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

**WORK PROGRAMME 2014 – 2015**

*1. General Introduction*

**INFORMAL DRAFT DISCUSSION DOCUMENT**

**Important notice:**

The present document is meant to facilitate the discussions towards the preparation of the work programme 2014 – 2015. It does not at this stage cover all relevant aspects and it does not prejudge the outcome of the ongoing inter-institutional negotiations on Horizon 2020 or internal work on cross-cutting aspects. Hence, it remains subject to change. Information, such as indicative budgets per call/area, will be provided at later stage.

# **General Introduction to the 2014-15 Work Programme**

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# 1. The Political context and key issues

## 1.1 Summary

The Commission has taken a new approach to implementing Horizon 2020, underpinned by strategic programming. This will ensure a coherent, evidence-based implementation of the activities set out in the Horizon 2020 Specific Programme, guiding the roll-out over the first years, specifically in the detailed preparation of the work programmes. This integrated approach, will be particularly important for areas that cut across different challenges and for linking key enabling technologies to their application in addressing societal challenges.

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.

**The foremost priority for Europe and for the start of Horizon 2020 is exiting the current economic crisis.** Horizon 2020 can make a significant contribution to this effort through boosting competitiveness, creating jobs and supporting growth. Key features for the first years of implementation of Horizon 2020, some of which has already begun, will therefore be:

- Focusing resources around areas of high growth and innovation potential within the societal challenges. In each focus area, a full portfolio of actions will be supported across the research and innovation cycle to maximise impact.
- Bringing forward key measures in industrial leadership on key enabling technologies, assuring access to finance and supporting innovative SMEs. These measures will also be assessed for their contribution to the focus areas.
- Launching a set of Public Private Partnerships to leverage major private investments in key technologies, including six Joint Undertakings under Treaty Article 187.
- Working with Member States to launch Public Public Partnerships, including four initiatives under Treaty Article 185, to pool resources and increase the return on public funding.
- Introducing a new set of measures to help overcome the innovation divide across Europe, thereby reinforcing major Structural Fund investments.

These focus areas and key measures will be complemented by more open, bottom up areas that respond to ideas from researchers and innovators.

A major investment will be made through the European Research Council and the Marie Skłodowska-Curie Actions to build the excellent science and researchers that will advance knowledge and underpin future competitiveness.

Complementing this are the direct research activities carried out by the Joint Research Centre (JRC) through its own work programmes, and the work of the European Institute of Innovation and Technology (EIT) in its efforts to build Knowledge and Innovation

Communities (KICs). The JRC's multi-annual work programme will also, following the strategic programming approach, setting out key orientations for 2014-16, to provide scientific support to Commission policy.

In subsequent years of implementation, the strategic programming process will help increase impact by taking into account new intelligence on scientific, technological, economic, market, and social trends and foresight, as well as emerging policy needs.

## 1.2 The Role of Horizon 2020 in Exiting the Crisis – Key Perspectives for the First Work Programmes

### **Europe's top challenge is the economic crisis and the path to sustainable growth.**

This challenge requires the development of a stable macroeconomic environment which true economic and monetary union can deliver. Through its capacity to combine growth and inclusiveness, our social market economy is one of Europe's greatest assets. But today its economy and its society face the threats of high unemployment, an ageing workforce, increased poverty and the risk of social exclusion becoming structural.

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.**<sup>1</sup> 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, smart cities, space applications, and more

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<sup>1</sup> A Stronger European Industry for Growth and Economic Recovery - Industrial Policy Communication Update, COM(2012) 582 final

efficient use and reuse of waste, water and biomass. 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, 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 has failed 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. 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 will unlock the combined potential of EU and Member States activities.

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.

The key drivers for this have been used to identify those areas 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 competitiveness, 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;
- boosting the industrial deployment of **enabling technologies**;
- developing measures which will address 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 Strategic Programme, will be of crucial importance to the whole of Horizon 2020.

The Strategic Programme comprises first, a number of '**focus areas**' which have a particularly high potential in terms of well-established research areas and the need for building critical mass to address in particular the societal challenges. Second, to help deliver growth and jobs and kick start the economy, measures to support innovation, to provide better access to financing and to help revitalise our industrial production base have been identified. Third, there are measures for sustained support to all enabling technologies, through a strong involvement of industry and SMEs.

### 1.3 Maximising Impact: Key Drivers for Implementation of Horizon 2020

The following sections describe the main features of the roll-out and implementation of Horizon 2020 in the initial 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 has been developed around a limited set of 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 needs from the research and innovation community, EU policy developments, and experience from existing programmes.

The areas that have been identified are listed in section 1.4 below. They have been developed into a full set of funding opportunities within the Horizon 2020 work programme.

Focus areas are located in the Horizon 2020 societal challenges, in many cases taking 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.
- 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, ERANets 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, 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 below). The development of the portfolio of activities will benefit from interactions with relevant initiatives such as European Innovation Partnerships, European Technology Platforms and Joint Programming Initiatives.

While these areas and the relevant calls will provide focus points for the first work programmes, they are complemented by other activities and calls that cover the other priorities under Horizon 2020, but which do not require a portfolio of activities to be developed or are not yet sufficiently mature to identify such a portfolio. Particular attention has been given to provide opportunities for creative proposals that address the challenges in innovative ways.

*Supporting innovation – reinforcing outcomes in the focus areas*

Measures to underpin outcomes 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 that operate close to end-users and markets** such as 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.

**Inducement prizes** will also be used, starting with a small number in the first work programme, where the aim is to identify and publicise innovations and engage investors and innovators to take new solutions to market. Prizes could be further leveraged through cooperative ventures between the Commission and private enterprises, non-profit organisations, charitable foundations, Member States or international partners to design and run competitions.

There will also be the **piloting of new forms and sources of innovation with a focus on public sector and social innovation** such as experiments with citizen-centric public services, distributed learning systems and services for access to cultural heritage. 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 retail sector innovation and innovation in business models.

1.3.2 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 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, 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.

In addition, priorities contributing to 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 programmes with 20% 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** 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-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.

#### 1.3.3 Providing access to finance

The current economic situation and especially the crisis within the banking sector make it very difficult for innovative companies to access finance at the right time and under the right conditions. Horizon 2020 will help overcome market deficiencies in accessing risk finance for research and innovation through a facility for debt and a facility for equity.

The debt financing facility will provide loans directly to single beneficiaries to facilitate R&I investments, and also offer guarantees and counter-guarantees to financial intermediaries that they make loans to beneficiaries. Any legal entity of any size that can borrow and repay money is potentially eligible for a loan, including SMEs, other firms, universities, R&I infrastructures, etc. The equity financing facility will concentrate on investments in early-stage risk capital funds providing risk capital and quasi-equity (including mezzanine capital) to individual enterprises. The facility may also invest in funds-of-funds. The target final beneficiaries are enterprises of all sizes undertaking or embarking on research or innovation activities.

As well as providing loans, guarantees or equity investments on a first-come, first-served basis, the two facilities can also target particular sectors or policies by channelling ring-fenced financial resources from other parts of Horizon 2020, other EU programmes, regions or Member States (using Cohesion Policy funds), and other initiatives. The SME window of the debt facility and the equity facility will be implemented in complementarity with the financing facilities of COSME, and complement financial instruments at national level.

The initial focus will be on **further expanding the loan guarantee and counter-guarantee scheme** for innovative SMEs and small midcaps piloted in Framework Programme 7 as the RSI (Risk-Sharing Instrument), now known as the SMEs & Small Midcaps Guarantee Facility for R&I; **debt financing for larger midcaps, large corporates, research and innovation infrastructures**, etc., pioneered in Framework Programme 7 as the Risk-Sharing Finance Facility (RSFF), and now known as the Loan & Guarantee Service for R&I; and on the equity side, under the Equity Facility for R&I, focusing initially on the early-stage (including technology transfer) and **strengthening support for seed, start-up and early-stage firms** via investments in risk capital funds (also ensuring continuity with the facility known as GIF-1 under the Competitiveness & Innovation Framework Programme (CIP)).

#### 1.3.4 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** 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)**, 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. **Particular attention will be paid to industry-academia secondments** and doctoral training that provides adequate competences for the evolving needs of both public and private employers. In this respect, industrial doctorates, whereby research enterprises and universities jointly structure a doctoral programme in which a large part of the PhD is undertaken in the non-academic sector, will be particularly fostered.

**Future and Emerging Technologies (FET)** 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**. They will focus on developing world class research infrastructures (RIs), including the support to the preparatory phase of new RIs, the implementation and operation of existing world class RIs such as ESFRI projects and ERICs; 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, trans-disciplinary research & innovation activities, stimulating the emergence of new businesses and piloting new models with a view of sustainability, **e-Infrastructures** will contribute to making Europe more innovative. In societal challenges - such as health, climate change or energy - that increasingly depend on computer modelling and on processing enormous amounts of data this activity will contribute to the scientific foundations and the technology developments to achieve the level of performance required to address the most advanced challenges.

### 1.3.5 Boosting the industrial deployment of enabling technologies

Horizon 2020 will provide extensive 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 deployment of Key Enabling Technologies (KETs) by industry** is a key factor in strengthening Europe's competitiveness, in particular in what concerns industrial productivity and innovation capacity. The goal of Horizon 2020 is 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 highest levels preceding mass production. For the higher technology readiness levels, **dedicated support will therefore be provided for larger-scale pilot lines and demonstrator projects** (including those of larger scale, for technology and product validation under industrial conditions) in order to facilitate industrial take-up and commercialisation. 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 identified in the Annex.

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, 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** 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.

### 1.3.6 Closing the research and innovation divide

Horizon 2020 has been designed, without compromising on excellence, to ensure equal access to the funding opportunities and that results of research and innovation activities are well disseminated and exploited. It is critically important to get the maximum from the investments and that means involving the best researchers, research centres, enterprises and those able to deliver the innovation and impacts which are expected. Specific measures will be available in Horizon 2020 to attract those institutions and individuals which, for a variety of reasons may not have been able to capture these benefits and opportunities.

The first **work programmes of Horizon 2020 will progressively roll-out the set of specific measures to overcome the innovation divide**. 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 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**.

### 1.3.7 Strong partnership with Member States

In terms of financial value, EU research and innovation funding is only a small percentage of the total research and innovation activities in the EU. 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 at national level. 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 launch a number of Public-Public Partnerships** under Horizon 2020 in 2014. The Commission has launched legislative proposals to take forward the Article 185 initiatives on the European and Developing Countries Clinical Trials Partnership (EDCTP), Eurostars (see above), the European Metrology Research Programme (EMRP), Ambient and Assisted Living (AAL) and the Baltic Sea Research and Development Programme (BONUS). In this process, these new partnerships will be 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 ERANet instrument will be introduced to support joint calls and actions. **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. Support will be given, where appropriate, to enable Member States to align their funding to implement Joint Programming Initiatives.

### 1.3.8 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. 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, the work programmes 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. International cooperation will therefore also need to be a systematic consideration in implementing each of the focus areas. As set out in the international cooperation strategy, this will ultimately lead to the drafting of multi-annual roadmaps for each of the Union's main partners.

Horizontal international cooperation activities will help in developing a 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 Focus areas

As a result of the strategic programming process, 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, covered by a specific call.

The focus areas are as follows:

##### *Personalising health and care*

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. Doing so requires the engagement of a variety of stakeholders working in partnership, whether through the Innovative Medicines Initiative bringing together academia, small businesses and the research based pharmaceutical industry; through the Ambient Assisted Living Joint Programme with Member States bringing together users, small businesses, academia and the ICT and service industry; through direct support to small businesses to bring their products and services to market, or through other forms of co-operative research, including international and Public-Public partnerships. 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 will support 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*

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. Based on 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 will be an important element in achieving these goals. Research and innovation actions within this challenge will cover the whole food chain, including both 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 €56 billion, almost half of which by SMEs, with direct employment for over 4 million. Actions in this area will support 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, and the reform of the common fisheries policy. It is expected that efforts in research will support: reaching a 20% gain in resource use efficiency (Roadmap to a Resource Efficient Europe); reverse the diminishing trend of productivity gains in primary production by 2020 (European Innovation Partnership); the constant adjustment of food safety policy in view of new scientific evidence (European Consumer Agenda); and the integrated EU approach to contribute to reducing ill health due to poor nutrition, overweight and obesity.

#### *Blue growth: unlocking the potential of the oceans*

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 ocean 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 untapped 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; 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 ocean's 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 rapidly extends to 40 GW of offshore wind capacity by 2020 and an exponentially rising 3.6 GW of 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 support the EU Blue Growth Strategy and relevant EU policies as well as provide in particular for transatlantic cooperation.

### *Smart cities and communities*

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 result in 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*

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, RES heating and cooling, but also to reduce cost and foster the market roll-out of offshore wind, concentrated solar power, high-efficiency bio-electricity, carbon capture, storage 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 priorities and approach within this focus area will

be aligned with the forthcoming Communication on energy technology and innovation. 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 support the European Strategic Technology Strategy Plan; Energy Roadmap 2050; and Low Carbon Economy Roadmap.

### *Energy Efficiency*

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 market uptake measures. 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. Market uptake measures 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*

Transport accounts for about 60% of oil consumption and 26% of all CO<sub>2</sub> 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 and SESAR) who are fully committed to cooperate and co-fund. Actions in this area will support the EU Road Map to a Single European Transport Area, 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*

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 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. and full compliance with EU waste policy could create an additional extra 400 000 jobs within the EU and an extra annual turnover of €2 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, energy, agriculture and marine 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, and 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, also covering the supply of raw materials through sustainable extraction (e.g. novel mining techniques) and finding substitutes. Actions in this area will support 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*

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. 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, including 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*

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 structural problems and short-term crisis impact (including short run vs. long run crisis 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*

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 support 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*

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 support the EU 2020 Flagship Initiative on a Digital Agenda for Europe and the upcoming EU Cybersecurity Strategy.

## 2. Structure of the programme, including calls and topics

There will be one Horizon 2020 work programme covering all the parts except for Euratom and the ERC for which separate work programmes are presented.

The work programmes comprise all of the various parts of Horizon 2020 as contained in the Specific Programme with the different Pillars.

In designing the work programmes, emphasis has been placed on streamlining the presentation compared with that for Framework Programme 7, with relatively fewer calls, each with fewer topics. 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 work programmes reflect the strong challenge-based approach, allowing applicants to have considerable freedom to come up with innovative solutions.

Cross-cutting issues (e.g. social sciences, gender, international strategy) been mainstreamed in each of the different parts of the work programmes, ensuring a more integrated approach to tackle these issues.

In terms of structure, each of the parts of the work programmes contains calls, and topics. Topics have three key features:

- *Specific Challenge* – this sets the context, the problem to be addressed, and why intervention is necessary
- *Scope* – this delineates the problem, specifies the focus and the boundaries of the potential action but without overly describing specific approaches
- *Expected Impact* – this describes the key elements of what is expected to be achieved in relation to the specific challenge

In addition, a simplified list of possible types of action is to be used (e.g. research and innovation -100%; innovation actions - 70%, ERA Nets)

As compared with Framework Programme 7, topics are generally broader and encompass a range of possible approaches. In many cases more than one possible action is envisaged for a particular topic.

**(to be completed)**