding opportunities under the different parts of the programme. Each part is self-contained, and describes the overall objectives, the respective calls, and the topics within each call. Each topic describes the specific challenge to be addressed, the scope of the activities to be carried out, and the expected impacts to be achieved.

Proposals can be submitted at this stage only against topics marked '2014' in the calls for proposals shown on the Participant Portal. Information on when proposals can be submitted against topics marked '2015' will be provided at a later stage.

In addition, the General Annexes to the Work Programme contain: a list of countries eligible for funding, and applicable rules; standard admissibility criteria; standard eligibility criteria; types of action: specific provisions and funding rates; specific requirements for innovation procurement supported by Horizon 2020 grants; rules of contest for Prizes, a description of Technology Readiness Levels (TRL); a description of the evaluation criteria; a note on budget flexibility; other classified information; and financial support to third parties.

As compared with Framework Programme 7 there are relatively fewer calls and topics. Furthermore, these are generally broader and encompass a range of possible approaches. In most cases more than one possible action is envisaged for a particular topic. The Work Programme reflects the strong challenge-based approach of Horizon 2020, allowing applicants to have considerable freedom to come up with innovative solutions.

The move to challenge-based calls, attracting more multi-disciplinary and multi-sectoral proposals, will go hand-in-hand with changes in the proposal evaluation procedure, particularly in terms of the make-up and briefing of panels of experts. In addition, a

simplified list of possible types of action is to be used (e.g. research and innovation actions -100%; innovation actions - 70%, ERA NETs – see General Annexes to the Work Programme for a complete list).

Cross-cutting issues (e.g. social sciences and humanities, gender, international strategy) have been mainstreamed in each of the different parts of the Work Programme, ensuring a more integrated approach (see section 1.4).

In designing the Horizon 2020 Work Programme emphasis has been placed on streamlining the presentation compared with that for Framework Programme 7. This approach will be mirrored in the way the Work Programme is accessed via the web, with new tools designed to allow ease of access including smart searches.

The Horizon 2020 Work Programme covers the large majority of the funding available. It is complemented by the separate Work Programmes for the European Research Council, Euratom, the Joint Research Centre, as well as the Strategic Innovation Agenda for the European Institute of Innovation and Technology (EIT).

1.2 Key drivers

Europe's most pressing challenge is to overcome the economic crisis, with the first indications of progress now just beginning to emerge, and thus put itself firmly on the path to sustainable development.

What is required is a change in how Europe's economy operates – a change that will release the many strengths Europe can bring to bear in tomorrow's economy of high innovation, knowledge and skills. This is why Europe 2020 places research, technology and innovation at the forefront of activities designed to help Europe exit the current economic crisis and build smart, sustainable and inclusive growth.

There is untapped potential for the European economy to be more innovative, productive and competitive whilst using fewer resources and reducing environmental impact. Combating climate change is a global challenge, but also provides a unique opportunity to shift to a sustainable, low-carbon economy, therefore 35% of the Horizon 2020 funds will be climate change related. Greater resource efficiency would contribute to growth, jobs and enhanced competitiveness, with reduced costs for business as well as significant benefits for health and the environment. Harnessing innovation potential should boost competitiveness while avoiding environmental degradation. The 60% of the Horizon 2020 funds supporting sustainability will help fill knowledge gaps concerning the ecological and social viability of innovative solutions, as well as the economic aspects. Food security, recognised as a major global challenge, calls for an increase in production of food in Europe through climate smart agriculture and resource efficient farming. EU governments face an urgent need to control healthcare and other public expenditures, while meeting the increasing demands from their citizens. While ensuring open borders, the EU needs to protect its citizens and their rights from threats and proactively reduce risks to health, food and product safety, critical infrastructures and disasters.

New knowledge, technologies and innovations can turn these challenges into opportunities. The roll out of the digital economy will bring benefits across all sectors, through enhanced productivity, efficiency and innovation. Growth opportunities will

come from new sources, such as the oceans and seas, smart cities, space applications, high performance computing and more efficient use and reuse of waste and raw materials, water, biomass and biomass processing by-products. Opportunities will also come from new forms of innovation, such as social and public sector innovation, and by integrating perspectives from social sciences and humanities.

There is ample evidence to show why this is a sound approach. Europe continues to be a scientific leader, home to some of the best researchers and research centres across the globe. It is for instance responsible for 23% of world expenditure on research, 32% of high impact publications and 30% of patent applications, and over the past decade it has managed to retain its position on the global level better than some of its main competitors.

Europe's industry has remained world-leading and is now faced with new global challenges in many strategic sectors such as transport, space, pharmaceuticals and bio-based products, agri-food, and some manufacturing and process industries such as steel and shipbuilding. Importantly, research is an area where levels of public and private sector investment play a crucial role in supporting and leveraging private sector spending, particularly in activities involving high-risks and higher returns.

The private sector has shown its willingness to invest. In the face of the continuing economic and financial crisis, major EU-based firms continue to rely on R&D for their competitive edge. They increased R&D investment by 8.9% in 2011, up from 6.1% in 2010. The increase nearly matches US firms (9%), beats the global average (7.6%) and is far ahead of Japanese companies (1.7%).

Research and innovation performance across Europe however remains uneven and Europe can do better to generate fast growing companies in areas of new technologies and new sources of growth. There is a risk that the economic crisis will exacerbate the divide between leading performers and those that are yet to develop high performing research and innovation systems. Therefore, teaming projects under the Horizon 2020 programme will aim at a creation of sustainable centres of excellence in less well performing Member States. Moreover, the reinforced European Research Area framework aims to drive-up performance across Europe through greater openness, competition and collaboration.

Horizon 2020 will capitalise on the huge potential and, by addressing the societal challenges, will provide a strong connection with society. It will also support the structural reforms to European research and innovation systems which, through improvements to both efficiency and effectiveness, will unlock the combined potential of EU and Member States activities, including its women and men. On this basis, the overriding priorities for the first Horizon 2020 work programme will be to boost competitiveness and support the creation of jobs and new sources of growth, as outlined in the ex ante impact assessment which accompanied the Commission's proposal for Horizon 2020.

The key drivers for this have been used to identify those areas (calls and other activities) on which resources and effort will be focused over the first work programmes so as to achieve maximum impacts, and those parts of Horizon 2020 which will be rolled-out more rapidly.

The key drivers are as follows:

- focusing on parts of the societal challenges with **high potential for sustainable competiveness, innovation and growth**;
- using **dedicated measures to leverage and boost engagement of industry, including SMEs**;
- providing **access to finance**, which is an essential condition for successful innovation;
- developing the **new knowledge and contributing to skills,** which underpin excellent research and innovation, and promoting EU excellence;
- boosting the industrial deployment of **enabling technologies**;
- addressing the **research and innovation divide**;
- supporting strong **partnership with Member States**; and
- ensuring a strategic approach to **international cooperation**, to facilitate access to the best researchers and the best sources of expertise globally.

These key drivers, although providing the determining factors for the first Work Programme, will also be of crucial importance to the whole of Horizon 2020.

1.3 Maximising the Impact of Horizon 2020

The following sections describe the main features of the roll-out and implementation of Horizon 2020 in the first Work Programme, designed to emphasise the key drivers for competitiveness, jobs and growth as outlined above.

1.3.1 Focusing on the parts of the societal challenges with high potential for sustainable competitiveness, innovation and growth – focus areas

The first **Work Programme includes focus areas**, for the concentration of effort and resources, in order to maximise impacts. These focus areas have been identified on the basis of the key drivers described above, taking into account the convergence between priorities set out in the Specific Programme, and EU policy objectives.

The 12 focus areas - listed in section 1.7 below - were identified following a process of evidence gathering and analysis, looking broadly at the EU's key priorities and setting these against the research and innovation activities which could meet these needs, using the key drivers described above to refine the selection. The fact that 12 focus areas were identified is a reflection of the current potential for such integration across the Industrial Leadership and Societal Challenges parts, as well to ensure a reasonable coverage of the different research and innovation fields.

Each focus area is covered by a call located in the Horizon 2020 societal challenges. In many cases these are comprised of elements from several challenges, while at the same time strongly underpinned by the innovation potential of the key enabling and industrial technologies. In this way, they will foster an integrated approach across Horizon 2020.

Focus areas provide the opportunity to build **scale and critical mass**, to exploit the existence of well-established research and innovation agendas, to maximise the chances of securing breakthroughs and realising impacts, to provide genuinely cross-cutting approaches, while at the same time aligning the implementation with major political initiatives, and improving synergy with national programmes.

Focus areas have been developed within the Work Programme to support **a portfolio of activities** that:

- Bring together relevant activities from different challenges and enabling technologies (while still **respecting governance arrangements, including a strong role for the horizontal configuration of the Programme Committee**);

- Provide support **across the innovation chain** from research, to development, to proof of concept, piloting, demonstration projects, and to setting standards and policy frameworks;

- Make use of, as needed, the **full spectrum of forms of funding and types of action** including research and innovation grants, ERA-NETs and other forms of cofunding, SME actions, support to innovation public procurement or pre-commercial procurement;

- Integrate different perspectives, including from the social sciences and humanities, support gender perspectives, and meet the demands from consumers, policy makers and other users of the results.

In some cases, the areas will be implemented through or supported by **Public Private Partnerships** or **Public-Public Partnerships** (see section 1.3.8). The development of the portfolio of activities will benefit from interactions with relevant initiatives such as European Innovation Partnerships, European Technology Platforms, the Knowledge and Innovation Communities of the European Institute of Innovation and Technology and Joint Programming Initiatives.

Another facet of possible complementarity with the focus areas is through **Joint Programming Initiatives** (JPI), which allow Member States to come together on a voluntary basis and in a partnership approach to agree on common visions and Strategic Research Agendas (SRAs) to address major societal challenges. Ten JPIs have been launched to date by the Competitiveness Council. Whilst JPIs are implemented primarily using national resources, the Horizon 2020 Regulation provides for possible support to a JPI through the ERA-NET Cofund mechanism where its activities correspond with a Horizon 2020 priority.

The calls which constitute the focus areas are complemented by other calls, in fact the vast majority of all calls in the Work Programme, which address the rest of the activities within the Horizon 2020 Specific Programme.

In certain domains the cumulative and collective effect of several calls together constitutes another form of significant concentration of effort under this first Work Programme. An example of this is **'cultural heritage'** which is addressed in: two calls under Societal Challenge 5 (*Climate action, environment, resource efficiency and raw materials*); one call in Societal Challenge 6 (*Europe in a changing world – inclusive innovative and reflective societies*); one call under *Leadership in enabling and industrial technologies;* and one call under *Research Infrastructures.*

1.3.2 Supporting innovation

To help deliver growth and jobs and kick start the economy, measures to support innovation to help revitalise our industrial production base have been identified.

These include: improving the overall framework conditions for innovation; the promotion of open innovation and collaboration between industry, academia and research and technology organisations; access to finance and skills; opening new markets; tackling the barriers preventing the growth of innovative firms; promoting different Public-Private Partnership schemes; knowledge transfer; and cutting red tape by simplifying participation schemes.

Substantial support will be provided for innovation and activities directly aiming at producing plans and arrangements or designs for new, altered or improved products, processes or services. For this purpose they may include prototyping, testing, demonstrating, piloting, large-scale product validation and market replication.

Significant support to demand side approaches will be another important feature, notably **pre-commercial and first-commercial public procurement of innovation**, as well as **regulation to foster innovation and standard-setting to facilitate market entry or diffusion of innovations**. A number of challenges require **innovation by and for the public sector** in order to drive up the performance of public services, for example support for green public procurement to help environmentally-efficient innovations to break into the market successfully. Innovative procurement and other actions will be supported to encourage industry and academia to invest in new R&I for solutions fitting public service needs, or to invest in adapting R&I results to meet larger market price/quality requirements from the public sector. Innovation procurement activities will be used to strengthen the demand-pull, as integral parts of challenge-driven calls in the focus areas.

It is foreseen that from 2015 a small number of **Inducement prizes** will be developed, with details to be included in a future update of the Work Programme. These are used to spur innovation by setting a concrete, ambitious target without specifying the path to reach it. They are used in specific cases where there is a need to stimulate new forms of collaboration to deliver a cutting-edge solution. Inducement prizes are likely to widen the scope of contestants because of simpler procedures lowering the barriers to participate.

There will also be the **piloting of new forms and sources of innovation with a focus on public sector and social innovation**, as in citizen-centric public services, distributed learning systems and services for access to cultural heritage, notably in Challenge 6 (Work Programme Part 13 – 'Europe in changing world – inclusive innovative and reflective societies') . Public administrations have a powerful means to pull innovation – in the EU, the overall market for purchases of goods, services and works by the public

sector accounts for almost 20 per cent of GDP. There will also be pilots on private sector services and products such as innovation in business models.

Funding provided is designed to prevent market distortions. For innovation actions care will be taken to ensure that this neither distorts competition nor leads to market interference without sufficient cause

1.3.3 Dedicated measures to leverage and boost engagement of industry, including SMEs

Boosting industry engagement through partnerships

There will be **early implementation of innovation driven Public-Private Partnerships**, which will leverage private investment for the development of key technologies and areas, aligned to the objectives of Horizon 2020, with a particular emphasis on systems integration, validation, piloting and demonstration activities. These activities will be aligned with the overall objectives and priorities under Horizon 2020 and in each case will contain measurable objectives.

The Commission has set out proposals for **new and revitalised Joint Undertakings** under Article 187 of the Treaty. Public-Private Partnerships based on contractual arrangements and increased financial commitment of the industry, will also be created. Many breakthroughs in energy efficiency for transport, building and manufacturing are expected to be achieved through the envisaged Article 187 initiatives on Clean Sky (concerning aircraft), Fuel Cells and Hydrogen, and the initiative Single European Sky Air Traffic Management Research (SESAR); and contractual Public-Private Partnerships, including on Energy-efficient Buildings, Green Vehicles, Factories of the Future and Sustainable Process Industries (SPIRE). Major technological advances are expected through Article 187 initiatives on Innovative Medicines Initiative, Bio-Based Industries, Electronic Components and Systems and contractual Public-Private Partnerships on the Future Internet, High Performance Computing (HPC), Robotics and Photonics. Further support will be provided to the European Industrial Initiatives established under the SET Plan. The roll out of these Public-Private Partnerships will allow industry to directly participate in the definition and implementation of research and innovation priorities. Further information on the contractual PPPs can be found in the introduction of part 5 of the Work Programme (LEIT), except for Green Vehicles (covered in part 11) and HPC (covered in part 2).

In addition, priorities reflecting the strategies of the demand-driven **European Innovation Partnerships**, industry-driven **European Technology Platforms** and other stakeholder groups are important and will be progressed. These provide foci for greater resource efficiency and critical mass, synchronisation of developments and availability of tools. Importantly, the input provided by these groupings will help identify the content of the calls for proposals.

A reinforced effort for SMEs

SMEs will be the centre consideration in the development of the Work Programme with 20% (compared with the target of 15% under FP7) of resources to be allocated across the societal challenges and enabling and industrial technologies, either within projects or through targeted measures. In particular, the **dedicated SME instrument**, following a

predominately bottom-up logic, will be introduced in order to address the needs of innovating SMEs. Coaching services will be offered to beneficiaries to strengthen innovation management capacity and to support accessing the loan guarantee and equity instruments described below to scale up project results. In general, this instrument will cater for a broad range of different types of innovation, and support SMEs up to market replication. Care will be taken to ensure easy access through a uniform and SME-friendly implementation of the instrument.

The Commission has launched the next stage of the **Eurostars Joint Programme**, through a legislative proposal under Article 185, in partnership with Member States. This will target research and development intensive SMEs on a bottom-up basis.

A robust system **for on-the-ground support to** businesses and SMEs in particular will be set up, entailing a **close-cooperation between the National Contact Points and Enterprise Europe Network**, ensuring a coordinated approach with COSME, the programme for the Competitiveness of Enterprises & SMEs. This will include a concerted effort to spread awareness of the opportunities, and to facilitate access.

Taken as a whole, the first Work Programme of Horizon 2020 underlines the Commission's determination to give priority to SMEs, and fresh impetus to plans for fully implementing the Small Business Act.

1.3.4 Providing access to finance

Horizon 2020 will help companies and other types of organisation engaged in R&I to gain easier access, via financial instruments, to loans, guarantees, counter-guarantees and hybrid, mezzanine and equity finance (part 6 of the Work Programme).

The priority for 2014-2015 is **to continue and build on activities that have proved their worth in supporting R&I in 2007-2013**: the Risk-Sharing Finance Facility (RSFF) and the Risk-Sharing Instrument for SMEs (RSI) in FP7, together with GIF-1, the early-stage part of the High-Growth & Innovative SMEs Facility in the Competitiveness & Innovation Framework Programme (CIP). Horizon 2020's financial instrument facilities will operate in conjunction with those of COSME, the successor to CIP.

The coming two years will also see **a significant participation by Horizon 2020 in the proposed SME Finance Initiative**; the launch of **a pilot facility supporting the technology transfer process**; and **a new focus on improving access to risk finance by larger midcap firms**. In addition, firms of all sizes, together with other types of organisation, will be able to get advice on how to make themselves more attractive to banks and potential investors. And to help prepare for new developments, studies will examine how best to encourage more business angel and crowd-funding investments in R&I and look into the potential for pan-European venture capital (VC) funds-of-funds.

As in the previous programmes, **debt and equity facilities will be run in a demand-driven manner**, though the priorities of particular sectors or of other EU programmes will be targeted if top-up funding is made available. **The focus remains on attracting private investments into R&I**.

Subject to the successful conclusion of negotiations, **the European Investment Bank (EIB) and the European Investment Fund (EIF) will play an important role in implementing each financial instrument facility in partnership with the European**

Commission. For EIF, this role includes (as under FP7 and CIP) conducting calls for expressions of interest for selecting the financial intermediaries, such as banks and risk-capital funds, that will make the actual loans to or investments in SMEs and small midcaps. While EIB will make large loans directly, it will also be able to use financial intermediaries as well, particularly when supporting medium and large midcaps.

1.3.5 Developing new knowledge and skills

Developing new knowledge and ideas, which are among the key drivers of competitiveness, calls for promoting excellence and making Europe's research and innovation system more competitive on a global scale. Horizon 2020 aims to strengthen the human resources base and strongly focus on delivering skills relevant to the labour market and allowing the knowledge to be translated into innovative products and services. It provides a clear response to a growing demand for highly skilled personnel to boost innovation and academia-business interactions in line with the key priority open labour market for researchers set in *the reinforced European Research Area partnership for excellence and growth communication* (2012).

The activities of the **European Research Council** (described in a specific and separate Work Programme) will continue to support the best ideas based on excellence by providing funding to the most talented and creative individual researchers and their teams to carry out **frontier research of the highest quality**, on the basis of Union-wide competition, which could lead to new innovative breakthroughs. The work programme has been developed by the ERC Scientific Council.

The **Marie Skłodowska-Curie Actions (MSCA)** (part 3 of the Work Programme) which offer excellent career development opportunities in academic and non-academic sectors to attract and retain high potential individuals in Europe, will be supported. The focus will be on emerging talent, building skills for long term careers, and offering attractive working and employment conditions. **Attention will also be paid to industry-academia secondments** and **doctoral training** that provides adequate additional competences for the evolving needs of both public and private employers.

Future and Emerging Technologies (FET) (part 2 of the Work Programme) provides a unique combination of high-risk, long-term, multidisciplinary and collaborative, research with the structuring of more mature ideas and communities. It involves fostering radically new technologies by exploring novel and high-risk ideas. Thus, it should prepare for the conversion of novel proofs of concepts into mainstream research and innovation and ultimately industrial applications and systems. In addition, **FET Flagships will address grand science and technology challenges** which require a common European research effort and sustained funding for a period of up to 10 years. This will be achieved through visionary, science-driven, large-scale, multidisciplinary research initiatives oriented towards a unifying goal, with a transformational impact on science and technology and substantial benefits for European competitiveness and society.

An essential component laying the foundation for new knowledge and skills will be the **research infrastructure activities** (part 4 of the Work Programme). They will focus on developing world class research infrastructures (RIs). The aim is to facilitate and to support the preparation, implementation, long-term sustainability and efficient operation

of the research infrastructures identified by ESFRI and other world-class infrastructures; on facilitating access through the support of integrating activities; on **fostering the innovation potential of RIs with a focus on instrumentation and the participation of industry**; and on reinforcing international cooperation with strategic third country partners.

By enabling more cooperation as well as computation-intensive and data-intensive research across disciplines, **e-infrastructures** will contribute in making European research – academic or industrial - more innovative and efficient. Addressing successfully the societal challenges and industrial competitiveness increasingly depends on high performance computing and accessing and analysing 'big data'; therefore e-infrastructure development and deployment will in part be driven by the requirements of the Industrial leadership and Societal Challenges parts of Horizon 2020; vice versa, projects in these parts of Horizon 2020 are expected to make use of available e-infrastructures services where relevant. The e-Infrastructure activity will also support open access to research results as described under section 1.5.

1.3.6 Boosting the industrial deployment of enabling technologies

Horizon 2020 will provide extensive research and innovation support to EU industry, which with more than 32 million employees in the EU and accounting for 80% of innovations, is the main source of growth and job creation. The **successful application of Key Enabling Technologies (KETs) by industry** is a key factor in strengthening Europe's competitiveness (see Introduction to LEITS in part 5 of the Work Programme), in particular in what concerns industrial productivity and innovation capacity. The goal of Horizon 2020 is to provide support to capture a large share of the rapidly expanding markets of KETs, to ensure the best use of these technologies to generate value across the economy and enable innovative solutions to societal challenges.

The first **Work Programme will support research and innovation activities in all identified key enabling technologies**, notably in the fields of micro- and nano electronics, photonics, nanotechnologies, advanced materials, biotechnology, advanced manufacturing and processing, and other strategic drivers such as space. It will also support **cross-cutting KET actions**, given the potential of combinations of different KETs to create unforeseen advances and new markets. Activities will address the whole innovation chain with technology readiness levels spanning from the low end to higher levels. For the higher technology readiness levels, **dedicated support will therefore be provided for innovation actions that include larger-scale pilot lines or demonstrators** in order to facilitate industrial take-up and commercialisation, without interfering with or distorting markets**.** In addition, **there will be a strong focus on the contribution of key enabling technologies to societal challenges,** including the support of KETs to all the focus areas.

Activities will be based on research and innovation agendas defined by industry and business, together with the research community, and have a strong focus on leveraging private sector investment. Public-Private Partnerships (as set out above) will be used extensively for the implementation and deployment of the key enabling technologies.

Internet and the Web have become the key vehicles for innovation and creativity across the economy and society, with the digital sector representing a market of around EUR 3 trillion world-wide and more than 10% of the world's GDP estimated to depend on ICT.

Under the first Horizon 2020 work programme, ICT activities will focus on the integration of advanced networks, of cloud computing with huge data processing capabilities, of high performance computing and of sensing and communicating devices to build smart connected environments to enable new classes of applications with high impact. Similar to KETs, such environments will be of strategic significance both for consumer markets and for the enterprise world. They will ensure that industry, public sector and society are equipped with a top range information infrastructure.

Space will focus on the development of technologies (part 5 of the Work Programme) to be used in future space programmes through strategic research clusters; and on reaping the benefits of the Union space flagship programme in order to improve Europe's capacity to address major societal challenges and for scientific use. Capitalising on a €10 billion Union investment over the last decade in infrastructure and service development, by 2015, the first Union space missions (Galileo and GMES/Copernicus) will reach the operational stage generating an unprecedented wealth of data available for the development of new space enabled applications by Horizon 2020 societal challenges and focus areas such as agriculture, ocean and water cycle monitoring, low-carbon energy infrastructure planning and protection, intelligent transport, disaster management and climate action.

1.3.7 Closing the research and innovation divide

The first **Work Programme of Horizon 2020 will progressively roll-out the set of specific measures to overcome the innovation divide** (see Work Programme Part 15 – 'Spreading Excellence and Widening Participation'). A strong initial emphasis will be to support Member States and regions in the effective implementation of the new research and innovation programmes under the Structural Funds. Policy support will be provided under Challenge 6 (Work Programme Part 13 – 'Europe in changing world – inclusive innovative and reflective societies') for national and regional governments on R&I policy design and innovation, to raise the excellence of their science base and support competitiveness of their industries, in line with smart specialisation.

Building on the pilot call under Framework Programme 7**, a first main round of ERA Chairs** will be awarded to bring outstanding academics to institutions which have the potential to compete internationally for research excellence. Furthermore, specific actions will reinforce research and innovation capabilities across Europe through, on the one hand, **concerted efforts for upgrading or creating centres of excellence (Teaming)** and, on the other, **structured exchanges between institutions (Twinning) focusing on upgrading knowledge in a particular field of research**.

1.3.8 Strong partnership with Member States

Europe requires more cooperation so that the brightest minds work together to make greater impact on societal challenges (e.g. demographic-ageing, energy security, mobility, environmental degradation), and to avoid unnecessary duplication of research and infrastructure investment. It also requires more competition to ensure that the best researchers and research teams receive funding as well as measures to accelerate the opening of the labour market for researchers. Horizon 2020 will support the achievement and functioning of the European Research Area (ERA), as set out in the *Communication*

on a Reinforced European Research Area Partnership for Excellence and Growth (2012).

As a key part of this approach, **the aim is to support a number of Public-Public Partnerships** under Horizon 2020 in 2014 in the form of Art. 185 initiatives and ERA-NETs while paying particular attention to Joint Programming Initiatives. The Commission has responded to proposals for joint programmes made by Member States and launched the ordinary legislative procedure for successor programmes of extended scope under Article 185: The European and Developing Countries Clinical Trials Partnership (EDCTP 2), Eurostars 2 (see above), the European Metrology Programme for Innovation and Research (EMPIR), Ambient and Assisted Living (AAL 2). In this process, these new partnerships have been assessed against the criteria set out in Horizon 2020 and aligned on the basis of measurable objectives with Horizon 2020 priorities.

Other approaches will be taken to support joint actions with and between Member States. The new ERA-NET Cofund actions will be introduced to support joint calls and actions. Support will be given, where appropriate, to enable Member States to align their funding to implement Joint Programming Initiatives. **Marie Skłodowska-Curie co-funding of doctoral programmes and fellowship programmes** will enable regional, national and international research funders to align their strategies and implementation practices with Horizon 2020 objectives in the area of human resources development.

1.3.9 International cooperation

As more research and innovation is performed in third countries, **it is crucial that Europe is able to access the best researchers and research centres worldwide**. Not only does this provide sources of new ideas and expertise, it is also important to ensure that European researchers are able to **collaborate worldwide with** the best in the field.

International cooperation is therefore a crucial element of Horizon 2020 (part 13 of the Work Programme contains specific calls on horizontal activities). It opens up new and emerging markets for our businesses, it assists in tackling global societal challenges together with our international partners and it also strengthens Europe's position as a major global player.

In line with the new strategy for international cooperation,[1] the Work Programme of Horizon 2020 will continue **the general opening of the programme to participation of entities from across the globe**.

This will be complemented by the **development of targeted international cooperation activities** for all societal challenges and enabling and industrial technologies.

In this way, Horizon 2020 will promote cooperation with third countries on the basis of common interest and mutual benefit. International cooperation will therefore also be an important element in implementing Horizon 2020.

As set out in the international cooperation strategy, a strategic approach will be taken by drafting multi-annual roadmaps for each of the Union's main partners.

[1] COM(2012) 497

As part of the implementation of the international cooperation strategy, common principles for the conduct of international cooperation (including on the protection of IPR) will be promoted in order to achieve a level playing field. This will include encouraging reciprocal access to third country programmes.

Horizontal international cooperation activities will help in developing this strategic approach towards third countries by supporting policy dialogues, networking and twinning activities, coordination of EU activities with those of the Member States and strengthening the European research and innovation presence in third countries.

1.4 Cross-cutting issues in Horizon 2020

The ability to better address cross-cutting issues has been one of the key concerns in the design of Horizon 2020 and is equally well reflected in the way that the programme will be implemented.

Such issues are by their very nature generic to many parts of the programme and can play a major part in ensuring the relevance and overall impact of the activities being supported. Furthermore in many cases interdisciplinary solutions are needed, cutting across multiple specific objectives of Horizon 2020.

The idea is that cross cutting issues will be promoted between specific objectives of the three priorities to develop new knowledge, key competences and major technological breakthroughs as well as translating knowledge into economic and societal value.

A list of such cross-cutting issues is found in Article 13 of the Horizon 2020 Framework Regulation.

Social sciences and humanities (SSH)

Social sciences and humanities research is fully integrated into each of the pillars of Horizon 2020 and each of the specific objectives. This is an essential part of the outcome approach around which Horizon 2020 is designed and will be implemented. In addition it is a key objective that social sciences and humanities research will contribute to the evidence base for policy making at international, Union, national, and regional levels.

This is achieved in several ways. First, social sciences and humanities are mainstreamed as an essential element of the activities needed to tackle each of the societal challenges to enhance their impact. This may be through either the embedding of social sciences within a topic or as a major and separate component of a topic. Second, social sciences and humanities research is at the heart of the societal challenge 'Europe in a changing world: Inclusive, innovative and reflective societies' (see part 13 of the Work Programme).

It has been estimated that over 150 topics in the 'programmed' parts of Horizon 2020 are relevant to social sciences and humanities, which represents around 20% of the total topics in the Work Programme. These are either dedicated topics under the Challenge 6 'Europe in a changing world – inclusive, innovative and reflective Societies' (part 13 of the Work Programme) or topics (more than 100) outside Challenge 6 where there is a clear SSH component. All these topics are 'flagged' by the system designed for searching the Work Programme.

Science and society

Horizon 2020 funded activities will support the relationships between science and society through the promotion of **Responsible Research and Innovation** (**RRI**) as a cross-cutting issue as well as through part 16 of the Work Programme, *'Science with and for society'*. In practice, RRI is a package aiming to better engage society all across Horizon 2020 Research and Innovation activities. This package touches mainly upon civil society engagement in Research and Innovation, supported by further activities enabling easier access to scientific results, better uptake of the gender equality and ethics dimension in R&I, and formal and informal education to science.

Gender equality and the gender dimension in research and innovation content

In Horizon 2020, gender will be addressed as a cross-cutting issue in order to rectify imbalances between women and men, and to integrate a gender dimension in research and innovation programming and content.

Applicants to Horizon 2020 are encouraged to promote **equal opportunities** in the implementation of the action and to ensure a balanced participation of women and men at all levels in research and innovation teams and in management structures.

The **gender dimension** is explicitly integrated into several topics across all the sections of the Work Programme. An in-depth understanding of men and women's needs, behaviours and attitudes contributes to the scientific quality and societal relevance of produced knowledge, technologies and innovations. It also contributes to the production of goods and services better suited to potential markets.

A topic is considered gender relevant when it and/ or its findings affect individuals of groups of persons. In these cases, gender issues should be integrated at various stages of the action and when relevant, specific studies can be included. These topics are flagged to ease access for applicants. This should not however prevent applicants to a non-flagged topic from including a gender dimension in their proposal if they find it relevant.

Small and medium-sized enterprises (SMEs)

Building on the gains made by previous framework programmes, Horizon 2020 will support the participation of SMEs (see section 1.3.3 of this document) in an integrated way across all specific objectives. This will be achieved through a dedicated instrument to which only SMEs may apply, and designed to provide a package of support for SMEs, bridging research and innovation activities. In line with the target set out in the Horizon 2020 Regulation, more than 5% of the funding to the Industrial Leadership and Societal Challenges parts of Horizon 2020 in the Work Programme 2014-2015 is allocated to the dedicated SME instrument.

In addition an overview of the SME instrument is provided in part 7 of the Work Programme, 'Innovation in SMEs'.

Fast Track to Innovation (FTI)

Due to start in 2015 and with the details to be included in a future update of the Work Programme, a dedicated action supporting Fast Track to Innovation has been designed with specific features to improve the programme innovation impacts. This will have a

bottom-up-driven logic on the basis of a continuously open call with its first cut-off date in 2015, with Time to Grant not exceeding six months.

Dedicated topics using the fast track to innovation instrument are already identified throughout the Industrial Leadership and Societal Challenges parts of the Work Programme.

Widening the participation

A core objective for Horizon 2020 is to ensure that the research and innovation potential of all Member States is fully engaged and exploited by activities funded under the programme. Yet there is clear evidence to show that the research and innovation potential of the Member States, despite some recent convergence, remain very different, and there are large gaps between 'innovation leaders' and 'modest innovators'.

Horizon 2020 activities (see section 1.3.7 of this document) will help to close the research and innovation divide in Europe by promoting synergies with the European Structural and Investment Funds (ESIF) and also by specific calls and measures designed to unlock excellence in low performing research, development and innovation regions, thereby widening participation in Horizon 2020 and contributing to the realisation of the European Research Area.

Part 15 of the Work Programme is dedicated to the support of 'Spreading excellence and wider participation'.

International Cooperation

International cooperation (see section 1.3.8 of this document) with third countries and international, regional or global organisations is necessary to effectively address many specific objectives defined in Horizon 2020. International cooperation is essential for frontier and basic research in order to capture the benefits from emerging science and technology opportunities. Cooperation is necessary for addressing the societal challenges and enhancing the competitiveness of European industry.

Promoting researchers and innovation staff mobility at an international level is also crucial to enhance this global cooperation. International cooperation in research and innovation is a key aspect of the Union's global commitments. International cooperation will, therefore, be promoted in each of the three priorities of Horizon 2020. In addition, dedicated horizontal activities (see part 13 of the Work Programme) will be supported in order to ensure the coherent and effective development of international cooperation across Horizon 2020.

Sustainable development and climate change

Horizon 2020 establishes sustainable development and climate action as distinct cross-cutting priorities for the whole programme, specifying that while climate action and resource efficiency are mutually reinforcing objectives for achieving sustainable development, the whole of Horizon 2020 should contribute towards these overarching objectives. It is expected that at least 60% of the overall Horizon 2020 budget should be related to sustainable development, and that climate-related expenditure should exceed 35% of the budget, including mutually compatible measures improving resource efficiency.

This first Work Programme contributes substantially towards these two cross-cutting priorities of sustainable development and climate action, and towards achieving the expenditure targets.

Other cross-cutting measures

The cross-cutting issues will be supported by a number of transversal support measures, including support to: enhancing the attractiveness of the research profession, including the general principles of the European Charter for researchers; strengthening the evidence base and the development of and support for ERA (including the five ERA initiatives) and the Innovation Union; improving framework conditions in support of the Innovation Union, including the principles of the Commission Recommendation on the management of intellectual property and exploring the possibility of setting up an European Intellectual Property Rights valorisation instrument; administration and coordination of international networks for excellent researchers and innovators (such as COST).

1.5 Communication, open access to research results and a new emphasis on data management

Horizon 2020 takes a new approach to communication and to the access provided to research results and to data management.

First, actions shall develop and implement a comprehensive communication plan to ensure a high visibility of the funded actions and help to maximise the impact of results.

Second, following Horizon 2020's open access policy, beneficiaries must ensure that peer-reviewed scientific publications resulting from Horizon 2020 funding are deposited in repositories and made open access i.e. free of charge online access for the user.

Beneficiaries must also aim to deposit at the same time the research data needed to validate the results presented in scientific publications. Further information on the Open Access in Horizon 2020 is made available on the Participant Portal.

A novelty in Horizon 2020 is the Open Research Data Pilot which aims to improve and maximise access to and re-use of research data generated by projects. Participating projects will make their research data available on a voluntary basis, as specified in their Data Management Plans (DMPs, see below). They will also be required to make available the data needed to validate the results presented in scientific publications. Participating projects will receive dedicated support. In particular, any costs relating to the implementation of the pilot will be reimbursed and specific technical and professional support services will be provided.

Areas of the 2014-2015 Work Programme participating in the Open Research Data Pilot are:

- Future and Emerging Technologies
- Research infrastructures – part e-Infrastructures
- Leadership in enabling and industrial technologies – Information and Communication Technologies
- Societal Challenge: Secure, Clean and Efficient Energy – part Smart cities and communities

- Societal Challenge: Climate Action, Environment, Resource Efficiency and Raw materials – except raw materials
- Societal Challenge: Europe in a changing world – inclusive, innovative and reflective Societies
- Science with and for Society

Projects have the possibility to opt out of the pilot.

Individual actions funded under other areas of the Work Programme can participate in the Pilot on a voluntary basis.

Further information on the Open Research Data Pilot is made available on the Participant Portal.

A further new element in Horizon 2020 is the use of Data Management Plans (DMPs) detailing what data the project will generate, whether and how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved. The use of a Data Management Plan is required for projects participating in the Open Research Data Pilot. Other projects are invited to submit a Data Management Plan if relevant for their planned research.

Further information on Data Management Plans is made available on the Participant Portal.

1.6 Synergies with European Structural and Investment Funds (ESIF)

The European Structural and Investment Funds (ESIF) will invest up to €90 billion in innovation and research in the period 2014-2020. Therefore, Art. 20 of the Horizon 2020 Regulation and Article 37 Rules for Participation encourage synergies between Horizon 2020 and other European Union funds, such as ESIF.

Synergy does not mean to replace national or private funding by ESIF or to combine them for the same cost item in a project. Synergy means to expand the scope and impact of both Horizon 2020 and ESIF funds in terms of scientific excellence and place-based socio-economic development respectively. Examples for this could be the development and equipment of research and innovation infrastructures or the fostering of innovation skills through ESIF that enable the participation in a Horizon 2020 project, or the transfer of knowledge and technologies resulting from Horizon 2020 projects to firms that can, thanks to ESIF support, develop it further, test, prototype, etc. towards innovations fit for market take-up. ESIF can also be used to expand the support and advisory services for potential Horizon 2020 participants. ESIF can also help deploy innovative solutions emanating from Horizon 2020, e.g. through public procurement in the fields of environment, transport, health and energy.

Applicants are therefore invited to identify the smart specialisation fields of their EU Member State or region (see*:* http://s3platform.jrc.ec.europa.eu/eye-ris3) and explore potential for synergies with the relevant Managing Authorities in charge of the ESIF in their territory (see: http://ec.europa.eu/regional_policy/indexes/in_your_country_en.cfm). More details on ESI Funds investments in research and innovation can be found in the following link: http://ec.europa.eu/regional_policy/activity/index_en.cfm

1.7 Focus areas in the Work Programme

A number of areas have been identified for special focus in the first H2020 Work Programme, on the basis that they hold significant potential to support the drivers presented above. Each of these is embedded in the relevant parts of the Work Programme according to where the centre of gravity lies, and covered by a specific call.

The focus areas are as follows:

> ***Personalising health and care*** *(see Work Programme part 8 – ' Health, demographic change and wellbeing'*; *with contributions from part 9 - 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy'*)

A combination of the immediate effects of the economic crisis, an ageing European population and an increasing chronic disease burden are jeopardising the sustainability and equity of European health and care systems, on which Europe already spends more than 9.5% GDP. Breakthrough research and radical innovation are required now to address the challenge, as is the translation of findings into the clinic and other health and care settings to improve health outcomes, reduce health inequalities and to promote active and healthy ageing. In order to do so, this focus area will support research and innovation throughout the health and care chain by promoting the development of personalised diagnostics, drugs and other interventions in an optimised and risk sharing approach, by empowering citizens to be active and engaged in managing their health and wellbeing for as long as possible, by improving health and care delivery through measures including evidence based integrated and self-care, and by promoting population health interventions, including adapting to changing environmental and climate factors. Personalisation of health and care has the potential to deliver improved health outcomes, to contribute to the sustainability of health and care systems and to engage citizens and patients in the development and use of interventions. Doing so requires the engagement of a variety of stakeholders as provided for in the topics of this focus area, and these activities will be complemented by the Innovative Medicines Initiative bringing together academia, small businesses and the research based pharmaceutical industry; by the European and Developing Countries Clinical Trials Partnership bringing together Member States and sub-saharan African countries to undertake clinical research on the main poverty related diseases; and by the Ambient Assisted Living Joint Programme with Member States bringing together users, small businesses, academia and the ICT and service industry; Biomedical research and innovation in these areas has the potential not only to improve quality of life, but also to deliver new jobs and growth (biomedical research industries provide a significant proportion of EU R&D business investment, the global tele-care and tele-health markets are estimated to grow to €17.6bn by 2015, and the health and care sectors estimated to have created 2 million jobs in the period 2008-2011). This focus area is in line with the EU Health Strategy; the Health Security Initiative; the eHealth Action Plan 2012-2020; the European Innovation Partnership on Active and Healthy Ageing as well as policy development necessary for the implementation of personalised approaches, for health and care system sustainability.

Sustainable food security *(see Work Programme part 9 - 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy')*

Ensuring availability and access to sufficient safe and nutritious food is a key priority that impacts all EU citizens and needs to be ensured today and in the future. At the same time the production and processing of food is a key economic activity providing jobs, skills and training, attracting investments, supporting rural and urban economies and also shaping landscapes. Given the economic scale of the food sector, the potential gains from research and innovation, and the structure of the sector with a strong participation of SMEs, this focus area will develop competitive and resource-efficient aquatic and terrestrial food production systems covering: eco-intensification of production; sustainable management of natural resources, including the accurate valuation of ecosystems services, while addressing climate change mitigation and adaptation; technologies for a sustainable food chain; safe foods and healthy diets for all; and a global food security system. Enabling technologies and space enabled applications, adequately set in a global context, will be an important element in achieving these goals. Overall, research and innovation actions within this challenge will cover the whole food chain, including both the supply and demand sides.

The economic and strategic importance of the agri-food sector is reflected in the following figures: agricultural exports in 2011 were worth €105 billion, or 7% of the total value of EU exports; Europe's food and drink industry is the largest manufacturing industry in the EU and in 2010 generated an annual turnover of €956 billion, almost half by SMEs, with over 4 million jobs. The whole agri-food sector employs 17 million people. Actions in this area will be in line with the EU Approach to Food Security; the EU Europe 2020 Resource-efficient Europe Flagship; the European Innovation Partnership 'Agricultural Productivity and Sustainability'; the Post 2015 Development Cooperation Agenda; the EU Biodiversity Strategy to 2020; the Common Fisheries Policy and the reform of the Common Agricultural Policy. It is expected that efforts in research will achieve a 20% gain in resource use efficiency (Roadmap to a Resource Efficient Europe); help reverse the diminishing trend of productivity gains in primary production by 2020 (European Innovation Partnership); enable food safety policy to be continually adjusted in the light of new scientific evidence (European Consumer Agenda); and provide the integrated EU approach needed for reducing ill health due to poor nutrition, overweight and obesity.

Blue growth: unlocking the potential of seas and oceans *(see Work Programme part 9 - 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy'; with contributions from part 10 – 'Secure, clean and efficient energy', and part 11 – 'Smart, green and integrated transport', and part 12 - 'Climate action, environment, resource efficiency and raw materials')*

Rapid technological progress in working offshore in ever-deeper waters, the need to reduce greenhouse gas emissions, and the need to look at how the 71 % of the planet that is seas and oceans can deliver human necessities such as food and energy in a sustainable way have opened up an opportunity for blue growth with the aim to harness the huge potential of Europe's oceans, seas and coasts for jobs and growth. This focus area addresses this overall challenge through five cross-cutting priority domains supporting the Blue Growth Agenda: valorising the diversity of marine life; sustainable harvesting

the deep-sea resources; new offshore challenge; sea and ocean observation technologies; and the socio-economic dimension. The aim of the focus area is to improve the understanding of the complex interrelations between various maritime activities, technologies, including space enabled applications, and the marine environment to help boost the marine and maritime economy by accelerating its potential through R&I. It will enhance sectoral and cross-sectoral cooperation by building on major international, regional and national initiatives.

At present sea and ocean bio-resources provide 15% of animal protein consumed globally; blue biotechnology has an expected yearly growth rate of 5 to 10%; deep-sea minerals extraction could gradually represent up to 10% of the world's minerals; marine renewable energy is rapidly extending to 40 GW of offshore wind capacity by 2020 and an exponentially rising 3.6 GW of sea and ocean energy by 2030. The Blue Growth economy in the EU is expected to grow to 7 million people employed by 2020. Actions in this area will be in line with the EU 'Blue Growth' strategy and relevant EU policies (e.g. Sea Basin Strategies and Action Plans) as well as provide support for international cooperation.

Smart cities and communities *(see Work Programme part 10 – 'Secure, clean and efficient energy'; with contributions from part 11 – 'Smart, green and integrated transport')*

Cities across Europe are forerunners in the transition towards a low carbon and resource efficient economy. 68% of the EU population lives in urban areas, a proportion that is growing as the urbanisation trend continues, and using 70% of the energy. Sustainable development of urban areas is a challenge of key importance and requires new, efficient, and user-friendly technologies and services, in particular in areas of energy, transport, and ICT. These solutions however require integrated approaches, both at the level of research and development of advanced technological solutions, as well as at the level of deployment. The first part concerns enhancing the development and validation of the technology as such, whereas the second part concerns the need for validation of new business cases and financing models, standardisation, scalability and replicability of the solutions, user acceptance and engagement. In particular the Energy, Transport and industrial technologies parts of Horizon 2020 will coordinate part of their activities for the development and technological validation of smart cities technologies that are at the intersection of the energy, transport, and ICT sectors. Once considered ready, these technologies can then be taken up by partnerships established under the European Innovation Partnership on Smart Cities and Communities. These partnerships will aim at large scale commercial roll out by transferring to cities and communities with similar constraints. The focus on smart cities technologies will aims at commercial-scale solutions with a high market potential in areas such as energy efficient and smart buildings and neighbourhoods; smart digital services for better-informed citizens; identification, optimisation and integration of flows (data, energy, people, goods); smart and sustainable digital infrastructures; smart and sustainable energy systems and smart mobility services. A powerful combination of this focus area and the EIP as a deployment mechanism will thus develop a strong pipeline of long-term, sustainable urban solutions in the EU, reduce greenhouse gas emissions as well as in general improve the overall air quality.

Competitive low-carbon energy *(see Work Programme part 10 – 'Secure, clean and efficient energy')*

One of the major challenges Europe will face in the coming decades is to make its energy system clean, secure and efficient. To help achieve such ambitious objective, this focus area aims to develop and put on the market affordable and efficient solutions to decarbonise the energy system, secure energy supply and to complete the energy internal market. The EU intends to reduce greenhouse gas emissions by 20 % below 1990 levels by 2020, with a further reduction to 80-95 % by 2050. In addition, renewables should cover 20 % of final energy consumption in 2020 coupled with a 20 % energy efficiency objective. Time is pressing. The solutions that will be developed and rolled-out to the market in the next 10 years will form the backbone of the energy system for the many decades ahead. This area will focus on: a smart European electricity grid involving major technological innovations for transmission, distribution and storage on all levels; alternative fuels and technologies including biofuels, fuel cells and hydrogen-based systems; competitive low carbon electricity to develop the next generation of renewables including solar energy, marine energy, geothermal energy, clean coal technologies, RES heating and cooling, but also to reduce cost and foster measures for market replication for offshore wind, concentrated solar power, high-efficiency bio-electricity, carbon capture, storage reuse and utilisation. Socio-economic research will help designing the most convenient pathways to achieve the climate and energy objectives while ensuring growth and creating jobs in Europe. Trends in energy demand will be taken into account, including adaptations to climate change. As far as nuclear research is concerned, activities will support ITER operation and ensure the safe and efficient operation of nuclear systems as well as the development of solutions for waste management. The aim is to provide an acceleration of technology development, necessary in order to meet EU climate and energy policy goals for 2020 and prepare the solutions needed to 2030 and beyond as a basis also for future economic growth. The Public-Private partnerships on Fuel Cells and Hydrogen and on the Bioeconomy will contribute to the objective of this focus area. Actions in this area will be in line with the European Strategic Technology Strategy Plan; Energy Roadmap 2050; and Low Carbon Economy Roadmap.

Energy Efficiency *(see Work Programme part 10 – 'Secure, clean and efficient energy'; with contributions from part 12 – 'Climate action, environment, resource efficiency and raw materials')*

Energy efficiency brings many advantages including addressing increasing dependence on energy imports, scarce energy resources and the need to limit climate change and boost the EU economic recovery. The EU 20% energy efficiency target by 2020 covers a dynamic area with a high potential for development and growth. Shifting to a more energy-efficient economy will accelerate the spread of innovative technological solutions and improve the competitiveness of industry, boosting economic growth and creating sustainable jobs in several sectors, estimated at 2 million jobs by 2020. This focus area will include actions in industry and buildings, including measures for market replication. Industry accounts for 27% of the final energy demand in the EU, with the major share (70 %) in large primary materials industries. Work will accelerate research and demonstration for optimisation of the use of materials, resources and processes and synergies between industries. As regards buildings, nearly 40% of final energy consumption is in houses, offices, shops and other buildings. Activities will address: highly energy efficient buildings, renewable heating and cooling, integrated solutions including design, technology, construction and behavioural change; sustainable

refurbishment focused on health/comfort; and building automation/control including ICT based energy management tools. Measures for market replication will focus on removal of non-technology barriers through capacity building, policy implementation measures and investment mobilisation support. Activities will also aim to generate the enabling conditions for EU companies to capture emerging markets for resource efficient and low carbon products and services. It is expected that activities under this priority could deliver more than 15-25 Mtoe reduction in the consumption of fossil fuels, more than 20 billion EUR of new energy investments, about 250,000 low-carbon jobs and improved knowledge base of EU actors across the board. The public-private partnership on Factories of the Future and Energy-efficient Buildings, will contribute to the objective of this focus area.

Mobility for growth *(see Work Programme part 11 – 'Smart, green and integrated transport'*)

Transport accounts for about (2011 figures) 63% of oil consumption and 29% of all CO_2 emissions, making the greening and efficiency of transport and mobility an imperative for meeting our climate goals, reducing the dependency on external energy markets and increasing the performance of the European economy. At the same time, the greening of transport offers a big opportunity to increase the global competitiveness of the European transport industry and promote growth and jobs. Transport as a whole represents 15.1% of total EU added value and 12.3 % of the EU labour force. Transport is on the brink of a new era of "smart mobility" where infrastructure, transport means, travellers and goods will be increasingly interconnected to achieve optimised door-to-door mobility, higher safety, less environmental impact and lower operations costs. In order to achieve efficiency at system-level, targeted efforts are needed to develop and validate new solutions that can be rapidly deployed, notably on corridors and in urban areas. They will address transport means and infrastructure and integrate them into a user friendly European transport system of smart connected mobility and logistics. Research and innovation on equipment and systems for vehicles, aircraft and vessels will make them smarter, more automated, cleaner and quieter, while reducing the use of fossil fuels and improving air quality. Research and innovation on smart infrastructure solutions, based also on GNSS applications, is necessary to deploy innovative traffic management and information systems, advanced traveller services, efficient logistics, construction and maintenance technologies. A thorough and mature research and innovation agenda has been defined collectively by the main stakeholders, (among others the public-private partnerships on Green Vehicles, Clean Sky, SESAR and any potential partnerships in the field of rail) who are fully committed to cooperate and co-fund. Actions in this area will be in line with the EU Road Map to a Single European Transport Area, the Strategic Research and Innovation Agendas (SRIAs) of the European Transport Technology Platforms (such as ACARE, ALICE, ERRAC, ERTRAC, WATERBORNE),the EU approach to research and innovation for Europe's future mobility; the review of the Thematic Strategy on Air Pollution; and the EU Low Carbon Economy Roadmap.

Waste: a resource to recycle, reuse and recover raw materials *(see Work Programme part 12 – 'Climate action, environment, resource efficiency and raw materials', with contributions from part 5 - 'Nanotechnologies, Advanced materials, Advanced manufacturing and processing, Biotechnology', and from*

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

Proper waste prevention and management represent a major opportunity for European society, notably in terms of job creation, access to valuable raw materials and resources, and cost effective ways of reducing greenhouse gases. This focus area therefore aims to boost the development of innovative, environmentally friendly and cross-sectoral waste management solutions, to build a better understanding of the environmental impact of human activities, and to seize new and significant market opportunities by positioning Europe as a global market leader in related innovation and technology: the global waste market, from collection to recycling, is estimated at €400 billion p.a.. Moreover full compliance with EU waste policy could create an additional extra 400 000 jobs within the EU and an extra annual turnover of €42 billion. It also aims to raise societal awareness in order to use resources efficiently, turning the waste sector into a carbon sink, as well as mitigate the dependency of Europe on imported raw materials. Activities will therefore address the whole production and consumption cycle, from waste prevention and the design of products and processes to waste disposal or re-use, including organisational, management and behavioural changes, and fostering business models that bring residual waste close to zero. Activities will focus on key sectors, such as industrial manufacturing, agriculture and food and will encompass the collection, recovery, recycling and transformation of valuable materials from urban and industrial waste streams, including municipal waste, construction and demolition waste, high tech products, agri-food and other bio-waste. The Public-Private Partnerships on Sustainable Process industries and on Bio-Based Industries will contribute to the objective of this focus area. This focus area will respond to needs identified in the European Innovation Partnership on Raw Materials, which also covers the supply of raw materials through sustainable extraction (e.g. novel mining techniques) and finding substitutes. Actions in this area will be in line with the Europe 2020 Resource-efficient Europe Flagship – in particular its milestone that by 2020 waste will be managed as a resource – the Eco-innovation Action Plan, the Communication 'Innovating for sustainable growth: a bioeconomy for Europe', the Raw Material Initiative strategy and the European Innovation Partnership on Agricultural Productivity and Sustainability.

Water innovation: boosting its value for Europe *(see Work Programme part 12- 'Climate action, environment, resource efficiency and raw materials'; with contributions from part 9 - 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy')*

Water is an invaluable resource for human health, food security, sustainable development and the environment, and is an economic sector of growing importance for Europe. However, water resources are constantly under pressure from climate change, urbanisation, pollution, overexploitation of freshwater resources and increasing competition between various user groups, and the improvement of the state of water resources will trigger substantial economic benefits. The objective of the Water Framework Directive – to achieve good status by 2015 – will be met only in around half of the European waters, making major additional action necessary. The aim of this challenge is therefore to seize these new and significant market opportunities by positioning Europe as a global market leader in related innovation and technology. The world market for drinking and waste water reached €250 billion in 2008, with corresponding investments of more than €33 billion per annum. The market for technologies to adapt to climate change – like protecting from floods and droughts – is

rapidly growing, considering that the cost of repairing damages is estimated to be about 6 times higher than the cost of adaptation. Moreover there is significant potential to boost the competitiveness and growth of the European water sector, which includes 9 000 active SMEs and provides 600 000 direct jobs in water utilities alone. A 1% increase of the rate of growth of the water industry in Europe may mean between 10 000 and 20 000 new jobs, while synergies with other sectors may generate even larger returns (some estimates indicate that the application of ICT in water management and monitoring could produce growth of 30% per year). The integrated portfolio of activities will address innovative tools and methodologies, such as advanced ICT and earth observation technologies, for risk assessment, mitigation and adaptation strategies. It will also address eco-innovative, integrated and cross-sectoral solutions for water management such as: wastewater and drinking water treatment technologies; water reuse systems; closed water cycles in industry; enhanced desalination technologies; improved materials; process, behaviour and technologies to enhance water and energy use efficiency; and appropriate management systems and strategies that incorporate water, wastewater, storm water and energy systems and duly consider changes in its availability due to climate change or other stressors. Specific actions will rely on relevant needs identified in the Blueprint to Safeguard Europe's Water and the Strategic Innovation Plans of the European Innovation Partnerships (EIPs) – in particular the EIP 'Water', launched in 2012. Actions in this area will support the Europe 2020 Resource-efficient Europe Flagship, and the general Union Environment Action Programme to 2020.

Overcoming the crisis: new ideas, strategies and governance structures for Europe *(see Work Programme part 13 - 'Europe in a changing world – inclusive, innovative and reflective Societies'*)

In the next 5-10 years the EU and its Member States will be required to continue significant reforms in order to overcome the financial and economic crisis while further promoting smart, inclusive and sustainable economic growth. The impacts of the economic crisis have been far reaching on the ability of the EU economy to innovate, grow, and create jobs with major societal consequences. Action is therefore needed now to help carry out the reforms that will lay the foundations for a sustainable job-rich recovery and will allow the economy to transform itself. The portfolio of activities within this area will focus on socio-economic research on: (1) the reform of the EU economic governance structure to better secure financial and economic stability (focusing on the "Blueprint for a deep and genuine Economic and Monetary Union"); (2) the social, political and cultural consequences of and responses to the crisis, such as higher unemployment and the widening of social disparities; (3) understanding the evolution of the crisis: long-term and short-term impacts and resolution strategies; and (4) the impacts of broader global trends on the EU's economy and governance (e.g. climate change, migration, etc.). Actions in this area will support the *Europe 2020 Strategy*, and the EU approach to *a Deep and Genuine Economic and Monetary Union*.

Disaster-resilience: safeguarding and securing society, including adapting to climate change *(see Work Programme part 14 - 'Secure societies – Protecting freedom and security of Europe and its citizens'; with contributions from part 12 – 'Climate action, environment, resource efficiency and raw materials')*

Securing the society against disasters is one of the central elements of the functioning of any society. There is barely any societal sector which is not to some extent concerned by disasters and related resilience and security issues. Considering just the impact of climate change, there is an urgent need of reducing disruptions to economic activities caused by extreme weather events, with ever growing cost to the EU reaching already €13 billion in 2011. Environmental and socio-economic impact of disasters and crime and terrorism on the population amounts to average annual losses of roughly 25% of the global GDP and 5% of the Union's GDP respectively. The objective within this challenge is to reduce the loss of human life, environmental, economic and material damage from natural and man-made disasters, including from extreme weather events, crime and terrorism threats. This area will therefore focus on developing technologies and running large-scale demonstration with a view to: 1) strengthening prevention and preparedness against natural and man-made disasters by underpinning an all-hazard approach to risk assessment across the EU; 2) developing solutions, for climate change adaptation in areas affected by natural disasters , such as for port cities, critical infrastructures, tourism; 3) facilitating disaster management, notably through communication technologies for crisis response actors and the linking of situational awareness centres; 4) building up community resilience and resilience of critical infrastructure, including against cyber-crime and cyber-terrorism. Actions in this area will be in line with the EU Internal Security Strategy and its Action Plan; the EU Security Industrial Policy; the EU Climate Adaptation Strategy, the EU's Civil Protection Mechanism and the European Programme for Critical Infrastructure Protection. New risk assessments will be produced, interoperable communication technology prototypes developed and a new resilience indicator will serve as a benchmark for this focus area.

Digital security *(see Work Programme part 14 – 'Secure societies – Protecting freedom and security of Europe and its citizens'*)

European administrations, businesses and citizens are increasingly dependent on ICTs for their daily activities. These technologies boost productivity, innovation, commercial exchanges and societal changes. It is well recognized that security of ICT products, applications and services is a serious concern for users. The lack of confidence is a barrier not only to a wider adoption of ICT products and services, but also to the growth of the economy. Almost a third of Europeans are not confident in their ability to use internet for banking or purchases. An overwhelming majority also avoid disclosing personal information online because of security concerns. Across the EU, one in ten internet users has already become victim of online fraud. This focus area aims to develop solutions to protect our society and economy against accidental or man-made disruptions of the information and communication technologies they so much depend on; providing solutions for end-to-end secure ICT systems, services and applications; safeguarding the human right of privacy in the digital society; providing the incentives for the industry to supply secure ICT; stimulating the uptake of secure ICT. The aim is to ensure cyber security, trust and privacy in the Digital Single Market, increasing citizen's participation in the digital society, whilst at the same time improving the competitiveness of the EU security, ICT and service industries. Actions in this area will be in line with the EU 2020 Flagship Initiative on a Digital Agenda for Europe and the upcoming EU Cybersecurity Strategy.