

Issue papers for the High Level Group on maximising the impact of EU research and innovation programmes

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Contribution to Juncker priorities and current challenges

Introduction

Following Jean-Claude Juncker's election as President of the European Commission in July 2014, the ten policy priorities of his mandate were formulated in late 2014 and adopted in 2015. They are:

- A New Boost for Jobs, Growth and Investment
- A Connected Digital Single Market
- A Resilient Energy Union with a Forward-Looking Climate Change Policy
- A Deeper and Fairer Internal Market with a Strengthened Industrial Base
- A Deeper and Fairer Economic and Monetary Union
- A Reasonable and Balanced Free Trade Agreement with the USA
- An Area of Justice and Fundamental Rights Based on Mutual Trust
- Towards a New Policy on Migration
- A Stronger Global Actor
- A Union of Democratic Change

While Horizon 2020 was adopted in late 2013, before the Juncker Commission came into office, it is the EU's main funding programme for research and innovation until 2020 and thus is an important mechanism for supporting and delivering on the current (and future) set of EU policy objectives. The contribution expected from Horizon 2020 to EU policy goals is outlined in the strategic documents that describe the aims of each individual Commission priority¹. Moreover, science is itself a policy objective for the Union.

The Horizon 2020 'work programmes' (legal documents that outline terms and conditions for funding projects, which are amended yearly) are explicitly aligned with the Juncker Commission priorities. In particular, many of the calls for research and innovation projects are designed to substantially contribute to the Jobs, Growth and Investment priority, the Digital Single Market, Energy Union and Climate change policy; as well as the Internal

¹ See for example the Energy Union strategy, in which support for research and innovation is one of the 5 core priorities. Almost EUR 5.7 billion has been allocated in Horizon 2020 to tackling the 'Secure, Clean and Efficient Energy' Societal Challenge during the period 2014-2020. So far, very few projects have finished or progressed to a state from where it is possible to draw valid conclusions on the programme's effectiveness and impact. So the contribution of Horizon 2020 to the Energy Union can only be assessed at this time in terms of inputs and budget allocations. The combined total Horizon 2020 budget devoted to energy in 2014-2015 was around EUR 2.6 billion, of which for example 24% addressed the 'Smart Growth' priority of the Energy Union strategy, 21% addressed the Energy Efficiency priority and 10% for Transport. Although the start of Horizon 2020 predates the designation of the Energy Union as a Commission political priority, energy and climate-related activities within the programme have been realigned to ensure policy coherence and to make sure that Horizon 2020 makes a sizeable contribution towards this political goal.

Market with a Strengthened Industrial Base, an Area of Justice and Fundamental Rights, Towards a New Policy on Migration and a Stronger Global Actor priorities.

Moreover, the 2014 Juncker Commission priorities provide an update and focus to the goals of Europe 2020, the EU's growth strategy for 2010 to 2020. Horizon 2020 directly addresses the long-term objectives of Europe 2020 and, in particular, many of the commitments of the 'Innovation Union' – the Strategy's major policy initiative on research and innovation². The Europe 2020 strategy seeks to achieve smart, sustainable and inclusive growth in Europe, including by devoting 3% of the EU's GDP to research and development by 2020. Article 4 of the Horizon 2020 Framework Programme Regulation states:

"Horizon 2020 shall play a central role in the delivery of the Europe 2020 strategy for smart, sustainable and inclusive growth ("Europe 2020 strategy") by providing a common strategic framework for the Union's funding of excellent research and innovation, thus acting as a vehicle for leveraging private and public investment, creating new job opportunities and ensuring Europe's long-term sustainability, growth, economic development, social inclusion and industrial competitiveness, as well as addressing societal challenges across the Union".

This strategy, with its vision for green growth built around job creation and poverty reduction ("inclusive"), education and innovation ("smart"), low-carbon emissions and low resource use ("sustainable"), acknowledges the economic, social and environmental dimensions of sustainable development encapsulated in the Sustainable Development Goals.

Socio-political context

Although positive signs are emerging, the EU has not yet overcome the effects of the economic crisis. High unemployment, especially amongst young people, remains the biggest socioeconomic concern and challenge in many Member States. The Commission's political agenda is therefore focused on strengthening the EU's competitiveness, stimulating public and private investment, promoting growth and creating new and sustainable jobs. At the same time, the EU has to respond to new emerging challenges, such as the war in Syria, rising migration flows or global health emergencies.

Research and innovation are important means to help tackle these deep-rooted challenges, with for example the mandate letter for the Commission's newly-created Security Union portfolio mentions: *"ensuring that EU-financed security research targets the needs of security practitioners and develops solutions to forthcoming security challenges"* as a major priority.

Horizon 2020 allows for a more flexible approach to respond to new emerging challenges compared to FP7.³ On migration, for example, the Commission has promoted EU initiatives that welcome researchers to Europe, such

² For example, commitment 6 of the Innovation Union states: *"Looking ahead to the next financial perspectives, the Commission will set out ways for future programmes to focus more on societal challenges, streamline funding instruments and radically simplify access".*

³ The FP7 ex-post evaluation concluded that even though FP7 responded to the economic crisis it was not flexible enough to respond to new emerging challenges. Horizon 2020 has been designed with sufficient built-in flexibility to tackle new and unexpected challenges, see Article 15 of the Horizon 2020 Regulation.

as the EURAXESS researcher mobility portal and the Marie Skłodowska-Curie actions of Horizon 2020. It has also more actively promoted policy-relevant results of EU-funded research on migration⁴.

Moreover, the EU was able to invest EUR 45 million in research to fight outbreaks caused by emerging infections such as the Zika⁵ virus. Three projects were funded which concentrate on filling the knowledge gaps on Zika infection and its consequences, and on investigating options for treatment and prevention. The consortia will also set up a Latin American and Caribbean network for emerging infectious diseases preparedness and response.

In 2014 the EU invested EUR 25 million in five targeted research and innovation projects to combat the Ebola virus outbreak, while some EUR 215 million was also mobilised jointly with industry participating in the Innovative Medicines Initiative public-private partnership. In February 2015, one of the projects funded through Horizon 2020 reported that a treatment developed during the course of the project reduces mortality by half (from 30% to 15%) in the early stage of Ebola⁶.

Key facts and figures on the Framework Programmes

Within the Multiannual Financial Framework (the overall EU budget for 2014 to 2020), the budgetary allocation for Horizon 2020 of around EUR 76 billion appears under the 'Competitiveness for growth and jobs' budget line. In 2014, Horizon 2020 represented 56.5% of the Budget 2014 Commitment Appropriations under this Heading.

The European Fund for Strategic Investments (EFSI) – a major initiative of the Juncker Commission – aims to ensure more and faster access to finance for innovative SMEs in the context of Horizon 2020. Research, development and innovation (RDI) is one of the priority sectors targeted by EFSI and, as at November 2016, out of the 385 EFSI transactions approved so far, around 96 are in the RDI sector and two-thirds of all projects "have a strong RDI element"⁷.

These projects received funding (through the European Investment Bank) amounting to around EUR 31 billion, which is 20% of the overall EUR 154 billion total investment related to EFSI approvals⁸. 9 projects are fully dedicated to RDI, receiving EUR 1.3 billion in EFSI funding which is expected to trigger an additional EUR 5.7 billion in total investments.

The table on the next page provides an overview of the different parts of the FP7 and Horizon 2020 programmes, grouped according to the major policy priorities of the Juncker Commission.

⁴Research and Innovation Projects in Support to European Policy: Migration and Mobility', February 2016 - http://ec.europa.eu/research/social-sciences/pdf/project_synopses/ki-na-27-592-en.pdf#view=fit&pagemode=none

⁵ EC News Alert of 21 October 2016: <https://ec.europa.eu/research/index.cfm?pg=newsalert&year=2016&na=na-211016>

⁶ See this EC web page for further details: <https://ec.europa.eu/research/health/index.cfm?pg=area&areaname=ebola>

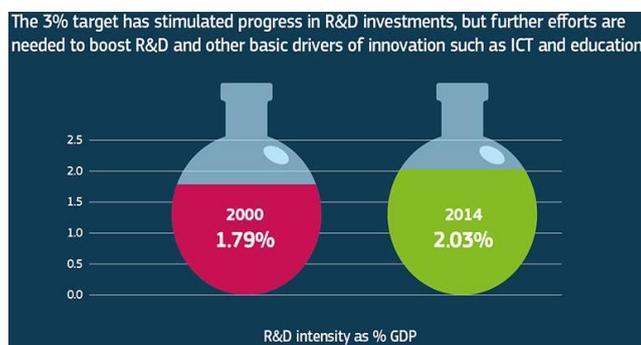
⁷ Sector-specific factsheet on Research, Development and Innovation. Investment Plan State of Play, European Commission, 28 November 2016. See: http://ec.europa.eu/priorities/sites/beta-political/files/research-innovation-development-booklet-investment-plan-sectors_en.pdf

⁸ Brochure, country factsheets and sector factsheets on EFSI, 28 November 2016. All documents are available at: http://ec.europa.eu/priorities/publications/investment-plan-results-so-far_en

Budget allocations in FP7 and Horizon 2020 grouped by Juncker Commission priorities⁹

| Juncker Priorities | FP7 Classification | EC Contribution in FP7 projects (Corda) (EUR million) | Horizon 2020 Classification | EC budget allocation in Horizon 2020 (legal basis) (EUR million) |
|---|--|---|---|--|
| Jobs, Growth and Investment | SP2 - Ideas | 7.739,83 | European Research Council | 13.094,80 |
| | SP3 - People | 4.824,16 | Marie Skłodowska-Curie Actions | 6.162,00 |
| | SP4 - Capacities (Research Infrastructures) | 1.528,32 | Research infrastructures | 2.488,00 |
| | SP4 - Capacities (Research for the benefit of SMEs) | 1.254,85 | Innovation in SMEs (excl. SME instrument) | 616,20 |
| | SP4 - Capacities (excl. Research Infrastructures and Science in Society) | 533,65 | Spreading excellence and widening participation | 816,50 |
| Digital Single Market & Deeper and Fairer Internal Market | SP1 - Cooperation (ICT, NMP (incl. Biotech), Space) | 12.391,05 | Leadership in enabling and industrial technologies (LEIT) | 13.557,00 |
| | SP1 - Cooperation (Health) | 5.758,78 | Health, demographic change and well-being | 7.471,80 |
| Energy Union and Climate | SP1 - Cooperation (Food, Agriculture and Fisheries, excluding Biotechnology and Marine research) | 2.106,55 | Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the | 3.851,40 |
| | SP1 - Cooperation (Energy) | 2.130,87 | Secure, clean and efficient energy | 5.931,20 |
| | SP1 - Cooperation (Transport) | 2.770,78 | Smart, green and integrated transports | 6.339,40 |
| Justice and Fundamental Rights | SP1 - Cooperation (Environment, incl. Climate Change) | 1.316,37 | Climate action, environment, resource efficiency and raw materials | 3.081,10 |
| | SP1 - Cooperation (Security) | 1.338,10 | Secure societies - Protecting freedom and security of Europe and its citizens | 1.694,60 |
| Democratic Change | SP1 - Cooperation (SSH) | 583,55 | Europe in a changing world - Inclusive, innovative and reflecting societies | 1.309,50 |
| | SP4 - Capacities (Science in Society) | 289,00 | Science with and for society | 462,20 |
| | Total FP7 | 44.565,9 | Total Horizon 2020 | 66.875,7 |

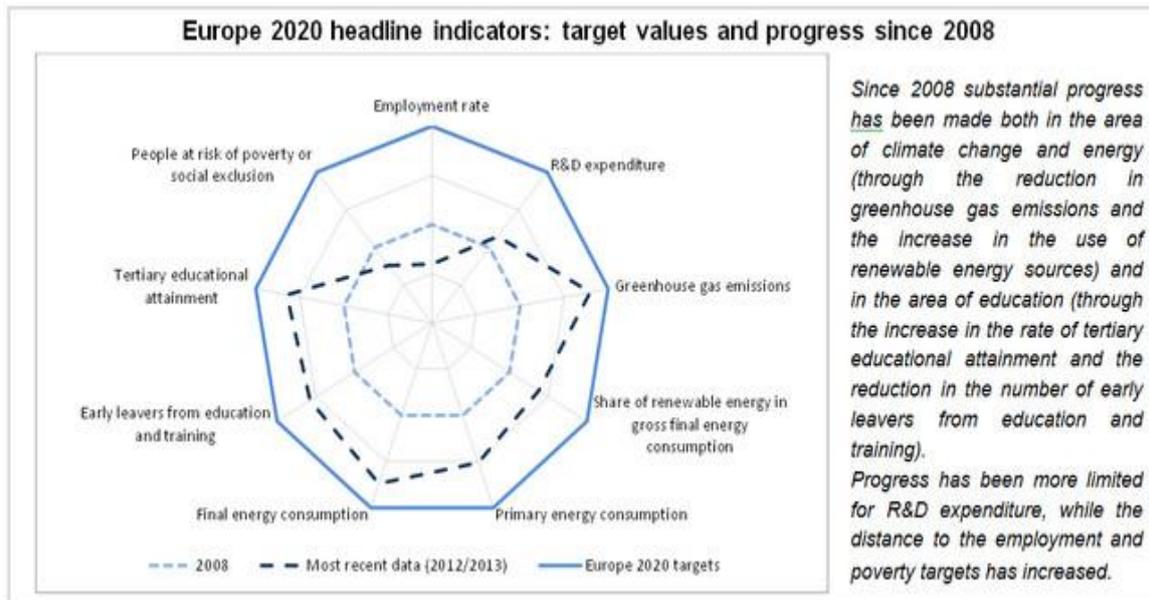
Progress towards the Europe 2020 target for R&D expenditure (3% of GDP) has been limited. The Europe 2020 headline target of increasing investment in R&D to 3% of GDP cannot be met, and was never intended to, by EU funding alone, while it represents less than 10% of total public R&D spending in the EU.



Horizon 2020 also aims to maximise the effects of EU funding by fostering collaborations and partnerships with and among Member States and private sector organisations, including through Joint Programming and public-private partnerships (PPPs)¹⁰, all of which are intended to have a significant leverage effect on investment in R&I in Europe.

⁹ The FP7 budget allocation is based on the EC contribution to signed grants, using a mapping of FP7 projects reflecting the current structure of Horizon 2020. The Horizon 2020 budget allocation is based on the indicative breakdown in the legal basis. These amounts do not include FP7 International Cooperation, Euratom, non-nuclear direct actions of JRC and the activities of the EIT.

¹⁰ Please see the 'Industrial Competitiveness' Issue Paper for further details and statistics on the JTIs and PPPs in Horizon 2020.



The Framework Programmes strongly contribute to sustainable development. Horizon 2020 promotes sustainable development both inside and outside the EU and integrates sustainable development as a cross-cutting issue for collaborative research with a dedicated 60% of its budget earmarked for sustainable development and 35% for climate change. Horizon 2020 funding for projects addressing sustainable development amounts to 55% of the overall funding thus far, while the equivalent figure is 27% for climate change¹¹.

In November 2016, the Commission published its Communication on the Sustainable Development Goals ("Next Steps for a Sustainable European Future"¹²) which ensures that all EU policy measures take on board SDGs at the outset. For the first time, research and innovation is mentioned in the Communication as a means to implement certain SDG targets, with a particular reference to FOOD 2030¹³.

While the overall contribution of Horizon 2020 to the Juncker Commission priorities thus far will be assessed in the interim evaluation of Horizon 2020, previous Framework Programmes such as FP7, can also be shown to have contributed (and some continue to do so) to the policy objectives of the Juncker Commission, as illustrated by the box on the next page.

¹¹ Data extraction from CORDA database based on Horizon 2020 projects funded up until August 2016.

¹² See: http://europa.eu/rapid/press-release_MEMO-16-3886_en.htm

¹³ SWD(2016)319 <http://ec.europa.eu/transparency/regdoc/rep/10102/2016/EN/SWD-2016-319-F1-EN-MAIN.PDF>

Illustrations of the contribution of FP7 to the Juncker priorities

As regards the contribution to growth and jobs, according to the High Level Expert Group on the FP7 ex-post evaluation, the FP7 programme has been estimated to:

- Contribute EUR 29 billion to tackling societal challenges.
- Contribute EUR 20 billion per year in additional GDP.
- Create an estimated 130,000 research jobs over 10 years.
- Create an estimated 160,000 additional jobs over 25 years.

The FP7 Ex-Post Evaluation Staff Working Document concluded that FP7 helped to improve the competitiveness of Europe's industry through ensuring strong private sector participation. This was assisted by the establishment of 5 Joint Technology Initiatives and 3 contractual Public-Private Partnerships, bringing together private partners and the European Commission, in areas such as innovative medicine and hydrogen fuel cells. In total 25% of the funding in open calls went to the private sector. Results of an econometric analysis show that SMEs participating in FP7 scored 38% higher than the control group with regard to employment growth and operating revenue.

FP7 supported the EU's objectives related to energy and climate change: especially the Energy and Environment thematic programmes helped achieve this objective. For Energy, a total of EUR 1.9 billion supported 374 projects in renewable energies such as wind, solar and biomass, and in addressing the performance of materials and hydrogen storage to improve energy efficiency and the security of supply and to reduce pollution. FP7-funded research also contributed to the implementation of EU environmental policies and strategies (e.g. EU Biodiversity strategy, EU Strategy on adaptation to climate change) and the work of international conventions and international bodies (e.g. Convention on Biological Diversity, UN Convention to Combat Desertification, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services).

FP7 also supported the EU's objectives related to the digital single market: the information and communication technology (ICT) area was the most funded thematic area of the FP7 Cooperation programme, with over 2000 projects supported and a total investment of EUR 7.8 billion. ICT projects have also contributed to policy-making and supported policy objectives beyond research. ICT was the areas of FP7 where collaboration between academia and the private sector was the highest and above EU, US and World averages with 6% of publications being published in collaboration between academia and industry.

FP7 supported the Innovation Union policy initiative: each euro invested by FP7 has generated around EUR 11 of direct and indirect economic effects through innovations and new technologies and products according to the independent expert group. FP7 contributed to a large degree to supporting the Innovation Union. 1,700 patent applications and more than 7,400 commercial exploitations have so far resulted from FP7 projects. With more than half of the projects from FP7 still ongoing, reported impact is expected to increase in the coming years¹.

FP7-funded collaborative research also contributed to the delivery of major EU policy goals in other EU policy areas, including:

- **FP7 Cooperation – Social Sciences and Humanities** projects have informed European policies in different fields such as Common Agricultural Policy or security and defence policies.
- **FP7 Cooperation – Space** contributed to the development of the GMES/Copernicus programme which provides information services in support of policy areas such as environment, energy, climate action, civil protection, external relations and blue growth.
- **FP7 Cooperation – Security** contributed to the implementation of EU external policies, the Common Foreign and Security Policy (i.e. in support of border control, conflict prevention and crisis management), the creation of an EU-wide area of justice, freedom and security, and policy areas such as transport, health, civil protection, energy, development, and environment.
- For **FP7 Cooperation – Health**, around half of finalised research projects reported on engagement with civil society actors or policy-makers. Around 25% of these were identified as having had an impact on EU policy.
- **FP7 Cooperation – Transport** supported preparations for the use of European satellite navigation systems (Galileo and EGNOS) in particular in the areas of road transport, aviation, professional applications and location-based services.
- In **FP7 Cooperation – Knowledge-Based Bioeconomy**: more than one third of the development and demonstration research contributed to standardisation and legislation (Common Agricultural Policy, Common Fisheries Policies).
- **FP7 People** – research training projects were the source of 17% of all patents emerging from FP7, much higher than the 9% of the FP7 budget that was allocated to the 'People' programme, otherwise known as the Marie Curie Actions.

Issues for consideration

- How can the Framework Programme reconcile predictability and flexibility in order to adapt to emerging challenges and new political priorities (i.e. balancing long-term perspectives with short-term needs)?
- What kind of impact should be expected from EU research and innovation in support of EU policy goals while respecting the inherent logic of science and innovation?
- How to achieve effective synergy with other Union programmes in order to maximise the impact of research and innovation funding (e.g. structural funds, agriculture, development)?

Selected stakeholder views¹⁴

The following comments provide a small sample of views on this issue:

- *"The implementation of the Energy Union is one example of the importance of EU-strategy-based collaborative research, as is the objective of committing 35% of Horizon 2020 funds to climate-related research [...] the Framework Programme is not only an important strategic and political tool, it also and above all represents enacted European collaboration and communication in an era when the EU is under threat from economic, political and societal crises".*
- *"It is very important to ensure continued political commitment, ambitious public investments and understanding of the long-term perspective if the current and future Framework Programme is to have a significant impact on jobs, growth and welfare in Europe".*
- *"Horizon 2020 is an important component of the Europe 2020 strategy for growth and jobs. It not only tries to bridge a gap between research and the market, and so stimulate the European economy, it also funds research activities in institutions that have proven to contribute more than what they actually cost. Investing in research and innovation is essential if Europe wants to move forward, realising its goal to become a true knowledge-based economy. The EU should continue to set the right example by dedicating a considerable part of their budget and efforts to the Framework Programmes".*
- *"The societal challenges have been defined on the basis of the political and socio-economic necessities for supporting EU policy areas. Two years after the launch of the Framework Programme, they have lost none of their urgency. The implementation of the Energy Union is one example of the importance of EU-strategy-based collaborative research, as is the objective of committing 35% of the Horizon 2020 fund to climate-related research. Collective research into major challenges which cannot be overcome at the national level represents major added value at the European level, and must utilise the full potential of research and innovation processes".*

¹⁴ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

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Open Innovation

Introduction

Horizon 2020 is the first programme to cover both research and innovation¹⁵. It is based on a broad innovation concept, which includes the use of existing technologies in novel applications, non-technological and social innovation. It introduced 'Innovation Actions' (IA) as a type of project which is close to the market and involves end-users¹⁶. The programme also features other activities to support innovation:

- A scheme for innovative SMEs with international ambitions in which single companies can take part
- A pilot Fast Track to Innovation scheme which aims to reduce the time from idea to market.¹⁷
- Demand-side instruments, such as pre-commercial procurement and procurement of innovative solutions
- Prizes to support open innovation. Prizes are a 'test-validate-scale' approach that brings together new-to-industry players and small players that may be less risk-averse and pursue more technologically radical concepts than large institutions.
- The InnovFin instruments, which expand the range of financial instruments provided by the European Investment Bank.
- The Future and Emerging Technologies Open scheme, which is part of the Excellence Science pillar.

In addition, the European Institute of Innovation and Technology (EIT), which is part of Horizon 2020, supports the creation of start-ups and spin-offs.¹⁸ Open innovation is also implemented by the European Innovation Partnerships (EIPs)¹⁹. Moreover, strong focus has lately been given to regulations that may hinder innovations to

¹⁵ With innovation and research actions having a different funding rate based on the principle that the closer to the market the supported activity is, the larger the additional funding from other sources should be.

¹⁶ It requires all proposals (except for those submitted in the Excellent Science pillar) to contain a plan for the dissemination and exploitation of the future results.

¹⁷ In order to reduce the time from idea to market, using a bottom-up approach, and to increase the participation of industry, SMEs and first-time applicants in Horizon 2020, the Fast Track to Innovation (FTI) pilot is implemented within the specific objective "Leadership in enabling and industrial technologies" and within the priority "Societal challenges". It should stimulate private sector investment in research and innovation, promote research and innovation with a focus on value creation and accelerate the development of technologies into innovative products, processes and services.

¹⁸ Recital 14 of the Horizon 2020 Regulation.

¹⁹ E.g. the EIP on Agricultural Productivity and Sustainability rests on synergies established between Horizon 2020 and the Common Agricultural Policy and focuses on the co-creation of knowledge by all concerned actors.

be implemented (i.e. an 'innovation principle' that would require regulation to be checked on its innovation-friendliness)²⁰.

Horizon 2020 marked a definite shift towards innovation, which is reinforced by the concept of Open Innovation. *"The basic premise of Open Innovation is to open up the innovation process to all active players so that knowledge can circulate more freely and be transformed into products and services that create new markets, fostering a stronger culture of entrepreneurship. The European Union is a research powerhouse, still the world's leading producer of scientific knowledge, ahead of the United States. However, Europe too rarely succeeds in turning research into innovation, in getting research results to market. Too often, new technologies that have been developed in Europe are commercialised elsewhere. Europe must get better at making the most of its innovation talent, and that's where Open Innovation comes into play".*²¹

In 2015, Commissioner Moedas launched a plea to support more start-ups and scale-ups that bring about market-creating innovations, using the label 'European Innovation Council' (EIC). The recent Start-up and Scale-up Initiative also puts emphasis on improving innovation support, including through Horizon 2020²². The challenge for Horizon 2020 is to help more innovative young companies to start and grow their business in Europe. In order to support this task, and to provide a user perspective, a High Level Group of Innovators will be set up at the beginning of 2017. The Commission intends to make changes already to Horizon 2020 for the period 2018-2020 as a preparatory phase for the potential future EIC. These will include: adopting a fully 'bottom-up' approach – so innovative projects that cut across sectors/technologies become eligible for support; making it easier for start-ups to access financial and technical support; targeting market-creating, breakthrough innovations with scale-up potential.

Socio-political context

Innovation drives growth

Innovation allows us to produce more with limited resources, thereby increasing productivity. As productivity grows, so does the economy, driving continuous improvement in incomes and welfare. There is a correlation between innovation and gains in the standard of living²³. Research into the links between research and innovation investment and economic performance shows a correlation between countries' investment in their future, their prosperity and GDP growth²⁴. A recent study estimates that a 1% increase in R&D spending could grow the economy by 0.61%.²⁵ Whilst innovation constantly re-shapes the global economy, historically, this process has led to net job creation.²⁶ Simultaneously, new markets emerge – the eco-innovation market, for

²⁰ See Competitiveness Council Conclusions May 2016 on research and innovation-friendly regulation:

<http://www.consilium.europa.eu/en/meetings/compet/2016/05/26-27/>

²¹ Open Innovation, Open Science, Open to the World – a Vision for Europe. European Commission, May 2016.

²² Commission Communication 'Europe's next leaders: the Start-up and Scale-up Initiative' (COM(2016)733).

²³ E.g. Solow (1957), Nuffield (1998)

²⁴ Eurostat (2016)

²⁵ Sahin (2015)

²⁶ The Economist (2014) 'Coming to an office near you – editorial'

instance, amounts to EUR 225 billion, employing 3.4 million people in the EU²⁷. Loss of competitiveness and resulting shift in global trade, on the other hand, often result in job loss.

Addressing major societal challenges increasingly calls for a systemic approach to innovation, whereby technological innovation goes hand in hand with non-technological forms of innovation such as business models, finance, regulation and governance, skills and social innovation.

In the EU, 59% of the population lives in cities, producing 68% of GDP and 62% of jobs. Cities, and especially larger and capital cities, are key actors of open innovation since they tend to have more highly educated population, more innovative enterprises and higher productivity. Cities benefit from agglomeration economies: they are the place for better matching between labour supply and demand, for easier access to markets through infrastructure network and for better learning through creative exchange of knowledge and ideas.

European cities are often located close to one other and proximity allows them to spread innovation faster through hubs and living labs, involving peri-urban areas and creating urban regions of smart specialisation. Networks of cities in Europe have been particularly effective in spreading innovation in five business domains: digital technology, spatial design, physical infrastructure, commercial business services, and social service provision. As highlighted by the World Economic Forum, Global Agenda Council on the Future of Cities, people-centred innovation happens in cities and it is the best way to mobilise citizens. From smart traffic lights to garbage taxes, innovations in technology, services and governance are not ends in themselves but means to foster behavioural change, enhance prosperity and improve quality of life.

Europe is behind with market-creating innovation

Europe could do better at breakthrough, market-creating innovation. The last few decades have seen the emergence of major new markets based on ICT, biotech, consumer internet, and most recently the collaborative economy. Despite early technology leads, the EU has created few companies that now dominate these new markets. Stakeholders, in a recent consultation on the idea for an EIC, widely agree that the lack of this type of innovation is an obstacle to growth and job creation in Europe²⁸.

Whilst new companies emerge at a similar rate in Europe as they do in the US, these new companies are not scaling up to become major employers and market leaders. This is demonstrated by the number of unicorns (young companies that have reached a market valuation of over EUR or \$ 1 billion) and their relative size. Europe is home to only 19 unicorns (e.g. BlaBlaCar, Rocket Internet or TransferWise), compared to over 100 in the US²⁹ (e.g. Facebook, Google, Amazon). European unicorns are also smaller – their combined value comes in at less than half the current market value of Facebook³⁰. According to the 2016 start-up and scale-up public

²⁷ EC (2011) 'Eco-Innovation Action plan FAQ'

²⁸ https://ec.europa.eu/research/eic/pdf//eic-infographic_24052016_a4.pdf#view=fit&pagemode=none

²⁹ Fortune (2016) 'The Unicorn List'

³⁰ GP Bullhound consultancy (2016) 'European Unicorns: do they have legs?'

consultation, securing finance for expansion is the top obstacle to start-ups' growth, followed closely by obstacles related to regulations³¹.

This is a missed opportunity for Europe. Fast growing innovative companies are important for creating new products and services and the jobs that come with them^{32,33}. Start-ups, usually tech-enabled³⁴, combine high reliance on product innovation, processes and financing, utmost attention to new technological developments and extensive use of innovative business models, often based on collaborative platforms. Too few European start-ups survive beyond the critical phase of 2-3 years, with even fewer growing into larger firms.³⁵

90% of market growth over the next decade is expected to be outside Europe. European companies need to gain more knowledge from international markets, participate in new value chains and reap greater benefits from these growing markets. This would notably involve international cooperation on innovation activities such as large scale trials or demonstrations and would result in enhanced competitiveness of European industry.

SMEs constitute a significant source of innovation, growth and jobs in Europe.

SMEs form the engine of the EU28 economy. In 2015, just under 23 million SMEs generated EUR 3.9 trillion in value added and employed 90 million people. They accounted in 2015 for two thirds of EU employment and slightly less than three fifths of EU value added in the non-financial business sector. The vast majority of SMEs are micro enterprises with less than 10 employees – such very small firms account for almost 93% of all enterprises in the non-financial business sector.

For the majority of companies that had introduced an innovative good or service since January 2013, the innovative goods or services represented up to a quarter of their turnover in 2015. The manufacturing sector, and in particular the high and medium-high-tech manufacturing sector, accounts for the largest share of business R&D investment. Although overall investment dynamics are mainly driven by large companies, the absolute number of SMEs in knowledge-intensive services sectors is more than 4 million in Europe. SMEs play a considerable role for future R&D and innovation in Europe.

The graphic included on the next page visualises the scale of the challenges faced by Europe in terms of the business environment and the knowledge-intensity of the economy.

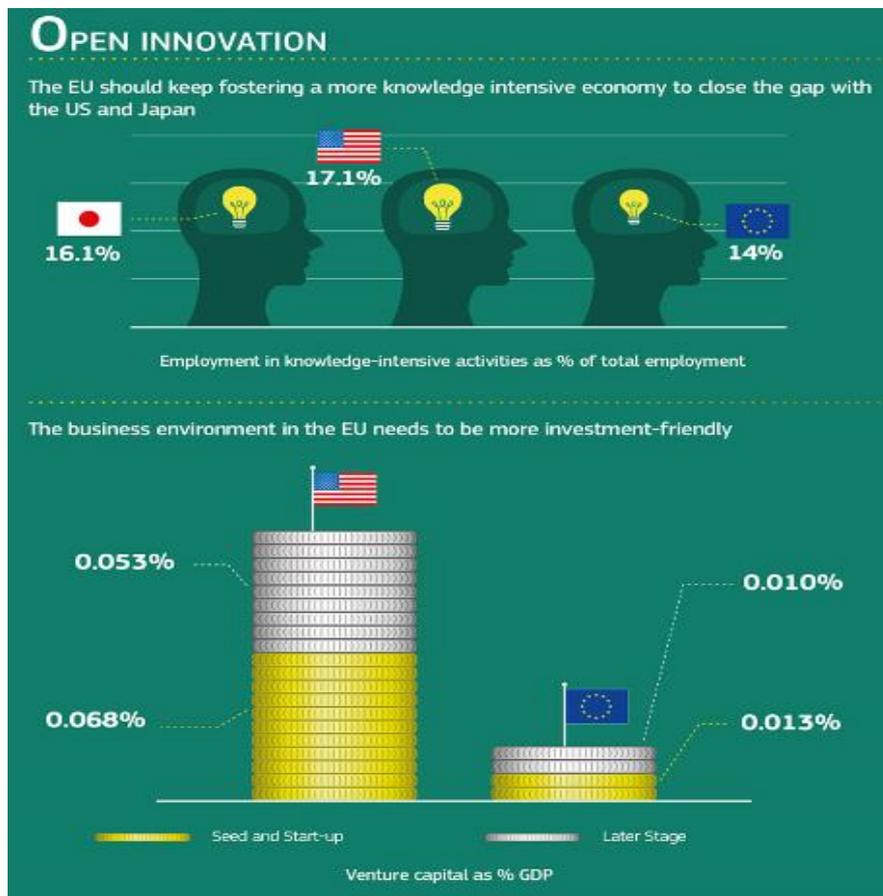
³¹ European Commission (2016) 'Report on the public consultation under the Start-up Initiative'

³² Ernst and Young (2016) 'Job creation survey'

³³ A UK study indicates that these high-growth businesses, comprising less than one per cent of the total business population, accounted for 36 per cent of net job creation between 2008 and 2013 (Anyadike-Danes, M. and Hart, M.: Moving on from the 'Vital 6%'. Enterprise Research Centre ERC p.5, quoted in The Scale-Up Report on UK Economic Growth, Sherry Coutu 2014). A recent study finds that the number of high-growth innovative enterprises in the EU in 2014 is only 0.16 % of all enterprises, but they grow fast (cumulatively over 2013-2014 by 3.2 %), providing employment to 3.3% of the workforce (Framework Conditions for High Growth Innovative Enterprises, by Inova, TNO and VTT, July 2016). Likewise, according to Henrekson and Johansson, 2010, 4 % of firms generate 70 % of new jobs. See also: <http://www.kauffman.org/blogs/policy-dialogue/2015/august/deconstructing-job-creation-from-startups>

³⁴ Connectivity; 5G and broadband etc.

³⁵ The percentage of firms that do not grow at all or by less than 5 % is over 45 % in Europe compared to 37 % in the US (Bravo-Biosca, 2011, A look at business growth and contraction in Europe).



Key facts and figures on the Framework Programmes

The ex-post evaluation of FP7 found - based on an analysis using the Community Innovation Survey tool - that innovative companies participating in FP7 were more likely to introduce product or service innovations to the market. FP7 thus supported innovative enterprises which obtain, on average, a higher proportion of their turnover from innovation than those not supported.

The High Level Group on the FP7 ex-post evaluation also stated that: *"We can also draw the conclusion that some of the most impactful elements of the FP7 are those that boost competitiveness through Open Innovation and Knowledge Transfer in the EU. (...) European R&D policy had already propelled collaboration and Knowledge Transfer to the forefront before the current emphasis on Open Innovation took hold in Europe."*

However, there is still a long way to go before Europe can claim truly global competitiveness and commentators underline the importance of putting Open Innovation and Knowledge transfer in the spotlight, of stimulating innovative businesses and markets, and building innovation hubs and networks. There is consensus that Universities and PROs should also be incentivised to be more entrepreneurial, and that there should be smart integration of public and private capital into the ecosystem."

The first years of Horizon 2020 show that this shift to innovation has been taken up well. More than 93% of the projects started have at least one company in the consortium³⁶. Of the participants, 50% are new (did not take part in FP7). In the SME Instrument, more than 80% of the participating companies are new. Despite many positive examples, e.g. in the health sector³⁷ and the EIT, Horizon 2020 could still do more to support start-up companies, fast growing technology companies and unicorns.

The Horizon 2020 measures to stimulate innovation have been implemented up until now as follows:

- **SME Instrument:** In the first two years, about 1,200 SMEs were supported with a total of EUR 513 million. The typical SME selected for funding in this dedicated instrument has been on the market for 11 years, has an annual turnover of EUR 4 million and employs 21 people. The highest share of young companies and start-ups are in the ICT sector. Most of the selected SMEs (63%) are in the seed or project-to-project stage, so still early in a company's lifetime. Among the selected SMEs, 'manufacturing' is the most represented economic activity (24%) closely followed by 'professional and S&T activity' (17%) and ICT (16%).
- **Fast Track to Innovation (FTI):** In 2015 77% of the participants come from the private sector; 48% are SMEs. Close to 60% of the FTI project coordinators are SMEs.
- **Innovation Actions (IAs):** Up to September 2016, 5.5% of the signed grants and 16.7% of the funding was allocated to IAs (the Excellent Science pillar does not feature IAs; within the other two pillars Industrial Leadership and Societal Challenges, 11.0% of the projects are IA with 27.0% of the EU contribution). IAs were applied especially in Energy, Security, FTI and SME Instruments calls. Within the Societal Challenges on Health and Europe in a Changing World, their share is much lower, due to the research orientation in these parts.
- **Prizes:** Up to 2016, 12 inducement prizes have been launched and six more will follow in 2017. All prizes are 'best-in-class prizes' which reward contestants that best meet the predefined objective. They target challenges such as Breaking the Optical Barrier, Ageing Population, Mother and Child Health, CO2 Reuse, Clean Car Engines, Cyber Security etc. So far, the finalised prizes under FP7 and Horizon 2020 were mainly used to fund incremental steps in research towards a bigger objective to be achieved in the future, or to further drive the market adoption of already existing solutions.
- **InnovFin:** Out of the 11,000 companies taking part in Horizon 2020, in the first two years 148 benefitted from the financial instruments in InnovFin for investments in scaling up (source: EIF). Out of the 1,640 SMEs taking part, 31 companies secured venture capital during or after the project (source: www.ventureradar.com). These numbers are expected to increase in the years to come when more projects start delivering results.

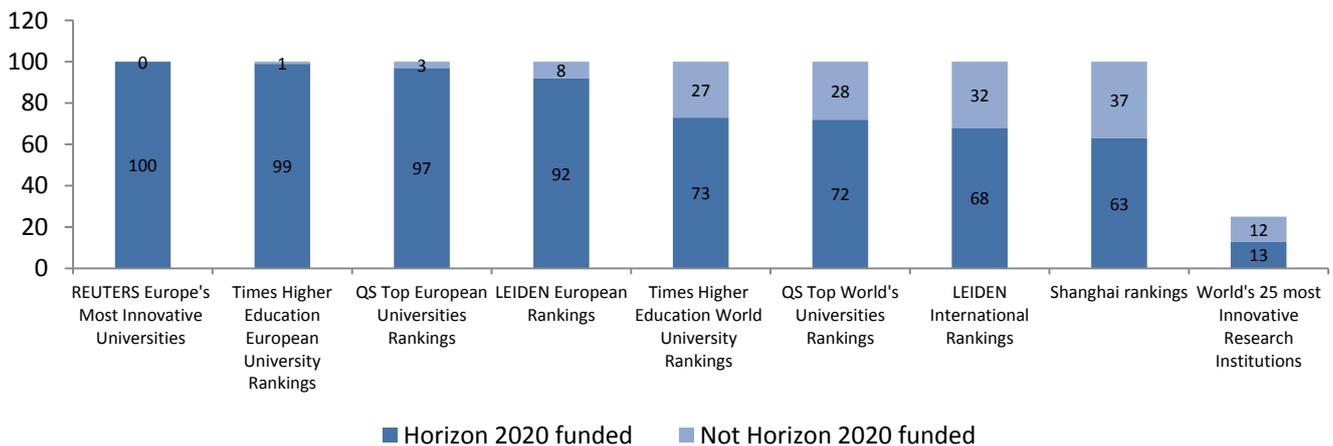
³⁶ For the Industrial Leadership and Societal Challenges, not for the Excellent Science pillar.

³⁷ A look at the FP7-Health portfolio (source: Corda) reveals that it has funded 10 of the 11 top spin-off European healthcare companies which later became unicorns. These are Collectis, Immunocore, Morphosys, Adaptimmune, Actelion, Galapagos, Oxford Nanopore, Basilea, Curevac, and Immunovia. In Societal Challenge 1 (SC1) of Horizon 2020 (health) two of these companies participate: Galapagos, Immunovia. For Horizon 2020, 3 companies (Galapagos, Immunovia and CureVac) were funded although they are not on the CB Insights list of unicorns (<https://www.cbinsights.com/research-unicorn-companies>).

- In the Excellent Science pillar, the **European Research Council** also funds innovation: it has funded 400 'proof of concept' projects that bring an invention or breakthrough idea towards application. The first 140 were analysed which showed that 42% use a spin-off company (existing, new or planned) to take the results to the market. Companies also take part in research training: out of 3200 Marie Skłodowska-Curie Actions, 470 projects involve a total of 1060 company labs and other commercial organisations.
- The **European Institute of Innovation and Technology**: the Knowledge and Innovation Communities have established colocation ecosystems to bring together education, research and business, as well as pan-European accelerators for innovative companies. Out of 807 KIC partners in EIT in 2015, 56% were SMEs. In 2015, KICs created 67 start-ups, incubated 510 business ideas, created 315 knowledge transfers and adoptions, and brought 92 new products, services and processes into the market.

Many of the top universities, research institutions and companies in Europe and the rest of the world are participating in Horizon 2020. This is also an indication that Horizon 2020 is supporting Open Innovation and is 'open to the world' (although international cooperation levels are only half that of FP7). An analysis of 15 international established top rankings shows the percentages of these top organisations that take part in Horizon 2020.

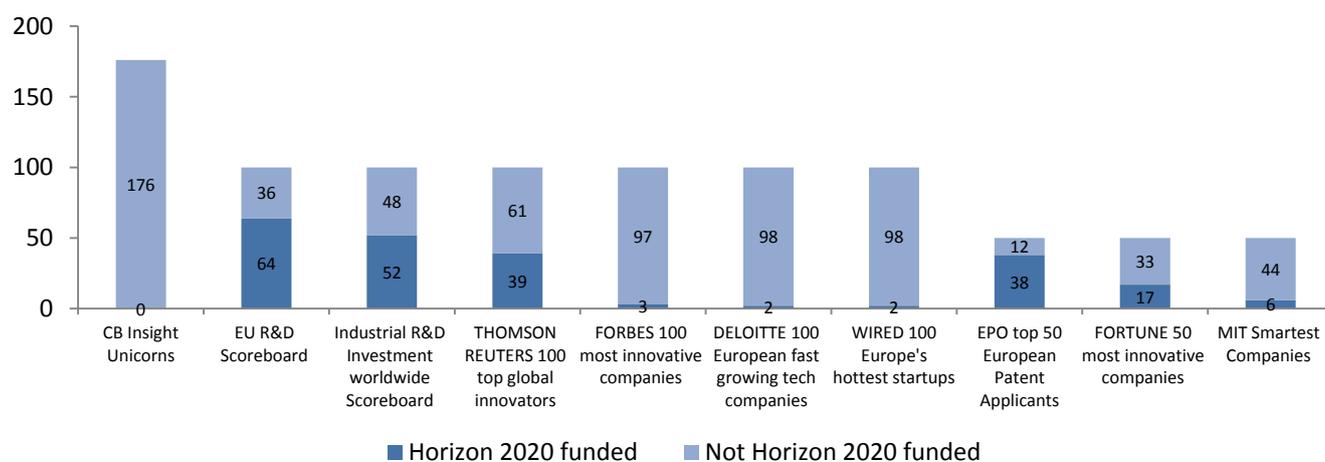
Graph 1: Does Horizon 2020 support the best universities and research institutions?



As far as universities are concerned, according to the rankings (Shanghai, Leiden International Rankings, QS Top World's Universities Rankings, and the Times Higher Education World University Rankings) 20% to 30 % of the world's top universities are based in the EU. Almost all of them take part in Horizon 2020. Regarding non-EU universities, more than half of them are participating in Horizon 2020.

From the 25 top institutions of the 'World's most innovative research institutions', 8 (32%) are based in the EU. Almost all of these take part in Horizon 2020, and so do a third of the world's best research institutions that are not based in the EU, as for example the Korea Institute of Science & Technology, Japan's RIKEN, and the Russian Academy of Science.

Graph 2: Does Horizon 2020 support the best private sector companies and start-ups?



The participation of "top companies" in Horizon 2020 is more diversified:

- The top-50 applicants to the European Patent Office often take part in Horizon 2020 (large majority of those with their headquarters inside the EU).
- Europe's top companies investing in R&D also take frequently part in Horizon 2020³⁸ (those that do not take part are mostly in the banking sector).
- The WIRED and Deloitte lists of the European top start-ups and fast growing tech companies show quite another picture: these companies hardly take part in Horizon 2020. Out of the Wired 100 hottest European start-ups in 2016 only two are participating³⁹.
- The rankings of Thomson Reuters, Fortune and the Industrial R&D investors show that (a) the headquarters of most of these big and established companies are based outside the EU and (b) roughly a quarter of these companies take part in Horizon 2020, both those with headquarters inside and outside the EU⁴⁰.
- The share of Horizon 2020 participants is much lower in the lists of the MIT smartest companies and Forbes most innovative companies. 12% of the MIT and 3% of Forbes ranked companies participate in Horizon 2020⁴¹.

³⁸ For example Bosch, Sanofi, BMW, Philips, Airbus and Siemens.

³⁹ Portuguese Beta-i and Unbabel.

⁴⁰ For example Alcatel Lucent, Alstom, Basf, Ericsson, Daimler, Solvay, Intel, Fujitsu, Samsung.

⁴¹ For example Huawei, Toyota, Oxford Nanopore, Movidius, Bosch, IBM and Intel.

- None of the firms on the CB unicorns list participate in Horizon 2020 (unicorns are young fast growing companies, reaching a capitalisation of EUR or \$ 1 billion).

Issues for consideration

- How to maximise the Open Innovation potential of EU Framework Programmes? How could users be more involved?
- How could the EU Framework Programme better support breakthrough market-creating innovation with the potential to scale up support to companies through a European Innovation Council?
- How could links with other relevant EU programmes (such as European Structural and Investment Funds and the European Fund for Strategic Investments) and national and regional activities be strengthened in order to support market-creating innovation?

Selected stakeholder views⁴²

A call for ideas was launched in early 2016 to gather stakeholders' views on disruptive, market-creating innovation, on gaps in the current innovation support landscape and on the potential remit of a possible European Innovation Council (EIC). A total of 1022 replies and more than 100 supporting documents papers were received⁴³. Over 80% of a total of the respondents believe that there are gaps in the EU's support for such disruptive market-creating innovation, and several respondents pointed to the difficulty of navigating the range of innovation funding options available.

Asked to identify the issues that a European Innovation Council could address, respondents identified 'filling in gaps for disruptive innovation and scale-ups', 'simplification of access' and 'strategic advice to improve the innovation environment' as priorities to be addressed. Many stakeholders also called for dedicated support for disruptive innovations and improved access to risk financing, while the idea of a European venture capital fund was mentioned several times. A significant number of respondents emphasised that support should be more joined-up so that companies can find suitable support as they progress along the innovation value chain.

Other stakeholder views on this issue include the following small sample:

- *"The impact of the EU framework programmes should be maximised and the design of the next framework programme should effectively address the European innovation challenge. In that light, a merger of instruments should be envisioned with a view to possibly reducing the number of instruments and intermediaries while increasing agility and collective impact. Competition for supporting the best and most excellent proposals should be an integral part of the next framework programme. Market-creating innovation and scaling-up should be promoted primarily through dedicating part of the budget to genuine "bottom up", open-ended calls. Financial instruments and programmes under the framework programmes should be streamlined and close collaboration with other actors and complementarity with*

⁴² Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address:

https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

⁴³ The EIC consultation is available at: <https://ec.europa.eu/research/eic/index.cfm>

other programmes should be ensured. It should be explored how best to stimulate access to finance for scaling-up for businesses and further development of the crowd-funding market".

- *"Societal challenges were reduced by 3.5% in order to finance EFSI and collaborative research in the lower Technology Readiness Levels (TRL) 1-5 lost ground to higher TRLs. This has driven many universities and research organisations away from research on societal challenges with the effect that interaction between industry and academia has been reduced rather than strengthened."*
- *"Excellent innovation projects can include both technological and non-technological/social innovation aspects. In both cases, the aim should be to help innovation projects to bridge the valley of death and/or make them ready for investments, so that the resulting product or service can be sold on the market or more generally the results can be implemented in society. For convenience, we state the EIC should focus on higher "technology readiness levels" (TRLs). We however always mean to include non-technological innovation projects as well."*
- *"European innovation infrastructures - both virtual and physical - are the backbone of dynamic research and innovation ecosystems and stable innovation-driven value chains. Innovation is a complex process allowing the transformation of knowledge from basic science and research, into new product and services commercialized in the market. Indeed, to innovate, industry, including SMEs, need to validate early stage prototypes and other solutions to end-user clients and investors. To do so, industry (especially true for SMEs) partly rely on research actors, and essentially on RTOs, to provide access to the necessary technology infrastructures for upscaling, prototyping and validation of new solutions before they can enter the market. In this context, the EIC is a unique opportunity to stimulate the development and utilisation of European technology infrastructures, providing an easier access for SMEs to these facilities. The EIC pilot should aim to enhance Europe's strategy on technology infrastructures. In particular, the EIC should undertake specific actions to develop appropriate framework conditions in order to accelerate the establishment of a pan European network of technology infrastructures".*

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Open Science

Introduction

Open Science refers to new ways of carrying out science in which many collaborate and contribute, using the latest digital advances. It goes further than open access only, which is already well known in the context of FP7 (open access to publication) and Horizon 2020 (open access to publication and data). Open Science makes scientific processes more efficient, transparent and effective by using new tools and models for scientific collaboration, experiments and analysis and by making scientific knowledge more easily accessible and reusable.

In 2014 the Commission launched a broad public consultation on 'Science 2.0: Science in Transition'⁴⁴. Its aim was to better understand the potential impact of Science 2.0 (broadly understood as a new approach to science that uses information-sharing and collaboration which are enabled by network technologies) and on potential policy actions. The consultation confirmed that the current transition of the science and research system results predominantly from a bottom-up and researcher-driven process enabled by ICT, the exponential growth of data as well as by an increasing number of researchers operating in a globally networked digital science system.

Open Science can be defined as: *"A new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools. The idea captures a systemic change to the way science and research have been carried out for the last fifty years: shifting from the standard practices of publishing research results in scientific publications towards sharing and using all available knowledge at an earlier stage in the research process. Open Science is to science what Web 2.0 was to social and economic transactions: allowing end users to be producers of ideas, relations and services and in doing so enabling new working models, new social relationships and leading to a new modus operandi for science. Open Science is as important and disruptive a shift as e-commerce has been for retail. Just like e-commerce, it affects the whole 'business cycle' of doing science and research – from the selection of research subjects, to the carrying out of research and to its use and re-use – as well as all the actors and actions involved up front (e.g. universities) or down the line (e.g. publishers)".⁴⁵*

Open Science incorporates different aspects: from skills, review of researchers' careers, open access, relevant infrastructure to making science more responsive to societal and economic expectations.

⁴⁴ The consultation results can be viewed at: https://ec.europa.eu/research/consultations/science-2.0/consultation_en.htm.

⁴⁵ Open Innovation, Open Science, Open to the World – a Vision for Europe. European Commission, May 2016. Available at: <https://ec.europa.eu/digital-single-market/en/news/open-innovation-open-science-open-world-vision-europe>.

Socio-political context

The public consultation process and the follow-up discussions with stakeholders, as well as political debate (Competitiveness Council meeting on 28-29 May 2015)⁴⁶, made clear that there is a broad consensus on five areas for action which underpin Open Science policy. These are described in the Open Science Agenda as:

- Fostering and creating incentives for Open Science - by fostering open science in education programmes and best practices and extending the input of knowledge producers in a more open science environment (citizen science). It is also about guaranteeing the quality, impact and research integrity of (Open) Science;
- Removing barriers for Open Science - which implies among other a review of researchers' careers with a view on creating incentives and awarding researchers for engagement with open science;
- Mainstreaming and further promoting open access policies - to research data and publications;
- Developing research infrastructures for Open Science - to improve data hosting, access and governance;
- Embedding Open Science in society as a socio-economic driver - whereby it becomes instrumental in making science more responsive to societal and economic expectations, notably by addressing major societal challenges.

The key stakeholders (universities, research performing organisations, research funders, libraries, researchers, publishers, and businesses) find themselves in various stages of responding or adapting to the evolving situation. For example, universities are requiring new types of skills from researchers and considering new ways to reward and evaluate researchers' careers, but also publishers are active as they are moving towards models of open access to publications and research data.

Researchers at all stages of their careers should, consequently, receive appropriate training to acquire the digital skills that will allow for optimal research data management and data sharing with the rest of the research community, through opening access to their publications and making their research data FAIR (Findable, Accessible, Interoperable and Re-useable).

Alternative metrics have been proposed with regard to determining the impact of research or measuring the output of a researcher. This means that assessing researchers' output and career will evolve from a model that is nearly relying on the sole basis of scientific publication and/or patent production to a model that incorporates other dimensions of researchers' activities. For example, new models of evaluating researchers could take into account activities of researchers such as opening access to their publications, making their data FAIR and managing them adequately. Some universities consider only publications which have been deposited in a repository (preferably their own when they have one) in the context of the researchers' evaluation for promotion; any other publication made in a peer-reviewed journal without having been deposited in a repository will not

⁴⁶ Available at: <http://www.consilium.europa.eu/en/meetings/compet/2015/05/28-29/>.

serve the researcher's career advancement. This is a way to incentivise researchers to promote open access to their publications.

New models for evaluation should also take into account communication activities of researchers, since promoting research results and careers to citizens, and even making them participate in the design and development of research, is key to build trust with society and gain its support. It is also a way of better embedding R&I organisations in the local economy and society. Such activities may include activities ranging from participating in a science festival, to promoting the interest of children in science, to developing a citizen science project. Another example: a private start-up (such as altmetric.com) tracks the impact of research activities through its presence and discussions on social media and an open science platform (such as researchgate) determines the impact of research outcomes not only on the basis of citations in peer-reviewed journals but also on the basis of amount of document downloads from their repository.

This requires that researchers be provided with the right tools and training support to develop the knowledge and the communication skills, using new digital (social) media, that will enable them: 1) to reach out efficiently to the general public, 2) to explain their research results in an easily understandable fashion, and 3) to emphasise how their work may contribute to improve people's lives and/or provide a better understanding of the world. Training in ethics and research integrity will naturally be essential to best accompany and guide researchers in the appropriate use of all the digital and communication skills., together with proper training in how to best include citizens in the research design and processes (when relevant) and in how to engage with them in citizen science projects, will allow researchers to increase the impact of their work. Indeed, the societal and economic impact of research is of growing importance to research funding organisations.

Besides technical interoperability issues, key stakeholders are also confronted with legal interoperability of open data sharing. There is a need to provide clarifications on, for example, the legal conditions of accessing and (re)using open data and the related rights and responsibilities. Otherwise there is a potential risk of infringement with respect to privacy and/or intellectual property rights. The development of guidelines or best practices based on lessons learned (if possible starting from the analysis of findings of EU-funded actions) could enable the stakeholders to better practice Open Science without fearing any legal repercussions.

Open Science is a global transition that can be effective only if it is 'Open to the World'. Key questions at the global level are how to incentivise open, globally networked research and researchers to share knowledge and data at an early stage of the research process, how to achieve interoperability of data and infrastructures, how to stimulate open access policies in all countries and how to achieve effective global governance. This knowledge should be shared beyond disciplines, international borders and the research system itself.

Open access (OA) is a key component of Open Science and is described as the practice of providing on-line access to scientific information that is free of charge to the user and that is re-usable. In the context of R&D, open access to 'scientific information' refers to two main categories:

- a) Peer-reviewed scientific publications (primarily research articles published in academic journals). In Horizon 2020, open access to peer-reviewed **scientific publications** is mandatory but leaves it to the researcher

to choose the most appropriate form of open access (to account for variation among disciplines, institutions and Member States).

- b) Scientific research data: data underlying publications and/or other data (such as curated but unpublished datasets or raw data). In Horizon 2020 the Commission runs a pilot project regarding open access to **research data** ('ORD pilot'). The pilot aims to improve and maximise access to and re-use of research data generated by Horizon 2020 projects, taking into account the need to balance openness and protection of scientific information, commercialisation and intellectual property rights, privacy concerns, security as well as data management and preservation questions. As of 2017, open access to data will become the default setting, while ensuring an option for opt-outs. The opt-out possibilities will be provided at any stage, i.e. in the application phase, during the grant agreement preparation phase and after the signature of the grant agreement. Costs associated with open access to research data, can be claimed as eligible costs. Proposals are not evaluated more favourably because they foresee open access to data and are not penalised for opting out.

Development of a **European Open Science Cloud** as part of the Digital Single Market Initiative⁴⁷ is another aspect of Open Science. Drawing on the ongoing integration and consolidation effort supported under the 'e-Infrastructures' priority of Horizon 2020, it aims to develop a trusted, open environment for the scientific community for storing, sharing and re-using scientific data and results as stated in the Commission Communication: European Cloud Initiative - Building a competitive data and knowledge economy in Europe.⁴⁸ In October 2016, the High Level Expert Group report on the European Open Science Cloud⁴⁹ published a number of recommendations to the Commission on a preparatory phase for the Cloud.

Other specific actions that could be taken to move towards a wide open science concept include:

- Removing barriers to the free flow of data, taking into account adequate protection to prevent abuses;
- Designing appropriate incentives and developing common standards for data sharing, and promoting data literacy;
- Facilitating greater access to publicly funded scientific publications;
- Including open science in the training of researchers, so that they develop the skills that will enable them to implement the various dimensions of open science in their daily work and become active contributors to the digital era in research;
- Promoting "living labs" demonstration projects engaging all relevant stakeholders in action research activities demonstrating solutions to challenges.

⁴⁷ Available at: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0192&from=EN>.

⁴⁸ COM(2016) 178 final. Available at: <https://ec.europa.eu/digital-single-market/en/news/communication-european-cloud-initiative-building-competitive-data-and-knowledge-economy-europe>.

See: ⁴⁹http://ec.europa.eu/research/openscience/pdf/realising_the_european_open_science_cloud_2016.pdf#view=fit&pagemode=none.

An Open Science Policy Platform has been set up to facilitate the development of Open Science policy through a structured discussion with major stakeholders. The Open Science Policy Platform will co-shape the policy on the basis of the draft European Open Science Agenda, and will advise the Commission on the policy actions required to fulfil Commissioner Moedas' expectation that the quality and impact of European science will be radically increased by advancing Open Science. The Platform will actively support policy implementation and encourage the active uptake of agreed best practices and guidelines for Open Science. There are eight priority topics for action: Rewards, Altmetrics, Open Science Cloud, The Future of Scholarly Publishing, Research Integrity, Citizen Science, Open Education and Skills, and FAIR Open Data.

The role of the citizen is an important aspect of Open Science. Citizen participation in the research and innovation process can take place in different ways: as observers, as funders, in identifying images or analysing data (several 'Citizens Observatories' projects, which increase citizen participation in environmental protection efforts, have been funded by Horizon 2020), or by providing data. Studies have demonstrated that citizen science projects prove to be cost effective, especially in the case of large-scale projects. In the UK, a £7 million government investment in volunteer monitoring schemes generated data estimated to contribute in-kind around £20 million⁵⁰. In France, savings of EUR 1 to 4 million per year have been estimated as a result of the Biodiversity Monitoring Programme of the French National Museum for Natural History⁵¹. Exploiting the potential of citizen science requires adequate standards and infrastructure, proven methods for data quality, interoperability and management, and robust technologies. There are also few EU-wide networks which connect emerging citizen science initiatives with each other.

Finally, the importance attached to these issues at the political level was illustrated by the Council of the EU's Conclusions of May 2016, which underlined that: *"open access to scientific publications and optimal reuse of research data are of utmost importance for the development of open science....the Council agrees to further promote the mainstreaming of open access to scientific publications by continuing to support a transition to immediate open access as the default by 2020"*⁵².

Key facts and figures on the Framework Programmes

According to the High Level Expert Group on the FP7 ex-post evaluation, FP7 laid the foundations for the free circulation of scientific knowledge with the move towards an Open Access policy for publications and data resulting from FP-funded research. According to OpenAIRE data in October 2015, around 165,000 publications originated from FP7 projects. Under FP7, from out of 171,258 scientific peer-reviewed publications, some 92,826 are open access, 3,216 are restricted access while 315 are still under embargo. This translates into an open access rate of 54% for all scientific peer-reviewed publications created during the lifetime of FP7 so far. Open access publications have significantly increased in recent years, reaching 56% in 2014 and 58% in 2015.

⁵⁰ Makechne, C., Maskell, L. C., Norton, L. R. & Roy, D.B. (2011) The Role of 'Big Society' in monitoring the state of the natural environment. *Journal of Environmental Monitoring*, 13(10), 2687-2691.

⁵¹ Levrel, H., Fontaine, B., Henry, P-Y., Jiguet, F., Juliard, R., Kerbiriou, C. & Couvet, D. (2010) Balancing state and volunteer investment in biodiversity monitoring for the implementation of CBD indicators: A French example. *Ecological Economics*, 69(7), 1580-1586.

⁵² Council Conclusions on the Transitions Towards an Open Science System, 27 May 2016. Available at: <http://data.consilium.europa.eu/doc/document/ST-9526-2016-INIT/en/pdf>

This can be seen as an indicator of the growing support towards open access in the scientific community.⁵³ So far, very few publications have been published from Horizon 2020 grants, since publications tend to be clustered towards or even after the end of a project. There is therefore currently insufficient data to report on the uptake of Open Access to publications in Horizon 2020.

For the uptake of the Open Research Data pilot in Horizon 2020 in 2014 and 2015 (when its scope was more restricted), figures show a participation rate of 65.4% and an opt-out rate of 34.6% in the core areas of the pilot. In other words, nearly two thirds of relevant projects participated in the pilot. The most important reasons for opt-outs were (i) IPR concerns (37%), (ii) projects which do not expect to generate data (18%); or (iii) over privacy concerns (18%). Furthermore, in the areas not covered by the pilot, 11.9% of projects make use of the voluntary opt-in possibility.

Issues for consideration

- On which elements of Open Science agenda should most progress be made in the future Framework Programme, and how: Open access to publications and data and the necessary infrastructures; citizen science; reward systems and skills in universities, other areas?
- How could the successor Framework Programme take Open Science in Europe to a new level, in line with the May 2016 Council Conclusions, including through the leveraging of activities and initiatives in Member States?

Selected stakeholder views⁵⁴

One major outcome of the public consultation on Science 2.0 highlighted the need for EU action to address common societal challenges with Open Science by creating 'knowledge coalitions' among societal, entrepreneurial and scientific actors. This could be done under the EU Framework Programme for research and innovation or through joint initiatives among and with Member States addressing societal challenges through open science actions. Stakeholders often refer to new ways of conducting research at the same time underlining issues which should be taken into account in this process.

Stakeholder views on the issue of Open Science include the following small sample:

- *"Horizon 2020 is a crucial tool for the Commission to motivate researchers, organisations and businesses to realise the European Research Area and move towards a more 'Open Science', 'Open innovation' and 'Open to the world' focus. The programme should be used to implement new policy initiatives and decisions of EU policy makers on issues such as gender, research integrity, open access to publications, open access to data and the European science cloud".*

⁵³ FP7 Ex-Post Evaluation Staff Working Document.

⁵⁴ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

- *"Horizon 2020 and future FPs must support the researcher-driven transition to new ways of conducting science. Open Access and data re-use increase the circulation of knowledge, spark innovation and foster collaboration on a global scale. The Open Access Policy in Horizon 2020 is a success and should be continued"*.
- *"A European science cloud, as suggested by the Commission, could offer Europe's researchers a virtual environment to store, share and re-use their data across disciplines and borders. This could be an important element for Open Data. We urge the Commission to carefully take into account cross-border cloud systems in specific science communities, which already exist and work well, as well as national activities aiming to achieve the same objective"*.

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Open to the World

Introduction

International cooperation in Horizon 2020 aims to achieve the following objectives: (a) Strengthening the EU's excellence and attractiveness in research and innovation, as well as its economic and industrial competitiveness; (b) Effectively tackling common societal challenges; (c) Supporting the EU's external and development policy objectives⁵⁵. To reach these objectives, a dual approach was adopted⁵⁶: fully opening Horizon 2020 to the participation of researchers and organisations from all over the world, and developing targeted cooperation activities with certain countries and/or regions. Cooperation with third countries is a cross-cutting issue (Article 14 of Horizon 2020 Regulation) – as opposed to FP7⁵⁷, international cooperation does not have a dedicated part, but is supported across the whole programme.

Legal entities from third countries⁵⁸ are eligible to participate as beneficiaries in all Horizon 2020 programme parts, except: actions under the SME Instrument, Fast Track to Innovation, EIT⁵⁹, parts of Spreading Excellence and Widening Participation, and Access to Risk Finance (InnovFin).

While European Research Council (ERC) grants are open to researchers of any nationality residing in any country at the time of the application, the hosting institution of a Principal Investigator must be established in an EU or Associated Country (AC)⁶⁰. The ERC puts in place special facilities in order to attract international grantees.

Under the Marie Skłodowska Curie Actions (MSCA), the vast majority of legal entities from third countries do not participate as beneficiaries but as partner organisations and therefore do not receive funding directly from Horizon 2020. Researchers and doctoral candidates may apply from any country in the world and receive a salary through the MSCA when coming to an EU or Associated Country; the same is valid for researchers and doctoral candidates from within the EU and ACs to do parts of their training in any country in the world.

⁵⁵ Horizon 2020 Regulation, Article 27

⁵⁶ Commission Communication "Enhancing and focusing EU international cooperation in research and innovation: a strategic approach" of 14 September 2012 (COM (2012) 497).

⁵⁷ In this context, the Expert Group on the Interim Evaluation of FP7 concluded that "the international perspective must be integrated into all programmes and instruments".

⁵⁸ Third countries are non EU Member States and non-Associated Countries.

⁵⁹ Entities from third countries are not automatically eligible for EIT-funded Knowledge and Innovation Communities, but it is possible to add them and they can be considered eligible with a permission of the EIT

⁶⁰ There are currently 16 Associated Countries who pay into the Horizon 2020 budget and participate under the same conditions as EU countries: Iceland, Norway, Albania, Bosnia and Herzegovina, the Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland (partially associated), Faroe Islands, Ukraine, Tunisia, Georgia and Armenia.

Legal entities established in the EU Member States, Associated Countries and some 130 developing countries (as well as International European interest organisations) are automatically eligible to receive funding through Horizon 2020 grants. However, compared to FP7 rules, legal entities from Brazil, Russia, India, China and Mexico no longer get automatic funding; they are only eligible for funding when it is provided for under a bilateral agreement, or is explicitly foreseen in the call, or when the Commission deems participation of the particular entity essential for the project.

Horizon 2020 is only open to association with EU-accession countries, (potential) EU candidate countries, European Free Trade Association (EFTA) and European Neighbourhood Policy (ENP) countries⁶¹, and countries already associated to FP7. If associated, legal entities from the country can participate in the programme under the same conditions as those from EU Member States⁶², and their financial contribution to the programme is based on their GDP.

Socio-economic and political context

A top priority for the Juncker Commission is to make the EU 'A Stronger Global Actor'. Research and innovation cooperation have an indisputable role to play in effective European neighbourhood policy, international relations and development policy, and this has been well-reflected in the EU Global Strategy presented in June 2016⁶³.

The need for EU international cooperation in research and innovation is more pressing than ever. Nearly 75% of knowledge is now produced outside the EU, and 90% of market growth over the next decade is expected to take place outside Europe. European researchers need access to this knowledge and European companies need to be present in the growing markets. Already today, external trade accounts for 35% of EU GDP and exports to countries outside Europe support 31 million jobs in the EU. The aim is to translate the Union's strengths in science and technology into a leading voice in global debates, and ensure that the EU keeps pace with globalisation by enhancing international cooperation in research and innovation so as to be able to solve global challenges and strengthen EU competitiveness⁶⁴.

EU research and innovation also needs to be 'Open to the World' to foster new knowledge production, increase scientific quality, access the latest knowledge and best talent worldwide and improve the competitiveness of R&I systems. International R&I cooperation boosts productivity of investments in R&I by enabling companies to gain more knowledge from international markets, participate in new value chains and reap greater benefits from growing markets outside the EU⁶⁵. This should result in strengthened competitiveness of European industry by promoting the uptake and trade of novel technologies and innovative solutions, for instance through the development of worldwide standards and interoperability guidelines.

⁶¹ For EFTA and ENP countries, the following criteria apply: good science, technology and innovation capacity; good FP participation track record; and fair dealing with IPRs, see Article 7 of the Horizon 2020 Regulation.

⁶² AC participate as observers in Programme Committees, in ERA strategic groups (ERAC, SFIC, EGPC, ESFRI), and in legal structures created under Articles 185 and 187 TFEU.

⁶³ HRVP Mogherini: 'A Global Strategy for the EU's Foreign and Security Policy, June 2016

⁶⁴ Commissioner Moedas: 'Open Innovation, Open Science, Open to the World', 2016; COM(2012)497; COM(2014)567; COM(2016)657

⁶⁵ European Commission: 'Science, Research and Innovation Performance of the EU 2016'

The EU share of the world gross expenditures in R&I has fallen from one quarter in 2000 to one fifth in 2013, the EU share of world output of scientific publications has dropped from one third in 2000 to one quarter in 2013, and the EU share of the world's patents has gone from 1/3rd in 2000 to 1/4th in 2013. In this challenging landscape, Europe has been able to maintain its lead in terms of highly cited scientific publications, retaining a third of the world share. Bibliographic studies show a higher scientific impact of researchers with international experience, while international co-publications are overall more often cited (50% more than publications with only EU authors).

Global societal challenges, including achieving the Sustainable Development Goals and the COP21 targets, increasingly call for global mobilisation of resources and coordination of activities to perform research more effectively and to maximize impact. Better alignment of research policy agendas leads to more impact of EU investments with faster and more effective solutions to challenges such as health, food, energy, transport, water, climate change and the circular economy. Furthermore, many fields of research now require infrastructures that are so sophisticated or costly that they exceed the capabilities of a single country, thereby leading to major multinational collaborations.

EU research and innovation also needs to be 'Open to the World' to support the Union's external policies and use science diplomacy as an influential instrument. Research collaborations and science diplomacy can help to prevent conflicts and disasters, to better understand complex issues, to develop shared strategies for good stewardship of our planet, and to enhance the visibility and attractiveness of European research on the global arena.

Being 'Open to the World' is easier if framework conditions are in place to enable cooperation on a level playing field for researchers and innovators from across the planet. Such conditions may concern, for example: legal obstacles; reciprocity in accessing public funding research data or infrastructures; participation in large scale pilots and pre-deployment actions; technological standards and related IPRs; or standards for research integrity.

There are various strategies for opening research and innovation programmes to international partners which vary according to domestic priorities and constellations of stakeholders:

- ***Dedicated international cooperation budgets for political/strategic initiatives***: Examples of such initiatives are thematically centred (e.g. clean energy) and/or geographically centred (e.g. countries of origin of migration), and a given initiative can draw on a dedicated budget either completely or as a top-up to its existing thematic allocation. For instance, the UK Newton Fund targets socio-economic development of 16 partner countries through science and innovation partnerships. Each partner country includes several funding organisations that provide matching resources and develop and run calls for proposals. The funding covers activities to increase capacity for R&I in partner countries as well as R&I collaborations on development topics.
- ***Funding all international partners for selected mission-oriented research topics***: For mission-driven research, e.g. curing cancer or transforming solar power directly to fuel, some national programmes supply funding to all organisations from third countries that succeed in the evaluation of

proposals. For example, foreign organisations, either non-profit or for-profit, are allowed to receive grants by the US National Institutes of Health. This includes both collaborative and single-beneficiary projects.

- ***Making international partners mandatory in selected topics or for designated countries:*** Some national research programmes include schemes where the participation from certain third countries is an eligibility criterion. For instance, the German research ministry launches '2+2 R&D projects' on a bilateral basis in which at least one German and one third country research institution must participate alongside at least one German and one third country industry partner.
- ***Programmatic cooperation between national research funding bodies:*** The aim of such cooperation is to align national strategies and help increase the efficiency and effectiveness of (mainly public) research efforts. It can involve varying degrees of joint effort, such as joint calls or joint programmes, including in global multilateral initiatives implemented through Article 185 initiatives, ERA-NETs and Joint Programming Initiatives with funding bodies from international partner countries. Examples include the European and Developing Countries Clinical Trials Partnership EDCTP, which has public funders from 14 European and 14 African countries; or the Intergovernmental Group on Earth Observations GEO, which provides a voluntary framework to help governments and international organisations coordinate their Earth observation strategies and investment).

Key facts and figures on the Framework Programmes

According to recital 41 of the Horizon 2020 Regulation, international cooperation activities should be maintained at least at the level of the FP7. However, so far, the participation from third countries in Horizon 2020 collaborative projects dropped in comparison to its predecessor. The latest statistics show that participation from third countries in Horizon 2020 collaborative projects is at 2.4%, almost half of what it was in FP7. Only 11.5% of Horizon 2020 projects include one or more international partners, compared to 20.5% under FP7, and the direct EU contribution to international partners has fallen from nearly 2.0% of the budget under FP7 to 0.7% under Horizon 2020⁶⁶. However, the number and budgets of Horizon 2020 joint/coordinated calls and twinning of projects co-funded by international partners are similar to FP7 levels.

The drop in international participation in Horizon 2020 projects can be explained as a combination of factors: change of funding rules for Brazil, Russia, India, China and Mexico; very few topics for which international participation is mandatory; recent conflicts and socio-political developments in the EU neighbourhood; and the increased focus on closer-to-market activities requiring a balancing of international engagements with interests of EU's companies, and an important move from project-level to strategic programme-level cooperation. Whereas corrective action has been taken (e.g. stepping up of dedicated international cooperation initiatives of

⁶⁶ Some forms of international cooperation cannot be properly captured in the statistics, e.g. EU-US cooperation in transport research where twinning of projects or the organisation of high-level symposia are being used to enable systemic long-term collaboration.

larger scale and scope, the development of co-funding mechanisms for industrialised/emerging economies⁶⁷) under the existing rules, international participation in Horizon 2020 will most likely not reach the level of FP7.

Of all MSCA fellows, 25% are neither nationals of the EU Member States nor Associated Countries and hence have been attracted to Europe. Since their creation in 1996, the MSCAs have helped training almost 100,000 fellows of more than 130 nationalities, 30% of them coming from outside Europe. There are 120 nationalities among the MSCA fellows supported since 2014. Highly developed countries such as the USA have been attractive destinations for outgoing MSCA researchers. However, emerging countries such as China, Brazil or India attract only small numbers of European researchers.

The international cooperation strategy of the European Research Council (ERC) is considered important to confer status and visibility to European research on the global stage and to attract and retain outstanding researchers in the European Research Area⁶⁸. Some 1,537 researchers with third country nationality have applied to ERC calls, and 204 received grants. The proportion of ERC grantees with third country nationality is 9.1% (compared to 7.1% in FP7). Altogether since 2007, the proportion of ERC grantees that were resident in third countries at the time of application is 2.8%. The ERC provides additional 'start-up' funding for scientists moving to Europe.

Issues for consideration

- How to make openness to the world and industrial competitiveness mutually reinforcing (for example, on the question of IPR protection and 'additional exploitation obligations' such as 'exploit first in the EU') and create win-wins?
- How can the Framework Programme create incentives for effective international cooperation and true openness to the world? Should the modalities for funding international partners be adjusted? How to assess success of international R&I cooperation?
- Which types of international collaboration should the EU Framework Programme support in order to tackle global goals in a changing world? Should the future Framework Programme be open to association by more countries, and on what conditions?

Selected stakeholder views⁶⁹

Stakeholder views on this topic include the following small sample:

⁶⁷ Co-funding mechanisms are in place in South Korea, Mexico, China, Russia, Japan, Australia, India, and regions of Brazil and Canada.

⁶⁸ The Commission has signed agreements with research funding organisations in USA, South Korea, Argentina, Japan, China, South Africa, Mexico, Brazil and Canada that enable researchers from these countries to join the ERC Principal Investigators and their teams.

⁶⁹ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address:

https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

- *"Increased international scientific collaboration is driven by the pursuit of quality; for maintaining competitive European research, international collaboration is essential to enhance competencies at the individual, organisational and societal level as well as to address the grand challenges."*
- *"The ability to engage in large-scale experiments in third countries is an important mechanism to promote the adoption of EU-based technological platforms in other geographies and their longer term sustainability. This involves a discussion of relevant framework conditions that are beyond the traditional 'research' issues such as global standards, intellectual property, procurement, access to market-oriented initiatives in third countries."*
- *"Global challenges such as CO2 and polluting emissions, oil dependency, transport safety and security, noise pollution, and standardisation of many services, products and procedures will benefit from global solutions [...] Horizon 2020 should reinforce international cooperation via bilateral and multilateral funding mechanisms in support of Europe's global role and the competitiveness and access to markets of the European stakeholders."*
- *"The EU may serve as a catalyst for international governance since it has credibility. Cooperation with developing countries is an avenue whereby good governance practices are shared and exported. This governance allows a framework to be put in place smoothly and serves to settle conflicts and differences."*
- *"Horizon 2020 plays an important role in stimulating mobility of researchers, within or to Europe. The Marie Skłodowska-Curie Actions play an important part in this, as does the ERC, through the portability of its grants and the work to attract non-EU grantees".*
- *"In general, academic organisations formed the core of international cooperation projects, with industry largely underrepresented among participants. The latter finding causes concern given that one of the major objectives of international cooperation in FP7 was increasing competitiveness."*

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Defence research

Introduction

According to Article 19(2) of the Horizon 2020 Regulation: "*Research and innovation activities carried out under Horizon 2020 shall have an exclusive focus on civil applications*". However, research on dual-use technologies is allowed, provided it preserves the civil focus. Dual-use research is not defined by the Horizon 2020 Regulation, but is understood as research on products, services and technologies that can have both civilian and defence purposes, provided that civilian needs are the focus of the research activities. Hence Horizon 2020 does not allow for support to defence research.

Upon agreement of the EU budget for 2017 by the European Parliament and the Council, the Commission will launch a preparatory action on Defence research in 2017, with a budget of EUR 25 million in the first year and an overall budget of an expected EUR 90 million over three years. The preparatory action aims at contributing to the technological autonomy of the EU in this field, and takes place outside the scope of Horizon 2020. The main objective is to prepare and test a mechanism to organise and deliver a variety of defence research, technology and development activities to improve competitiveness and innovation in the European defence industry, in view of financing EU defence research within the next EU multiannual budgetary period (known as the Multiannual Financial Framework, MFF).

The preparatory action on defence research will be a first step, limited in time and in budget, which will serve to test the added-value of the EU supporting defence research. It will pave the way for a European defence research programme within the next MFF post-2020.

On 30 November 2016, the Commission adopted the **European Defence Action Plan**⁷⁰, which includes measures to support the competitiveness of the European defence industry and will contribute to the development of the strategic capabilities. The Commission proposed the creation of a European Defence Fund, as called for by President Juncker in the 2016 State of the Union speech with two complementary financing structures ('windows') that would be phased in over time:

- The "**research window**" will fund collaborative defence research projects at EU level. Given the importance of defence research investment, the scale of existing national defence research budgets and the high costs of developing cutting-edge defence technologies, the Commission proposed, as a budget for the defence research programme EUR 500 million per year under the post-2020 MFF. The precise

⁷⁰ COM(2016) 950 - Communication from the Commission to the European Parliament, the European Council, the European Economic and Social Committee and the Committee of the Regions - European Defence Action Plan, 30.11.2016.

relationship with the next research and innovation framework programme (Article 182 of the EU Treaty) will be determined in the new EU budget.

- The "capability window" will support the joint development of defence capabilities (equipment and technologies) commonly agreed by Member States. This would be financed through the pooling of national contributions and where possible supported by the EU budget.

The "research window" will fund a limited number of key research projects linked to defence capability priorities agreed by Member States. The governance of the future defence research program will take account the specificities of the defence sector, by closely associating Member States and industry, in defining research priorities.

A key feature is that Member States will decide the military capability priorities and, as a consequence, will influence the focus of the research programme. The future research programme will target critical defence and innovation-driven technologies, based on excellence. Financing will mainly be through grants. Special measures to encourage SME participation and a defence-specific intellectual property right regime will also be proposed, to address the specificities of the defence market.

Socio-political context

In order to provide high-level strategic advice on future defence research funded at EU level, a 'Group of Personalities on the Preparatory Action for CSDP-related research', set up by Commissioner Elżbieta Bieńkowska, published a report⁷¹ in February 2016 entitled 'The case for an EU-funded defence R&T programme'⁷² (the GoP report). The report highlights, among other issues, that continuous innovation and technological leadership are pre-requisites for Europe's capacity to provide for its own security. Technological leadership requires European companies to define and produce state of the art defence products. Today, several Member States are in the process of acquiring key military products from foreign sources (e.g. the American F-35 Joint Strike Fighter with a life expectancy longer than 40 years) - this pushes the EU industrial base towards more of a subcontracting role, instead of a leading role.

The GoP report also notes that, due to the particular features of defence-related research, some of the governance rules and modalities that are currently in use for Horizon 2020 will have to be adapted, such as the role of the Advisory Group (representing the views of major stakeholders), which would have to include the defence industry, defence experts, defence-oriented RTOs, the EEAS and the European Defence Agency itself. Standard Horizon 2020 funding practices would also need to be adapted to defence research needs, such as an increased attention to the risk of 'double funding' (because of dual-use research).

In June 2016, Commission Vice-President Federica Mogherini (EU High Representative for Foreign Affairs and Security Policy) presented to the European Council the new European Global Strategy on Foreign and Security

71 "Report of the Group of Personalities on the Preparatory Action for CSDP-related research – European Defence Research: the case for an EU-funded defence R&T programme", published by EUISS (2016), http://www.iss.europa.eu/uploads/media/GoP_report.pdf.

72 The EDA defines "R&T" as defence-related research and innovation activities within the TRL 1-6 band.

Policy. It calls for a stronger Europe in security and defence matters, European strategic autonomy and an effective common security and defence policy (CSDP). The EU Global Strategy and the agreed level of ambition in security and defence provide an ambitious but realistic new strategic framework for the EU as a security and defence actor. This strategy is now being translated into concrete actions to support the development of key capabilities necessary for the security of the Union and its citizens, in the form of the Implementation Plan and the European Defence Action Plan.

Taking greater responsibility for security requires EU investment in the development of key defence capabilities to be able to deter, respond and protect against external threats, addressing calls for greater solidarity in security and defence. The European Parliament and the Council of the EU have also supported this priority.

The European Defence Action Plan is the Commission's contribution to a stronger European defence through ensuring that the European industrial base is able to meet current and future security needs. The Action Plan will support Member States in implementing the identified capability priorities. The Action Plan highlights how EU policies and instruments can support Europe's defence industry competitiveness and collaboration between Member States. It will allow the Commission, for the first time, to provide support for the whole sequence of capability development from research to placing products on the market. The European Council welcomed the Commission's proposals on the European Defence Action Plan and invited the Commission to make proposals in the first semester of 2017 for the establishment of a European Defence Fund⁷³.

Key facts and figures

Dual use research

Although a complete picture of dual-use relevant research within Horizon 2020 is difficult to establish, the priorities 'Industrial Leadership' (e.g. specific objective 'Leadership in Enabling and Industrial Technologies') and 'Societal Challenges' offer prospects of technological advances that can trigger innovation with a dual-use potential (i.e. not only civilian).

For instance, in the 2016-2017 Work Programme of Horizon 2020, a broad spectrum of 'dual-use' technologies and competences are applied in part of Societal Challenge 7 - "Secure societies". This represents an investment of around EUR 164 million. It includes Critical Infrastructure Protection (2016 budget: EUR 20 million), Security (2016 budget: EUR 113 million) and Digital Security (2016 budget: EUR 29 million). Furthermore, untargeted dual-use applications can come from various Horizon 2020-funded projects: ultra-high temperatures ceramics (use in civil aircraft or rockets), materials for protective clothing (for carpenters or soldiers), active substances (as medicine or poison), drone technology (for parcel delivery or espionage), Earth observation data and infectious diseases research⁷⁴.

⁷³ European Council conclusions of 15 December 2016.

⁷⁴ It is important to differentiate between dual use in the sense of civil/military, and dual use in the sense of misuse (US NIH language). For example, infectious diseases research for military use would be outlawed under the 1972 Biological Weapons Convention, ratified by 170 countries.

In the 2016-2017 Work Programme of Horizon 2020 on 'Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing' (part of the 'Leadership in enabling and industrial technologies' programme part), two Public Procurement actions aim at providing the 'first look' into the dual-use issues and exploitation of dual-use relevant results of EU-funded research projects.

Defence research

The EU's added value in this field can be described as developing incentives and mobilising EU policies to make defence cooperation common practice rather than the exception. This is the only way to maximise the output of defence expenditure: on the supply side, defence cooperation will consolidate the defence industry in enlarging the home market; on the demand side, defence cooperation will generate more interoperability. There is a strong business case for spending money more efficiently.

Collectively, the EU is the world's second largest military spender, behind the US. However, because of fragmentation of efforts, Europeans are still very much dependent on the strategic enablers provided by the US for military operations. The decrease of national defence budgets in Europe over the last decade will have a major impact on Europe's ability to act, while other global actors (China, Russia and Saudi Arabia) have been upgrading their defence sectors on an unprecedented scale. In 2015, the US invested more than twice as much as the total spending of EU Member States on defence. China has increased its defence budget by 150% over the past decade. By contrast, over the last decade EU Member States have decreased defence spending by nearly 12% in real terms.

This decrease in national spending in defence has not been compensated by more European cooperation. Europe suffers from inefficiency in spending due to duplications, a lack of interoperability, technological gaps and insufficient economies of scale for industry and production. Around 80% of defence procurement is run on a purely national basis, leading to a costly duplication of military capabilities. The lack of cooperation between Member States in the field of defence and security is estimated to cost annually between EUR 25 billion and EUR 100 billion.

Outside the scope of Horizon 2020, the Commission launched in 2015 a Pilot Project on defence research based on a proposal from the European Parliament. Through a delegation agreement, the European Defence Agency (EDA) was entrusted with the implementation of a small research programme. Three topics were published against which proposals were called, and three grant agreements, one for each topic, worth a total of EUR 1.4 million were signed on 28 October 2016.

Defence research in innovative technologies, products and services is key to safeguarding the long-term competitiveness of the defence sector and, ultimately, Europe's strategic self-reliance. However, defence research and technology (R&T) expenditure has suffered from significant cuts in national budgets of late. Between 2006 and 2013, defence R&T expenditure in the 27 Member States participating in the EDA has been reduced by 27%. This has not been compensated by greater cooperation: over the same period, as collaborative defence R&T has decreased by more than 30%.

Between 2006 and 2013, defence R&T expenditure in the 27 Member States participating in the EDA has been reduced by 27%. In 2014, EU27 defence R&T expenditure amounted to circa EUR 2 billion. This has not been compensated by greater cooperation: over the same period, with collaborative defence R&T decreasing by more than 30%. During the period 2006-2011, the US spent an average of EUR 9 billion per year on defence R&T and an average of EUR 54.6 billion per year on defence R&D. These figures are expected to increase. Between 2012 and 2015, Russian R&D in defence has doubled, while China, according to available data, is also increasing its investment in R&D⁷⁵.

European defence research is concentrated in three countries, by decreasing order of intensity: France, the UK and Germany, whose combined efforts represented 92% of European defence research and development in 2013. In 2013, European collaborative R&T represented EUR 168 million, with France accounting for 66% of this collaboration. A reason why other countries only invest very small amounts in defence research and development is due to the scale effect and the high financial barrier to enter the defence R&D field, where critical mass is crucial.

The EDA also stimulates research and technology. Since its creation in 2004, the participating Member States have allocated EUR 500 million to over 150 R&T projects. By adding industrial and in-kind contributions to these projects, this figure raises to almost EUR 1 billion.

With a turnover of nearly EUR 100 billion, the European defence industry brings a major contribution to the wider economy⁷⁶. It directly employs more than 500,000 people of which more than 50% are highly skilled. The industry also generates an estimated further 1.2 million jobs indirectly⁷⁷. In addition, investments in the defence sector have a significant economic multiplier effect in terms of creation of spin-offs and technology transfers to other sectors, as well as the creation of jobs.

The defence industry is dependent on the launch of capability development programmes by governments and, more generally, on the level of public investment in defence. In addition, defence system development takes place with a long-term perspective and implies high risks, as operational needs may change over the course of product development. In this context, defence companies will not invest in military technologies unless they have government commitment to procure the products they are developing. In this sense, EU-wide competition and increased cooperation, which are two means to enhance the efficiency and innovative capacity of the European defence industrial base, can be said to be still too limited.

Creating civil-military synergies

Defence technologies developed through the Preparatory Action and the future Programme may also meet civilian needs. Synergies should be encouraged to boost innovation for the wider civil economy, such as technologies on cyber defence while avoiding any duplication. Conversely, civilian research could also be used to

⁷⁵ Figures taken from Commission Communication on a European Defence Action Plan (p.7), COM (2016) 950 final, 30 November 2016.

⁷⁶ "Employment multiplier effect of between 2.2 to 2.4" in Duran J., Isusi I., Corral A., *Study on the Perspectives of the European Land Armament sector*, IndustriAll, 2012, p. 38.

⁷⁷ Data from the Aerospace and Defence Industry Association (ASD).

support the defence industry. Horizon 2020 can be used for boosting fundamental research and innovation, in particular through promoting a cross-fertilisation effect. The Commission will bring together, as of 2017, defence industry and civilian industries benefiting from Horizon 2020 funding to encourage linkages between potential new technologies and processes into the defence industry.

Industries, Research and Technology Organisations (RTOs) and other research actors involved in defence applications and research are eligible to participate in Horizon 2020-funded activities that have an exclusive focus on civil applications. In fact, the participation of leading European defence companies has been very active, both in FP7 and Horizon 2020 (more than 1400 projects and an EU contribution of over EUR 700 million in FP7, and more than 500 projects with an EU contribution of over EUR 400 million in Horizon 2020 to date). CEA, Thales and the former EADS are the most active participants. In this context, it should be noted that Horizon 2020 has special security-related implementation provisions (i.e. specific requirements on IPR/sharing results of projects).

Specificities of the defence market

The defence market does not follow the conventional rules and business models that govern traditional markets. Governments are the only end-customers for defence equipment and they simultaneously act as the requirement specifier, the contracting authority, the regulator and, often, also as a supporter of exports. Moreover, many defence industries are either directly owned or substantially sponsored by the government. As a result, the supplier base is rather limited, involving only a select number of defence companies, since the political, economic and technological barriers to entry are high.

Finally, defence system development is both very long term and very high risk: it takes many years, sometimes even decades, to come to fruition, and defence capabilities must, by definition, be at the leading edge of technology – otherwise, the system may not provide military advantage over adversaries. This also means that operational needs may change over the course of product development; as a result, governments need the flexibility to adjust their requirements – or even, on occasion, to cancel a development project altogether. In this context, defence companies will not invest in military technologies, unless they have government's commitment to buy their future developed products.

Issues for consideration

- Taking into account the recent political decision on establishing the European Defence Fund, what are the elements which would help determine the most appropriate way of implementing it (e.g. fully integrated within the future Framework Programme; a ring-fenced part of the future Framework Programme; or a separate programme, outside the future Framework Programme)?
- How to ensure maximum excellence from EU funding for defence R&D and maximum return from dual use research?
- What can be learned from national experience in supporting civil and defence R&D?

Selected stakeholder views⁷⁸

In a recent Eurobarometer survey⁷⁹, an average of 74% of the European respondents was in favour of a common defence and security policy among EU Member States. The European Parliament published in March 2016 a study⁸⁰ 'The future of EU Defence Research', based on stakeholder interviews, recommending that the EU launches an ambitious European Defence Research Action Plan that should include a European Defence Research Programme. It also recommends increasing the share of Horizon 2020 funding dedicated to dual-use research in its final budgetary phase (2018-2020). This could focus on RTO studies working at fundamental S&T research (TRL 1 to 3) which could be used for defence purposes and the use and Public-Private Partnerships to produce operational demonstrators (TRL 7 & 8).

The European Parliament report on "the European Defence Union" recommended the effective launch of the preparatory action for a future EU defence research programme, provided with a sufficient budget, of at least EUR 90 million for the next three years (2017-2020). It took the view that the preparatory action should be followed by a major dedicated EU-funded research programme as part of the next MFF starting in 2021; noted that the European Defence Research Programme will need a total budget of at least EUR 500 million per year over that period in order to be credible and make a substantial difference.

Finally, WeMove.EU has launched a petition⁸¹ against the inclusion of defence in the EU budget, entitled: 'Halt the inclusion of arms industry research into the new EU budget. No EU money should go to military technology. Research money should go to projects developing nonviolent ways of preventing and resolving conflicts, and in particular tackling root-causes of instability'. It has gathered over 63,000 signatures to date.

⁷⁸ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

⁷⁹ Survey of May 2016, <http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Chart/getChart/themeKy/29/groupKy/181>

⁸⁰ "The future of EU Defence Research", study requested by the European Parliament's Committee on Foreign Affairs and the Committee on Security and Defence, authored by M. Mauro and K. Thoma (2016).

⁸¹ <https://act.wemove.eu/campaigns/EU-dont-invest-in-weapons>

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Industrial competitiveness

Introduction

Industry, which accounts for 80% of private research and innovation, is the backbone of the EU economy. A highly performing industrial base, a strong services sector and genuine synergies between the two are needed to maintain Europe's global leadership in sectors with high-value jobs such as the automotive, aeronautics, engineering, chemicals and pharmaceutical industries but also to seize the potential of newly emerging sectors.

Competitiveness requires a stable, simple and predictable environment, based on principles of better regulation as outlined in the Commission's Regulatory Fitness and Performance Programme (REFIT). The overall policy and regulatory framework at European and national levels should foster investment and innovation. Enhancing market take-up of new, innovative products and services and promoting the creation and growth of SMEs is at the core of EU industrial policy, with the objective of realising smart, sustainable and inclusive growth and jobs.⁸²

The Commission is examining how the regulatory environment at EU level can hamper, or stimulate, innovation.⁸³ Through the application of the R&I tool of the Impact Assessment guidelines, the Commission is able to systematically assess the impact of new EU policy and legislative initiatives on innovation. This way the Commission helps foster an innovation-friendly regulatory environment for industrial competitiveness. Through "Innovation Deals" the Commission is piloting in the area of circular economy a new non-legislative approach to assist innovators who face regulatory barriers – real or perceived – in getting their innovations to market. The aim is to enable innovators and regulators to reach a joint understanding of how new technologies and innovations can be progressed in existing regulatory frameworks.

Strengthening the Union's scientific and technological bases, notably in support of its industrial competitiveness, is enshrined as an objective in the EU Treaty. It has been a core objective of successive R&D Framework Programmes since the start, and it is a central aim of Horizon 2020 as well.⁸⁴

Horizon 2020 supports industrial competitiveness through:

⁸² http://ec.europa.eu/europe2020/pdf/themes/2015/industrial_competitiveness_policy_20151126.pdf

⁸³ See the EC Staff Working Document "Better Regulations for innovation-driven investment at EU level" published in 2016: https://ec.europa.eu/research/innovation-union/pdf/innovrefit_staff_working_document.pdf

⁸⁴ Horizon 2020 provides a common strategic framework for the Union's funding of excellent research and innovation, thus acting as a vehicle for leveraging private and public investment, creating new job opportunities and ensuring Europe's long-term sustainability, growth, economic development, social inclusion and industrial competitiveness, as well as addressing societal challenges across the Union. See Article 4, Horizon 2020 Regulation.

- A dedicated '**Industrial Leadership**' pillar⁸⁵ designed to mobilise private sector (notably SME) participation in EU-funded research and innovation projects, and to develop new products and services for market take-up in industrial sectors with a high potential to drive economic growth. It consists of three specific objectives: (i) Leadership in Enabling and Industrial Technologies; to make Europe a more attractive place for businesses to invest in R&D and innovation; (ii) Access to Risk Finance; to strengthen EU support to create better access to venture capital and loans for innovative companies; (iii) Innovation in SMEs; activities providing tailored support for SMEs with the potential to grow and internationalise.^{86 87}

- Leveraging private investment in key industrial sectors through **Public Private Partnerships** (PPPs). These take the form of various industry-led Joint Technology Initiatives (JTIs), e.g. for aviation, new medicines, electronics (*see Annex for full list*). They are expected to mobilise a total investment of over EUR 17 billion, of which the EU budget contribution is expected to be up to EUR 6.2 billion. In JTIs, industry defines ambitious research agendas that deliver on EU policy goals, with the calls for proposals implemented through dedicated joint undertakings. Resulting projects bring together industry (including innovative SMEs), universities, research laboratories, and other groups and users

- Eight **contractual PPPs** in areas of strategic importance for European policy and industry such as Factories of the Future (FoF) to support the manufacturing industry through the development of sustainable production technologies and systems; Energy-efficient Buildings (EeB) to increase the competitiveness and energy efficiency of the construction industry; European Green Vehicles Initiative (EGVI) to develop a competitive and resource efficient road transport system with significantly less CO2 emissions; Sustainable Process Industries (SPIRE) to make the process industry more resource- and energy-efficient; Photonics, a key enabling technology for many sectors, from energy to health; Robotics, a driver of industrial competitiveness and essential to address challenges in areas such as demographic change, health and well-being, food production, transport and security; High Performance Computing, which stimulates Europe's productivity and economic growth as well as it advances European science; Advanced 5G networks for the Future Internet, The partnerships are expected to leverage more than EUR 6 billion of investments to be allocated through calls for proposals under Horizon 2020.⁸⁸ In contrast to the Joint Technology under Horizon 2020, the contractual PPPs do not organise their own calls but the Commission awards funding through open calls under the different Horizon 2020 programme parts.

⁸⁵ The LEIT specific objective consists of three parts: (i) ICT, (ii) Space, and (iii) Nanotechnologies, advanced materials, biotechnology, advanced manufacturing and processing.

⁸⁶ Recital 9, Horizon 2020 Specific Programme stipulates: "In order to maintain and increase the Union's industrial leadership, there is an urgent need to stimulate private sector research and development and innovation investment, promote research and innovation with a business-driven agenda and accelerate the development of new technologies which will underpin future businesses and economic growth. The priority "Industrial leadership" should support investments in excellent research and innovation in key enabling technologies and other industrial technologies, facilitate access to risk finance for innovative companies and projects, and provide Union-wide support for innovation in SMEs"

⁸⁷ At least 20 % of the total combined budget for the specific objective "Leadership in enabling and industrial technologies" and the priority "Societal challenges" should go to SMEs. Fast Track to Innovation (FTI), a pilot action in years 2015-2016, also supports innovation under the specific objective "Leadership in enabling and industrial technologies" and under the priority 'Societal challenges', with a bottom-up-driven logic on the basis of continuously open call.

⁸⁸ Three of the PPPs (FoF and EeB) were first established in 2009 in response to the economic crisis and have already shown their success in strengthening European supply chains and innovating key industrial sectors.

- The **European Institute of Innovation and Technology** which, through its Knowledge and Innovation Communities (KICs), covers the entire value chain in certain sectors, from education to R&D, demonstration, start-up incubation, marketing and sales. Industrial partners, together with the finance and service sectors, are expected to significantly contribute to the budget of the KICs and are integral to their success.⁸⁹

In addition, industrial participation is encouraged across all parts of Horizon 2020. In the Excellent Science pillar, the Marie Skłodowska-Curie Actions feature non-academic sector partners playing a strong role in joint researcher training projects. The excellence-based frontier research funded by the European Research Council, the 'Innovation Actions' projects on Raw Materials⁹⁰, the InnovFin scheme⁹¹, as well as the mix of actions funded under Societal Challenges (SME-specific actions, inducement prizes and collaborative projects) also have, or will have, a positive effect on innovation in the EU – although rather upstream in the research and innovation chain.⁹² Horizon 2020's mix of support tools to boost industrial competitiveness normally addresses the 'technology offer' rather than the demand.

Notable exceptions are the prizes (which have been limited in number thus far), and the pre-commercial public procurement and the public procurement for innovative solutions (which have not been widely taken up to date). The Commission also invests in industrial competitiveness through the COSME (Competitiveness of Enterprises and SMEs) programme and the Investment Plan for Europe, with the latter projected to unlock public and private investments with impact on the real economy of at least EUR 315 billion in 2015, 2016 and 2017. The plan targets investment projects in strategic infrastructure and research and innovation in particular. The European Structural and Investment Funds (ESIF) foresee EUR 100 billion for Member States to invest in research and innovation, guided notably by the policy of smart specialisation⁹³. The Digital Single Market strategy has set out 16 initiatives, which could mobilise investment of EUR 415 billion into the EU economy each year, promoting innovation and creating a large number of new jobs.

Socio-political context

This aim of industrial competitiveness should be seen in the context of globalisation and international economic integration, where technical advances have made it possible for industry to slice up value chains and perform activities in the most cost-effective locations. This poses new challenges on existing comparative advantages and the competitiveness of countries and regions.

Productivity is a key driver for competitiveness, investment and growth. The link between innovation and productivity is well established through the impact of R&D investment on productivity. Europe faces a productivity gap when compared with its main competitors, as illustrated on the next page.

⁸⁹ Recital 16, EIT Regulation states that the KICs should aim at maximising the share of contributions from the private sector.

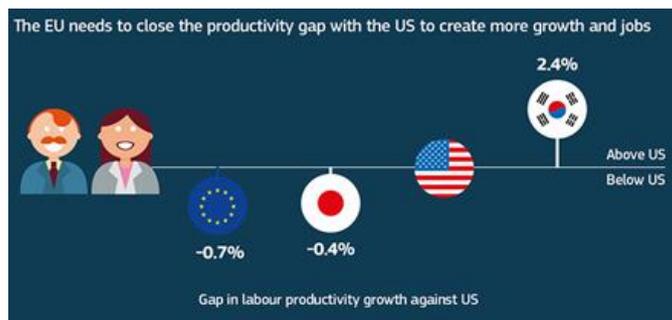
⁹⁰ Call topic: SC5-14-2016-2017: Raw materials innovation actions: The main objective is to develop innovative pilots demonstrating clean and sustainable production of non-energy non-agricultural raw materials in the EU from primary and/or secondary sources, in line with the European Innovation Partnership on Raw Materials' target.

⁹¹ See: <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/access-risk-finance>

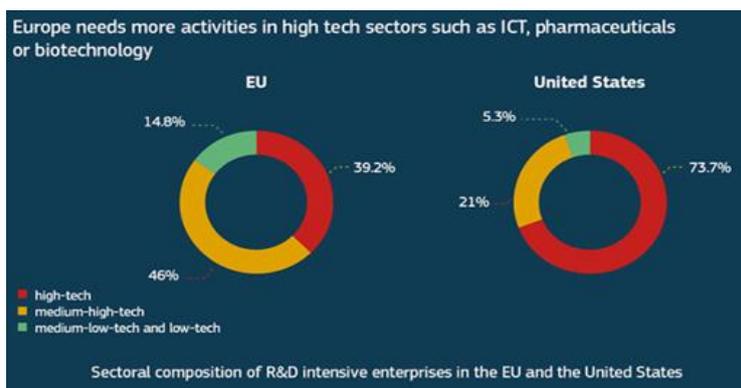
⁹² Data from completed ERC projects shows that around one-fifth of ERC projects in the Physical Sciences and Engineering and Life Sciences domains have reported at least one patent arising from their project.

⁹³ See the 'Contribution to Juncker priorities' Issue Paper for further statistics on the R&I investments provided through the EFSI.

Such a gap creates loss of investment opportunities and declining market shares in global trade. The shortfall of investment over the past few years is likely to continue to hamper job creation, exerting a negative impact on the capacity for the EU to remain competitive in the long term.



Europe lags behind in the adoption of new technologies, both in manufacturing (in sectors such as construction, textiles and steel) and in services, due to lack of investment, lack of readiness particularly of smaller business to adopt new technologies and due to barriers to the diffusion of innovation.



As illustrated in the graph above, the EU industry, compared to its competitors such as the US, is comparatively medium tech. Europe's top R&D investors are for example in the automotive sector, not in ICT.

Another factor that increasingly determines industrial competitiveness is the ability to generate fast growing firms that speedily bring innovation on a large scale to the market. An economy's capacity to create jobs in fast growing firms in the most innovative sectors is the main source of GDP growth. Over the period 2001–2013, the Member States most effective on that account enjoyed an annual GDP growth rate that was triple that of other EU Member States (and twice the EU average, the US or the Japan)⁹⁴. In this context, the Commission is considering the creation of a European Innovation Council including a preparatory phase to be implemented through the forthcoming set of Work Programmes spanning 2018 to 2020.

⁹⁴ See here: https://ec.europa.eu/research/innovation-union/pdf/innovrefit_staff_working_document.pdf for further details.

The increasing productivity gap between cutting-edge firms and the rest means that the benefits of innovation are not spread widely, with negative implications on social and regional cohesion – as well as on overall growth potential and prosperity. Meanwhile, new challenges and opportunities are emerging due to technological and non-technological change, and the need to foster a more sustainable, circular and low carbon economy.

Strengthening industrial competitiveness should be seen in a context of globalisation and international economic integration, with globally distributed value chains and activities performed in the most cost-effective locations. This increasingly challenges existing comparative advantages, and regions' and countries' competitiveness.

Key facts and figures on the Framework Programmes

The extent to which EU Framework Programmes are supporting industrial competitiveness can be measured based on a number of indicators, including:

- Participation of the private sector
- Leveraging industry investments through JTI and cPPPs
- Technology Readiness Levels (TRLs) of funded projects.

During the seven years of FP7, private for profit institutions accounted for 30% of all FP7 participations and received 25% of the EC contribution (over EUR 11 billion). The highest business sector participation in absolute numbers was recorded in the ICT thematic area, where business represented just over one third of participations and budget. According to the FP7 ex post evaluation "there are indications that the increased emphasis in the later stages of FP7 on innovation and industry participation, in response to the economic-financial crisis, is beginning to generate positive micro-economic effects.

Participating organisations are reporting innovative product, process and service development, higher TRLs and increased productivity and competitiveness. Survey results show that, compared to FP6, projects supported under FP7 have finished with higher TRL levels and innovative companies supported by FP7 were more likely to introduce new product, process or service innovations to the market and to obtain a higher proportion of turnover from innovation than those not supported by FP7. A counterfactual analysis assessing the 'average number of patent applications per researcher' showed that, on average, researchers in organisations participating in FP7 tend to apply for patents more than those which do not take part in the EU's Framework Programmes".⁹⁵

It is premature, at this stage of the programme's lifetime, to fully assess the contribution of Horizon 2020 to industrial competitiveness. However, certain trends relating to industry participation in the programme can be identified:

⁹⁵ Programme Statement to the Draft EU Budget 2017, part on performance of FP7, section on assessment of the extent to which the programme has contributed to policy achievements)

- Private for-profit institutions accounted for 31.7% of all Horizon 2020 participations so far and received 26.7% of the EC contribution (over EUR 4.2 billion)⁹⁶.
- In 2015, the Horizon 2020 funding provided to JTIs and PPPs was just over EUR 1 billion⁹⁷. The cumulative investment package deriving from JTIs and PPPs is expected to mobilise over a seven year period a total of EUR 22 billion, whereby EUR 8 billion from Horizon 2020 will leverage EUR 10 billion from industry, and close to EUR 4 billion from Member States.⁹⁸

The following Horizon 2020 Key Performance Indicators are linked to industrial competitiveness:

| Indicators | Status |
|---|--|
| Percentage of Horizon 2020 beneficiaries from the private for profit sector | <ul style="list-style-type: none"> - In 2015, private-for-profit entities (PRCs) represent 32.6% of the total participations in signed grants. - In 2014 PRCs represent 31.0% of the total participations in signed grants. - For both years, PRCs represent 31.7% of the total participations in signed grants. |
| Share of EU financial contribution going to private for profit entities (Leadership in Industrial and Enabling Technologies and Societal Challenges) | <ul style="list-style-type: none"> - In 2015, in LEIT and Societal Challenges, the share of the EU financial contribution going to private entities was 41.9%. - In 2014, in LEIT and Societal Challenges, the share of the EU financial contribution going to private entities was 43.6%. - For both years, in LEIT and Societal Challenges, the share of the EU financial contribution going to private entities was 42.8%. |
| EU Financial contribution for PPP-P2Ps | <ul style="list-style-type: none"> - In 2015 the EU funding to Public-Public Partnerships (Art 185 and ERA-NET Cofund) was EUR 234 million and from PPP (art 187) EUR 1,007million⁹⁹. In total this amounts to EUR 1,241million. |
| PPPs leverage: total amount of fund leveraged through Art. 187 initiative including additional activities divided by the EU contribution | <ul style="list-style-type: none"> - Only the CleanSky2 Joint Technology Initiative has so far reported and certified its contribution to the signed grant agreements in 2015. In total EUR 179 million have been certified with a union contribution on EUR 60 million. This corresponds to a leverage effect of 1.9:1. |
| P2P leverage: total amount to funds leveraged through Art 185 initiatives (and ERA-NET Cofund actions). | <p>In 2015 public funding to P2P is EUR 262 million (Art. 185) and EUR 466 million (ERA-NET Cofund): in total EUR 728 million. The Union contributed to these actions for Art. 185 with EUR 95 million and for ERA-NET Cofund with EUR 139 million: in total EUR 234 million. This equals a leverage effect of 2.1:1. Further information is provided on this type of projects in the 'Contribution to the European Research Area' Issue Paper.</p> |
| Share of the EU financial contribution to LEIT and Societal Challenges going to | <p>In 2015, 24.5% (EUR 1,057 million) EU funding allocated to signed grants in LEIT and Societal Challenges (EUR 4,304 million) was allocated to SMEs.</p> <p>In 2014, 22.9% (EUR 1,072 million) EU funding allocated to signed grants in LEIT and Societal</p> |

⁹⁶ According to the Horizon 2020 Annual Monitoring Report for 2015, 50% of partners participating in the Climate-KIC and 75% of partners in the InnoEnergy KIC are from the industrial sector. To date, the Industrial Leadership pillar was allocated 20% of the overall funding (EUR 3.15 billion) and the total share of signed grants was 13% of all Horizon 2020 grants

⁹⁷ Horizon 2020 Annual Monitoring Report for 2015.

⁹⁸ Commission Communication "Public-Private Partnerships in Horizon 2020: a powerful tool to deliver on innovation and growth in Europe" COM(2013) 494 final: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013DC0494&from=EN>

⁹⁹ Including only part of IMI2 calls.

| | |
|--|---|
| SMEs (LEIT and Societal Challenges). Target 20%. | Challenges (EUR 4,667 million) was allocated to SMEs. For both years, 23.7% (EUR 2,129 million) EU funding allocated to signed grants in LEIT and Societal Challenges (EUR 8,973 million) was allocated to SMEs. |
| Share of the EU financial contribution to LEIT and Societal Challenges going to the SME Instrument. Target 7%. | - In 2015, 6.3% (EUR 270 million) of the 2015 EU funding allocated to signed grants in LEIT and Societal Challenges went to signed grants from the dedicated SME Instrument in 2015. - In 2014, 5.5% (EUR 255 million) of the 2015 EU funding allocated to signed grants in LEIT and Societal Challenges went to signed grants from the dedicated SME Instrument in 2015. For both years, 5.9% (EUR 525 million) of the 2015 EU funding allocated to signed grants in LEIT and Societal Challenges went to signed grants from the dedicated SME Instrument in 2015. |
| Share of projects and EU financial contribution allocated to innovation actions in Horizon 2020 | - In 2015, 6.5% of the signed grants were innovation actions and 19.9% of the funding was allocated to innovation actions. - In 2014, 4.5% of the signed grants were innovation actions and 14.9% of the funding was allocated to innovation actions. - For both years 5.4% of the signed grants are innovation actions and - 17.2% of the funding in Horizon 2020 went was allocated to innovation actions. |
| Within the innovation actions, share of EU financial contribution focussed on demonstration and first-of-a-kind activities.¹⁰⁰ | Within innovation Actions, share of EU funding allocated to demonstration. - 2015: 84.4% - 2014: 89.8% - Total for both years: 86.6% Within Innovation Actions, share of EU funding allocated to first-of-a-kind activities. - 2015: 8.8% - 2014: 4.9% - Total for both years: 7.1% |

Issues for consideration

- In what ways can the Framework Programme best contribute to strengthening industrial competitiveness: through public-private partnerships offering scale and scope to leverage private investment; through regular collaborative R&I projects; through increased focus on SMEs and a European Innovation Council (EIC)?¹⁰¹
- Should Framework Programme support to industrial competitiveness differentiate between mature and emerging sectors, and how?
- While allowing the industry to participate in projects at their own cost, should the Framework Programme continue to provide financial support for large industry? If so, through grants, loans or any other form?

¹⁰⁰ For flagged projects.

¹⁰¹ For further details on the plans for developing a European Innovation Council, and the background policy context, please consult the 'Open Innovation' Issue Paper.

Selected stakeholder views¹⁰²

While stakeholder views understandably approach the question of Horizon 2020's support for industrial competitiveness from many different angles, there is a basic consensus that the programme should maintain its focus on supporting industrial competitiveness.

- *"Innovation projects within Horizon 2020 are intended to generate economic growth and employment, and to consolidate the Union's competitiveness. In the course of the financial and economic crisis, the EU Research Framework Programme was increasingly formulated as a programme designed to provide economic stimulus. Sustainable drivers of innovation are created in the long term through the optimal interplay of knowledge and application-oriented research. To achieve this, it is vital that the entire research and innovation process be taken into account, including an approach to impact which goes beyond short-term economic stimulus".*
- *"Industry participation is vital for the success of Horizon 2020. It is evident that the total amount of funding from Horizon 2020 for industries is less significant in relation to industry spending on R&I. The main benefits for industry partners can be seen in terms of network building, new links to universities, research organisations and other stakeholders such as cities. EU projects play a significant role in providing critical mass for developing new standards and in supplying industry with new expertise, new clients and markets and new talents... This beneficial effect for Europe's competitiveness should be fostered further...In view of the next programme we also strongly urge refraining from setting up more instruments and encourage the Commission instead to actively reduce the number of instruments".*
- *"To create impact with EU R&I programmes, participation of key industrial sectors and companies must be further promoted to ensure market introduction by industry. Collaborative involvement of large and smaller companies (outside the SME instrument) should be further promoted".*
- *"The mid-term review of Horizon 2020 should be used to re-assess the equilibrium of funding between different pillars of Horizon 2020 allowing the Industrial Leadership Programme to meet its policy targets defined by the EU institutions".*
- *"R&I projects today aim at creating impact from research mainly through patents and publications. Creating future industrial companies (research-driven, resource-intensive, hardware, deep-tech scale-ups) is of utmost importance for Europe's competitiveness".*
- *"The new structures and opportunities provided by Horizon 2020 have helped to preserve highly qualified jobs and skills in the R&D automotive value chain e.g. with the public-private partnership on Green Cars".*
- *"We recommend a better balance between high and low TRLs instead of focusing too strongly on calls with higher TRLs in the hope for achieving an immediate economic impact".*

¹⁰² Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

Annex: Innovation Investment Package - total investments (2014-20) (in € millions)

| Joint Undertakings (JUs) - Joint Technology Initiatives (JTIs) | | | |
|---|--|--------------------------------------|----------------|
| JUs implementing JTIs | Max. EU (Horizon 2020) + EU Member States (for ECSEL only) | Industry | Total |
| Innovative Medicines Initiative 2 | €1638 | €1638 | €3276 |
| Fuel Cells and Hydrogen 2 | €665 | €380 | €1045 |
| Clean Sky 2 | €1755 | €2194 | €3949 |
| Shift2Rail | €450 | €470 | €920 |
| Bio-based Industries | €975 | €2730 | €3705 |
| Electronic Components and Systems | €1185 (+ €1170 from EU Member States) | €1657 | €4012 |
| <i>Total JTIs</i> | <i>€7838 (€6668 from Horizon 2020 + €1170 from EU Member States)</i> | <i>€9069</i> | <i>€16 907</i> |
| SESAR Joint Undertaking | | | |
| JU | EU (Horizon 2020) | Eurocontrol and other members | Total |
| European Air Traffic Management System (SESAR) | €585 | €1000 | €1585 |
| TOTAL JUs | | | €18492 |
| Public-public Partnership | EU (Horizon 2020) | Member States | Total |
| European and Developing Countries Clinical Trials Partnership 2 (EDCTP 2) | €683 | €683 | €1366 |
| European Metrology Research Programme (EMPIR) | €300 | €300 | €600 |
| Eurostars 2 (for SMEs) | €287 | €861 | €1148 |
| Active and Assisted Living Research and Development Programme | €175 | €175 | €350 |
| <i>Total joint programmes</i> | <i>€1445</i> | <i>€2019</i> | <i>€3464</i> |

Contractual PPPs – indicative budgets (2014-20) (in € millions)

| cPPP | EU (Horizon 2020) indicative budget |
|-------------------------------------|--|
| Factories of the Future | 1,150 |
| Energy-efficient Buildings | 600 |
| Sustainable Process Industry | 900 |
| European Green Vehicles Initiative | 750 |
| 5G networks for the Future Internet | 700 |
| High Performance Computing | 700 |
| Robotics | 700 |
| Photonics | 700 |
| <i>Total</i> | <i>6,200</i> |

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Widening participation

Introduction

Despite efforts at national and European level, disparities in terms of research and innovation (R&I) performance persist among EU Member States. Especially in advanced economies such as in Europe, scaling up and improving investment in R&I is an essential pathway to economic growth and competitiveness. Increasing the R&I performance of low performing Member States and fully integrating their unexploited potential into the European Research Area and single market will maximise the impact of R&I investments, both for the EU as a whole and for each Member State concerned. Currently, low R&I performing Member States¹⁰³ include those who joined the EU since 2004 (EU-13), Portugal and Luxembourg.

To address this issue, European Structural and Investment Funds (ESIF) have been used for R&I capacity-building, notably in low performing Member States and regions. In the period 2014-2020, more than EUR 40 billion are allocated for R&I activities through a process of smart specialisation, which encourages all Member States to identify and build on their existing strengths.

Within Horizon 2020, specific and targeted measures were also introduced to help spread excellence and widen participation. The specific Horizon 2020 programme part on 'Spreading Excellence and Widening Participation' (SEWP) aims to '*fully exploit the potential of Europe's talent pool and to ensure that the benefits of an innovation-led economy are both maximised and widely distributed across the Union in accordance with the principle of excellence*'. It has a total budget of 816 million euros (proposed by the Commission to be increased by EUR 110 million following review of the Multiannual Financial Framework (MFF)).

SEWP's key measures on widening participation¹⁰⁴ are as follows:

- **Teaming** which focuses on the creation of new or updating existing centres of excellence in low R&I performing Member States through a "teaming" process with an internationally-leading institute in Europe.

¹⁰³ This definition is based on the composite indicator of Research Excellence (with a corrective threshold of 70% of the EU average). The detailed scores of the composite indicator can be found in "Research and Innovation Performance in EU Member States and Associated Countries 2013" at:

http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2012/innovation_union_progress_at_country_level_2013.pdf

¹⁰⁴ Besides low R&I performing Member States also 12 Associated Countries are allowed to submit (in the case of ERA chairs) or coordinate (Teaming, Twinning) project proposals.

- **Twinning** which aims towards significantly strengthening a defined field of research in an emerging institution in a low R&I performing Member State through linking this institution with at least two internationally-leading counterparts in Europe.
- **ERA Chairs** which supports universities or research organisations in low R&I performing Member States, with the objective of attracting and maintaining high quality human resources under the direction of an outstanding researcher and research manager (the "ERA Chair holder").

Additionally, three other actions provide support to low R&I performing countries (but not only):

- The Horizon 2020 **Policy Support Facility (PSF)**¹⁰⁵, launched in March 2015, provides support to Member States in the design, reform, implementation and evaluation of research and innovation policy. The PSF provides tailor-made services at the request of Member States and Associated Countries¹⁰⁶. Its support is either topic-specific (mutual learning exercises) or country-specific (peer reviews of national R&I systems, or specific support to a policy reform). Some of the low R&I performing Member States have already benefited from PSF support (Bulgaria, Hungary, Malta), for others PSF support is ongoing (Romania, Slovakia) while Slovenia, Latvia, Lithuania and Poland will soon benefit) from PSF services. Also some Associated Countries (Ukraine, Moldova) have already benefited from PSF support.
- **COST**¹⁰⁷ (Co-operation in Science and Technology), an intergovernmental framework set up in 1971, currently has 36 member countries. COST does not fund research but supports networking among scientists through short term scientific missions, workshops, conferences, training schools and other actions. COST has committed to spend 50% of its EUR 300 million budget from Horizon 2020 for the benefit of research communities in low R&I performing countries. Of the 300 ongoing COST networking actions managed by the COST Association, low R&I performing countries are participating in all running COST Actions whilst benefiting from 43% of the budget.
- The Commission supports a dedicated network of **Widening National Contact Points (NCPs)**¹⁰⁸ through the NCP WIDE_NET¹⁰⁹ project. This project promotes activities mainly related to the SEWP calls (Teaming, Twinning and ERA Chairs) in the Member States and builds the skills of the NCPs through the organisation of brokerage events, workshops and conferences. Furthermore, each part of Horizon 2020 has a dedicated network of NCPs which are promoting activities from the Framework Programme (there are 22 NCPs).¹¹⁰

Complementing these measures under Horizon 2020, actions funded under ESIF include support for research infrastructures and research centres; promoting business R&I, technological and applied research and key

¹⁰⁵ <https://rio.jrc.ec.europa.eu/en>

¹⁰⁶ See the 'Open to the World' Issue paper for a full list of the Associated Countries to Horizon 2020.

¹⁰⁷ <http://www.cost.eu/>

¹⁰⁸ National Contact Points are national structures established and financed by governments of the 28 EU Member States and the Associated Countries. NCPs give personalised support on the spot and in applicants' own languages.

¹⁰⁹ <http://www.ncpwidenet.eu/>

¹¹⁰ http://ec.europa.eu/research/participants/portal/desktop/en/support/national_contact_points.html

enabling technologies, as well as networking and development of clusters. An important example of synergies between ESIF and Horizon 2020 is the ELI - Extreme Light Infrastructure (distributed) project, located in Czech Republic, Hungary and Romania, that is supported by these countries under their ESIF resources complementing the European Strategy Forum on Research Infrastructures (ESFRI).

The Seal of Excellence is another example of efforts to create synergies between different programmes. It is a quality label granted to proposals submitted under Horizon 2020, which were evaluated as a high-quality proposal but could not be funded under the available call budget. The Seal allows regions, Member States or any other funding sources (including ESIF) to identify and support these high quality proposals.

Strengthened synergies of Horizon 2020 with ESIF and with the Instrument of Pre-Accession (IPA II) for Associated Countries are a way to increase the impact of investments in low R&I performing countries. Both Horizon 2020 and ESIF aim to maximizing synergies, but challenges remain in order to achieve such practical linkages on the ground.

Socio-political context

The issue of widening participation has been the subject of continuous debate and analysis notably during EU Presidencies of EU13 Member States. According to an analysis carried out by the Commission¹¹¹, some of the main causes of certain countries' low participation in EU Framework Programmes were as follows:

- Insufficient R&D investments in those countries
- Lack of synergies between certain countries' national research systems and EU research
- Insufficient access to existing networks
- Differential wage levels between countries
- Insufficient and ineffective information, communication advice and training

The High Level Expert Group on the Ex-post evaluation of FP7 concurred that "*some of most important reasons for the comparably lower share and lower success rates of the EU-13 organisations are information and language barriers; lack of professional contacts and research networks; lack of leading Universities and Research organisations leaders in proposal matters; limited understanding of FP7; weak training in preparing successful proposals; insufficient motivation to participate in FP7; lack of practice in project management; little experience in cross-country cooperation; generally low focus on R&D in policy and in business; few options for exploitation of research results at the national level.*"

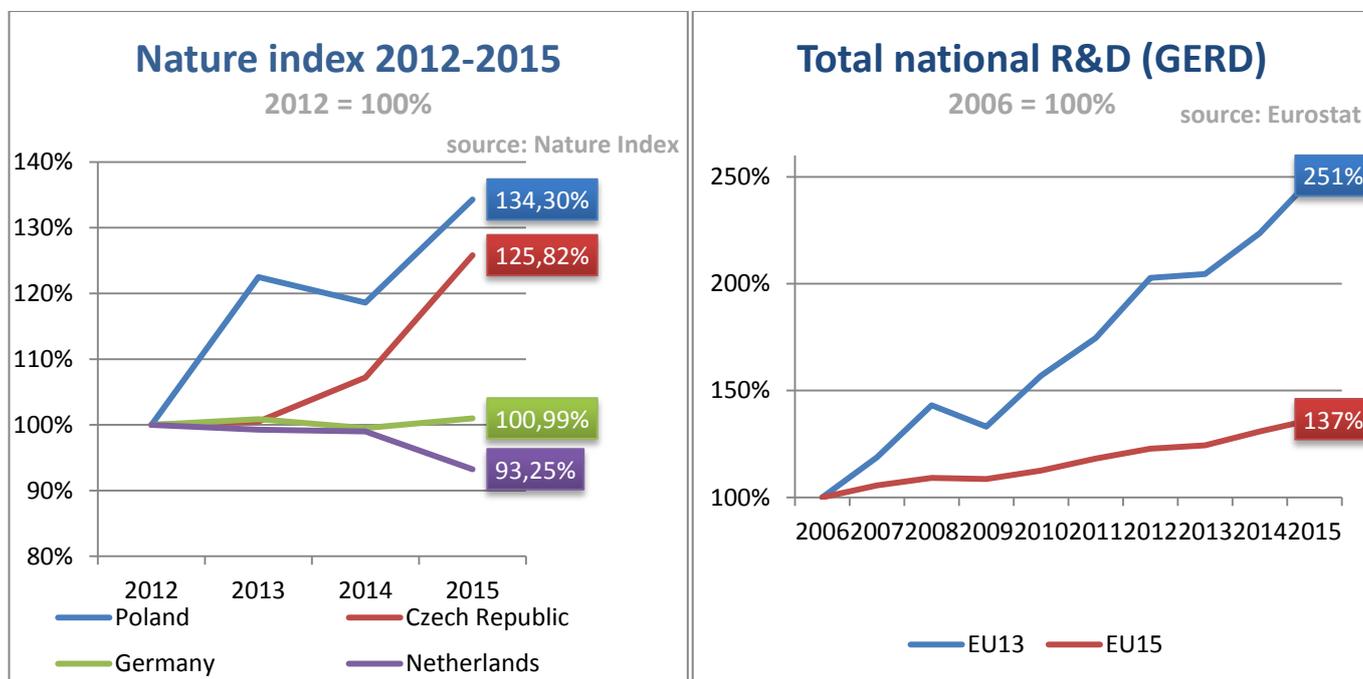
¹¹¹ European Commission analysis of September 2011, at the request of the Polish Presidency, see: <http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%2014728%202011%20INIT>. This has been confirmed by other studies, analysis and public discussions, for instance the FP7 MIRRIS project <http://www.mirris.eu/>.

During the negotiations for Horizon 2020, Member States paid special attention to low participation. A special provision was therefore introduced into the Horizon 2020 rules which provides for a reimbursement of "bonuses" paid by non-profit research organisations to their staff (i.e. an additional salary). This reimbursement is subject to certain conditions and to an annual capping of EUR 8,000 per person. However, in practice the implementation of this provision has proved to be too complex for beneficiaries and has had some unintended effects in terms of limiting Horizon 2020 funding. The Commission is currently exploring ways and means allowing a wider use of this provision by research organisations in low R&I-performing Member States in the context of the programme's interim evaluation.

Widening participation is a shared responsibility to be addressed both nationally and at EU level in a complementary way, whilst respecting the principles and role of each level and instrument used. Important structural reforms of national R&I systems are required in order to increase their efficiency and quality. Only national authorities can decide and implement these reforms. Horizon 2020 can stimulate reforms and leverage higher and better R&I investments across Europe, but always maintaining R&I excellence as the cornerstone objective and evaluation criterion, if Europe wants to be able to compete worldwide and deploy measures that mutually benefit all parties involved.

Key facts and figures of the Framework Programmes

The variations in participation patterns among Member States are multi-level and complex; it is not simply a case of "East vs West" or "new Member States vs old Member States", as illustrated by the two graphs below as illustrated by the two graphs shown below. The left-hand graph shows that high-quality research outputs from countries such as Poland and the Czech Republic have increased in recent years, while those from countries such as the Netherlands and Germany have stagnated or decreased. The right-hand graph shows that, gross domestic expenditure on R&D has recently increased by a far greater proportion in EU-13 countries than in the EU-15.



As regards the participation in the EU Framework Programmes the High Level Expert Group on the Ex-post evaluation of FP7 concluded: "The EU Member State participation patterns reflect the size, diversity and maturity of national science and innovation systems: high shares of EU funding are allocated to large, research intensive countries like France, Germany, the Netherlands, and the United Kingdom. These countries often host centres of excellence that have made substantial investments in acquiring and maintaining top level qualified human resources and professional support structures. In contrast, Mediterranean countries that suffer from the economic crisis and high unemployment rates reduced their public RTD expenditures.

While FP7 could not compensate this loss, it still provided opportunities for researchers through mobility and cooperative projects. The share of FP7 funding for organizations from new EU Member States, as well as the success rates of proposals coordinated by researchers from these countries, were significantly lower. These lower shares were not caused by a bias against the new EU Member States, but rather by a comparably high number of weak proposals submitted by, or with partners from the EU-13. However, since the science and innovation funds on national level are also substantially lower in these countries, FP7 played a more important role in relative terms, especially in competitive funding".

The table below compares EU-13 with EU-15 participation patterns for FP7 and Horizon 2020:

| | FP7 | | Horizon 2020 | |
|---|-------|-------|--------------|-------|
| | EU-13 | EU-15 | EU-13 | EU-15 |
| EU Funding (% of total contribution)¹¹² | 4.2% | 85.2% | 4.5% | 88.6% |

112 For FP7: Data from SWD FP7 Ex-Post Evaluation, for Horizon 2020: Annual Monitoring Report 2015

| | | | | |
|---|-----------|-----------|-----------|-----------|
| Success rate, applications¹¹³ | 18.1% | 22.0% | 11.1% | 14.1% |
| Participation (% of total)¹¹⁴ | 8.0% | 80.0% | 8.5% | 83.1% |
| EU funding per researcher¹¹⁵ | EUR 1,300 | EUR 3,900 | EUR 1,578 | EUR 4,981 |
| EU funding per million EUR of national RTD expenditures (GERD)¹¹⁶ | 29 094 | 22 436 | 29 784 | 31 346 |
| Share of applications which are high quality proposals¹¹⁷ | 43% | 52% | 39.5% | 53% |

The table paints a mixed picture. The share of the funding received by organisations in EU-13 countries in Horizon 2020 is indeed very low (4.3% in 2014 and 4.7% in 2015). However, in some EU-13 countries, the EU Framework Programme plays a very important role in total national RTD expenditure (GERD): Horizon 2020 funding represents 25.9% for Cyprus, ~10% for Malta and ~5% for Romania, compared to 1.5% of Germany and France's national GERD¹¹⁸. Moreover, EU contribution normalised by GERD shows that EU-13 countries now get relatively similar amounts to EU-15.

The Widening measures have led to an impressive participation in all calls under SEWP so far.¹¹⁹ Especially the Teaming action has attracted a lot of attention at political level, with submitted proposals either coordinated or supported financially by national or regional authorities. In several countries (e.g. Poland), national competitions were held by relevant Ministries in order to identify the best proposals for the EU-wide competition – a first in the history of Framework Programmes. Equally, because of the link (Teaming in particular) with regions' Smart Specialisation Strategies for Research and Innovation, some countries have taken the initiative to link the actions with their Operational Programmes in ESIF (e.g. Poland, Czech Republic).

Under Horizon 2020 so far, 31 Teaming Phase 1, 10 Teaming Phase 2, 67 Twinning and 14 ERA Chairs projects have been funded. Out of a total of EUR 254 million allocated, 73% of the funding went to partners from low R&I-performing countries.

Issues for future consideration

For the last three years of Horizon 2020, apart from the Commission proposal to increase the SEWP budget by an extra 12%, a number of measures, including some with short term impact, are under consideration that, without compromising on excellence, are intended to stimulate and facilitate high quality participation from low R&I performing Member States. These include networking (facilitated by an enhanced role of NCPs),

¹¹³ For FP7: CORDA FP7 extraction, for Horizon 2020: CORDA Horizon 2020 Interim Evaluation extraction

¹¹⁴ For FP7: Data from SWD FP7 Ex-Post Evaluation, for Horizon 2020: Annual Monitoring Report 2015

¹¹⁵ For FP7: HLEG Report on FP7 Ex-Post Evaluation (annual data) (source: "total R&D personel" rd_p_persreg), for Horizon 2020 Data from AMR2015 (annual data from 2014) (source: "Total number of researchers FTE" rd_p_persreg)

¹¹⁶ For FP7: HLEG Report on FP7 Ex-Post Evaluation (annual data) (source: "GERD" rd_e_gerdreg), for Horizon 2020: Data from AMR2015 (annual data from 2014) (source: "Total number of researchers FTE" rd_p_persreg)

¹¹⁷ For FP7: HLEG Report on FP7 Ex-Post Evaluation, for Horizon 2020: Data from AMR2015

¹¹⁸ Data taken from Horizon 2020 Annual Monitoring Report 2015

¹¹⁹ Some 169, 88 and 553 proposals were submitted under the 2014-15 Teaming, ERA Chairs and Twinning calls respectively.

communication (raising visibility of existing Widening projects 'champions' in low R&I performing Member States) and thematically targeted activities (with key topics of relevance to low R&I performing Member States).

Overcoming the R&I divide remains an important political issue. ESIF investments can have a long-term positive impact in low R&I performing Member States through capacity-building. Moreover, Horizon 2020 widening actions (teaming, twinning, ERA Chairs) also contribute to building up their knowledge base.

- Is overcoming the R&I divide in the EU a matter of investment, reforms or both?
- Is the R&I divide the sole responsibility of low R&I performing Member States, or a shared one for the EU as a whole?
- Should structural funds be the only EU instrument used to address the issue, or should the future R&I Framework Programmes also continue to contribute, notably through widening actions?

Selected stakeholder views¹²⁰

Issues of low participation of some Member States and "brain-drain" are raised in many opinions of stakeholders. However, proposals for how to tackle it differ:

- *"We are very worried about the low participation rate of many EU Member States in projects funded by Horizon 2020 [...] the best universities are supporters of [teaming and twinning], and very active participants in these schemes, and support its continuation for the remainder of Horizon 2020 [...]. We suggest that the EC starts looking at alternatives, such as using a small percentage of the Structural Funds to create synergies with Horizon 2020."*
- *"FP funding should be exclusively used for funding research and innovation. In addition, it should help avoid, rather than cause, negative effects such as 'brain-drain'. To have an impact, initiatives such as the 'Spreading Excellence and Widening Participation Programme' and schemes such as 'Teaming and Twinning', need to be adequately funded and have better synergies with ESIF [...] Horizon 2020 must also make sure that barriers for newcomers are lowered. To reflect on appropriate solutions to the knowledge divide, the concentration of funding at institutional level should continue to be monitored."*
- *"Measures should be taken to encourage the inclusion of new partners and partners from EU13, in order to take advantage of the entire potential of the ERA [...]. Expert discussions on new instruments facilitating the openness and inclusiveness of existing networks (e.g. CSA networking projects or introducing an additional criterion for geographical differentiation for projects with equal scores) should be started."*

¹²⁰ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder



Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Mission-oriented vs investigator-driven R&I

Introduction

Horizon 2020 has two different approaches to funding schemes: bottom-up and top-down (investigator-driven and mission-oriented). Bottom up calls are completely open calls, which do not prescribe any thematic areas or subjects. They allow for researchers to pursue their own promising ideas and for breakthrough discoveries to emerge from this process. They allow the innovator to write the proposal as they see fit, enable the submission of proposals that do not fall neatly within a thematic box, and promote the submission of interdisciplinary/cross-sectoral proposals. Top-down calls are targeted in the sense that they have some degree of thematic prescription in order to help deliver on EU policy objectives.

As summarised in the table on the next page, the challenge-based approach adopted for the Societal Challenges and the technology-driven approach taken for the Leadership in Enabling and Industrial Technologies parts of Horizon 2020 sees the challenges defined in a top-down way - but in less specific and broader terms than the equivalent programme parts under FP7.¹²¹

The European Research Council and the Marie-Skłodowska Curie Actions (in the Excellent Science pillar) operate on an entirely bottom-up basis, although for evaluation purposes the submitted proposals are grouped into thematic panels. The programme part on Leadership in Enabling and Industrial Technologies follows a technology-driven approach to develop enabling technologies that can be used in multiple areas, industries and services.

The dedicated 'SME Instrument', a new feature of Horizon 2020, is implemented in a primarily bottom-up manner through a continuously open call. As part of the preparatory phase for a European Innovation Council to be implemented through the forthcoming set of Work Programmes spanning 2018 to 2020, the SME Instrument will take a fully bottom-up approach as of 2018¹²².

The table on the next page provides a visualisation of the main approaches taken per pillar in Horizon 2020.

¹²¹ Some parts of FP7 followed a top-down approach, publishing quite specific calls, while other parts of the programme followed a bottom-up approach (such as FP7 Ideas – the European Research Council, and FP7 People – the Marie Curie Actions). The Interim Evaluation of FP7 suggested changing the mix of funding schemes, and introducing more open calls during the second half of the programme. Many stakeholders, primarily scientists, also felt that the top-down research topics within FP7, particularly within the Cooperation programme, were formulated in an overly prescriptive way.

¹²² For further information on the plans to develop a European Innovation Council, please consult the 'Open Innovation' Issue Paper.

| Horizon 2020 pillar | Main approach | Expected impact on |
|---|--|--------------------|
| Excellent Science ¹²³ Excellence-driven | Bottom-up (ERC, Marie Skłodowska-Curie Actions, FET-Open) Top-down (FET Proactive, Research Infrastructures) Either single beneficiary or collaborative projects | Science |
| Industrial Leadership ¹²⁴ Technology-driven | Primarily bottom-up (SME Instrument, Access to Risk Finance) Top-down (Leadership in Industrial and Enabling Technologies) Either single beneficiary or collaborative projects | Industry |
| Societal Challenges ¹²⁵ Challenge-driven | Top-down Collaborative projects | Society |

Socio-political context

There can be said to be a consensus that scientific knowledge is a 'public good' in economic terms (as many people can consume it at the same time, without it being used up) and 'non-excludable' (it is hard to stop people getting access to it). In times of budgetary constraints, the EU is faced with tough choices when it comes to prioritising investments in research and innovation and in responding to the needs of the society. This requires a strategic approach to be taken towards the major challenges faced by the EU. Uncertainty about the future makes it necessary for societies to develop broad science bases (including talent, excellent research institutions and infrastructures).

Scientific advances do not always follow preordained plans or painstakingly prepared proposals. Many of the most important discoveries in science were entirely unanticipated. Science often evolves through intelligent design, but just as often progress results from blind chance. When R&I policy is framed in terms of societal challenges, the concept of uncertainty helps explain why we need a balance between bottom-up and top-down approaches. Addressing societal challenges in a top-down way targets 'known knowns' and partially 'known

¹²³ Recital 7, Horizon 2020 Specific Programme: "Research actions carried out under the priority "Excellent science" should be determined according to the needs and opportunities of science. The research agenda should be set in close liaison with the scientific community. Research should be funded on the basis of excellence".

¹²⁴ Recital 9, Horizon 2020 Specific Programme: "The priority "Industrial leadership" should support investments in excellent research and innovation in key enabling technologies and other industrial technologies, facilitate access to risk finance for innovative companies and projects, and provide Union-wide support for innovation in SMEs...The activities shall follow a business-driven agenda. The budgets for the specific objectives 'Access to risk finance' and 'Innovation in SMEs' will follow a demand-driven, bottom-up logic. Those budgets shall be complemented by the use of financial instruments".

¹²⁵ Annex I, Part III, Societal Challenges, Horizon 2020 Regulation: "For Societal Challenges, all the activities shall take a challenge-based approach, which may include basic research, applied research, knowledge transfer or innovation, focusing on policy priorities without predetermining the precise choice of technologies or solutions that should be developed. Non-technological, organisational and systems innovation as well as public sector innovation will be given attention in addition to technology-driven solutions".

unknowns', whereas bottom-up R&I is more suitable to cover 'unknown unknowns', as well as approaching the 'known unknowns' in novel ways. By definition, the top-down part of Horizon 2020 is defined against foresight, evidence, strategy and policy, with the boundary conditions framed by public policy commitments of different durations (i.e. the EU climate targets for 2030, or the Juncker Commission priorities which feature some more immediate targets for 2020). Also, dealing with societal challenges implies that certain levels of investment in the concerned areas are reached (which a purely bottom-up approach does not allow for). At the same time, bottom-up research can also address societal challenges and contribute to new and emerging areas of science with potential relevance to these challenges¹²⁶. For example, the Nobel Prize awarded in 2010 to ERC grantee Konstantin Novoselov for graphene could have significant impact on fighting climate change by reducing energy needs in aircraft through lighter structures or by reducing power consumption in electronics.

Key facts and figures on the Framework Programmes

In Horizon 2020, the top-down, mission-oriented part is assigned a higher amount of the overall budget partly because 35% of the overall Horizon 2020 budget should be allocated to Climate-related research and innovation, and 60% to Sustainable development-related activities¹²⁷. In Horizon 2020, using a basic calculation of budgetary allocations for the different programme parts, it can be said that approximately EUR 25 billion is allocated to bottom-up funding schemes, with around EUR 47 billion allocated to top-down funding¹²⁸. In FP7, around EUR 12 billion was allocated to bottom-up schemes while around EUR 36.5 billion was allocated to top-down funding schemes¹²⁹. Hence it can be considered, on the basic level of the overall budget, that there is a more even balance between bottom-up and top-down funding in Horizon 2020 than in FP7.

Regarding the balance between top-down and bottom-up activities, the FP7 Ex-Post Evaluation High-Level Expert Group stated that: *“The Framework Programmes should combine strong policy objectives with decentralised and flexible implementation procedures. Implicit assumptions about how Framework Programmes work should be made explicit and published. Development of research themes and topics should focus on defining a number of concrete goals, while approaches and methods to accomplish these goals should be determined on a bottom-up basis [...] Horizon 2020 explicitly addresses Societal Challenges, the programme’s design follows a top-down approach rather than involving citizens and society in a substantial manner.”*

Instead of introducing bottom-up approaches in areas that need top-down approaches to address enabling technologies or societal challenges, the High-Level Expert Group suggests to put a special emphasis on the formulation of research topics which should focus on defining a number of concrete goals, while approaches and methods to accomplish these goals should be determined by the respective research proposal.

¹²⁶ ERC Annual Report 2015. Available at: https://erc.europa.eu/sites/default/files/publication/files/erc_annual_report_2015.pdf

¹²⁷ Recital 10 of the Horizon 2020 Regulation.

¹²⁸ The budgetary allocations from Horizon 2020 for the European Institute of Innovation and Technology and Joint Research Centre are excluded from this calculation.

¹²⁹ Seventh FP7 Monitoring Report, March 2015, DG Research and Innovation, European Commission. This calculation excludes the FP7 budgetary contribution to the Euratom programme and the Joint Research Centre.

Issues for consideration

- How should the balance between investigator-driven research (e.g. ERC, MSCA) and mission-oriented research (e.g. Industrial Leadership, Societal Challenges) be set (in Horizon 2020, this is approximately 30-70%); should more focus be given to one of them?
- In the mission-oriented part of the programme, should the non-prescriptive approach to calls be strengthened, or should more guidance be provided?
- How should the mission orientations be defined in order to reflect strategic EU priorities and citizens' expectations?
- How could bottom-up support for innovation be developed under a European Innovation Council?

Selected stakeholder views¹³⁰

Stakeholder views illustrate the diversity of opinions on these issues, and a small sample is as follows:

- *"Tackling the great societal challenges of Europe requires a better connection between the pillars of Excellent Science and Societal Challenges and a much greater focus on high quality research in all three pillars".*
- *"Balance across the whole research and innovation chain from fundamental to market-innovation driven research should be provided at EU level. A reasonable balance between the three funding pillars within Horizon 2020 should be a key target for the mid-term review. Making the appropriate balance between those pillars will require looking at their differences in terms of impact, lead times, leverage effects and in particular their specific European added-value".*
- *"Programmes managed by a future European Innovation Council should be bottom-up, in the sense of rewarding initiatives taken by companies and industry. Still, the EIC should be given room for prioritising between projects along the lines of societal and environmental challenges".*
- *"Horizon 2020 has developed a much needed and welcomed challenge-driven approach. Complex societal challenges are best addressed through trans-national and trans-sectorial cooperation. We believe that this way of working is essential in order to develop the radical innovations of the future. The emerging solutions and innovations have potential to generate business opportunities with global relevance. However, as stated in the Lund Declaration 2015, barriers are still evident in the European Research and Innovation Area hindering the investments made to achieve full impact. With our own experiences we can see how the challenge perspective could be further developed and strengthened in*

¹³⁰ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

Horizon 2020. A further advanced European challenge-driven innovation approach will be a key driver of the necessary creation of new markets in Europe. In this context, we would like to see a future EIC contributing to the next level of challenge-based research and innovation".

- *"We recommend maintaining the challenge-based, non-prescriptive approach. The broader, more open topics provide opportunities for more creativity, different ideas and approaches to be brought to bear in the respective areas, and require the involvement of a wide range of stakeholders in activities [...]Horizon 2020 needs more early stage collaborative research opportunities. It is however important that calls for earlier stage projects are also sufficiently bottom-up, to allow for the brightest ideas and the best consortium to get funded. More bottom-up opportunities would also enhance a more transparent process of work programme design [...] It is important for the researchers to set the agenda, at least for a reasonable part of the collaborative research funding opportunities. Bottom-up initiatives are however not only important in earlier stage projects... it is also important to provide bottom-up funding for close to market activities [...] The ERC and MSCA [...] have proven to be highly valuable programmes for European research but also innovation and education".*

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Simplification

Introduction

An EU Framework Programme that features simple and accessible rules and procedures for participants is a constant ambition. The many provisions on simplification included in the Horizon 2020 legal base show that this is a high priority. Simplification is a central aim of Horizon 2020 and is fully reflected in its design, rules, financial management and implementation. The programme aims to attract the strong participation of universities, research centres, industry and specifically SMEs and be open to new participants, as it brings together the full range of research and innovation support in one common strategic framework, including a streamlined set of forms of support, and uses rules for participation with principles applicable to all actions under Horizon 2020. Simpler funding rules should reduce the administrative costs for participation and contribute to the prevention and reduction of financial errors¹³¹.

Moreover, the European Parliament called for a pragmatic shift towards administrative and financial simplification and stated that the management of European research funding should be more trust-based and risk-tolerant towards participants¹³². The interim evaluation report of the Seventh Framework Programme concludes that a more radical approach is needed to attain substantial progress in simplification and that the risk-trust balance needs to be redressed¹³³.

Simplification is also an ongoing process that is developed in close dialogue with stakeholders. In 2015, the Commission launched an online survey on the perception of the simplification measures by stakeholders, which was addressed to all contacts in ongoing Horizon 2020 grants. Article 32 of the Horizon 2020 Regulation also commits the Commission to consider the scope for further simplification during its interim evaluation¹³⁴.

Socio-political context

Horizon 2020 aimed for simplification in four major ways:

1. Structural simplification:

¹³¹ Recital 20, Horizon 2020 Regulation

¹³² The European Parliament resolution on simplifying the implementation of the Research Framework Programmes, 11 November 2010

¹³³ Recital 43, Horizon 2020 Regulation

¹³⁴ "The interim evaluation shall also take into consideration the scope for further simplification and aspects relating to access to funding opportunities for participants in all regions and for the private sector, notably SMEs".

- Programme architecture: integration of FP7, the Competitiveness and Innovation Programme and the European Institute of Innovation and Technology into one programme
- Fewer legal acts: Horizon 2020 and Euratom have one single Rules for Participation and one Specific Programme (in FP7, there were 12 legal acts);
- Coherent set of rules applicable to all actions; deviations only if duly justified;
- Common toolkit of funding schemes.

2. Simpler funding rules:¹³⁵

- Direct costs: real costs with broader acceptance of participants' usual accounting practice (i.e. average personnel costs);
- A single flat rate for contributing to the indirect costs (25%). This flat rate is applied to the direct costs,¹³⁶
- A single maximum reimbursement rate in a given project, without differentiation between organisation categories or types of activities. The reimbursement rate is up to 100% of the eligible costs for Research and Innovation Actions and up to 70% for Innovation Actions (with one exception: non-profit organisations are reimbursed 100% also in Innovation Actions);
- Simpler time recording; no time recording for staff working 100% on the project.

Consequences: major simplification of legal entity validation; simpler budgeting, more flexibility in ongoing projects, shorter time-to-grant, lower risk of errors.

3. Revised control and risk strategy:

- Extension of the guarantee fund to all actions under Horizon 2020 (provided they apply the Rules for Participation);
- Reduction of ex-ante financial capacity checks (only non-public coordinators for grants with requested EU contribution above EUR 500,000);

¹³⁵ In FP7, the reimbursement to which a project is entitled is determined via a complex matrix of organisation categories and activity types, making the financial management of the grant difficult and restricting the flexibility of the consortium in the implementation of the project. Moreover, for the calculation of indirect costs (overheads) in FP7, four different methods exist (two flat rate models, depending on the organisation categories; real indirect costs and a simplified method of determining real indirect costs). In particular, the real indirect cost options are a considerable source of financial errors.

¹³⁶ Except costs for subcontracting, costs of financial support to third parties and in-kind contributions not used on the beneficiary's premises.

- A considerable reduction of the number of certificates on financial statements to be provided by beneficiaries (i.e. only one at the project end);
- The reduction of the period for ex-post audits from five years after the project end to two years after the payment of the balance (expectation: max. 7% of beneficiaries audited);
- A simplification of the requirements for recording of staff work time;
- The extended use of simplified forms of grants: unit costs in the Marie Skłodowska-Curie Actions (MSCA) and output-based lump sum funding in the SME instrument (phase 1);
- Reduction of the number of MSCA funding schemes from 11 to 4 and unification of the rules and framework conditions for mobility.

4. Simplified implementation processes:

- The Participant Portal as a web-based one-stop shop for all interactions of proposal and grant management between participants and the Commission, providing the user-friendly platform for the electronic-only management of Horizon 2020 grants;
- Replacing the validation of SME status by a web-based 'wizard' for SME self-assessment, guiding SME applicants through the details of the EU's SME legal definition;
- The creation of the Common Support Centre in the Commission, supporting the implementation of the programme across all Directorates-General, Executive Agencies and other bodies implementing parts of Horizon 2020¹³⁷. The purpose of this new service is to achieve a harmonised interpretation and implementation of the rules;
- External guidance written in plain language and supported by a dedicated helpdesk;
- Streamlining, harmonisation and acceleration of the internal business processes for proposal and grant management, with fully electronic internal work flows.

These simplification measures were combined with the obligation to ensure much quicker funding than in FP7, by introducing a maximum eight-month period from call deadline to signature of successful proposals ("reduced time to grant")¹³⁸.

Through the rollout of an integrated suite of IT systems from definition of the calls all the way to follow-up of running projects, it has been possible to implement Horizon 2020 smoothly and achieving reduced time-lines,

¹³⁷ Currently 9 Directorates-General are involved in priority-setting for Horizon 2020, while the programme is implemented by 4 Executive Agencies and 7 Joint Undertakings.

¹³⁸ The European Research Council (ERC) is exempted from this.

even when for some calls for proposals the response has been very high. Having the Research Participant Portal as the unique entry point for the programme has also been well received by stakeholders.

Right from the start of Horizon 2020, the Commission systematically collected stakeholder feedback. Based on this, a series of additional simplification measures have already been implemented (within the existing Horizon 2020 legal framework). These include:

- Further simplification to the requirements on time recording for project staff.
- Simplification of accounting for costs incurred in Euros by beneficiaries in non-Eurozone countries, allowing such beneficiaries to use their usual accounting practice on this aspect.
- Monthly calculation of hourly rates for personnel costs, more in line with some beneficiaries' usual accounting practice.

Further detailed measures, allowing a broader acceptance of beneficiaries' usual accounting practice, are currently under consideration, concerning the eligibility of costs related to specific atypical forms of employment relationships, to internal invoicing and to depreciation of equipment. In addition, a new third party option is under consideration that would allow participation of organisations from third countries not receiving funding in the work of a Horizon 2020 project without the need to sign the Grant Agreement when they are attached to a beneficiary of the project (who signed the grant agreement).

Moreover, within the context of the European Innovation Council (EIC) pilot in the Horizon 2020 work programme 2018-2020, the Commission aims at simplifying the SME Instrument grants. The measures under consideration are making the calls completely bottom-up, further streamlining the evaluation process and a further reduction of the time to grant.

As concerns more substantial changes, the European Court of Auditors has suggested that the Commission should lean towards a trust-based approach in research funding and in this respect should consider moving away from its current system of reimbursing beneficiaries for proven costs, towards lump sum financing based on performance/results. The wider use of output-based funding with lump sums has the potential to reduce drastically the financial error rate and is also in line with the Commission's priority on Budget Focused on Results. Such forms of funding aim to shift the focus from checking inputs (i.e. costs incurred) to monitoring performance and outcome, covering the entire project life cycle, including new ways of ex-post audits. The revised Financial Regulation provides a fresh opportunity for an extended use of such simplified forms of funding (flat rates, unit costs, lump sums) and in particular for funding based on results, output, performance, or fulfilment of certain conditions.

Horizon 2020 currently uses output-based funding, with a lump sum only for the SME Instrument phase 1, and there are no other similar schemes that could serve as an example. The challenge with funding based on output/results/performance in the field of research is to define the conditions for the decision on the release of the lump sum. These conditions must take into account the intrinsically risky nature of research and innovation

projects (i.e. unexpected scientific results, or no results despite honest effort, or the falsification of a scientific hypothesis must not be a reason for not paying the lump sum).

Key facts and figures on the Framework Programmes

Concerning FP7, the ex-post evaluation concluded that significant simplification efforts led to savings of administrative effort and related costs of EUR 551 million in FP7 (compared with FP6) at the whole programme level, but that FP7 did not involve large-scale simplification of rules, which were too complex and inconsistent and Horizon 2020 should achieve a "quantum leap" in simplification for applicants and beneficiaries. The overall targets concerning simplification when Horizon 2020 was adopted were as follows:

- Reduction of administrative costs for beneficiaries by 30%
- Reduction of average time-to-grant by 100 days (from 350 to 250)
- Reduction of financial error rate by one third

While a direct causal relationship between the simplification measures in Horizon 2020 and the observed participation figures cannot be established, the statistics on participation show clearly that Horizon 2020 is highly attractive. About 120,000 proposals were submitted in total so far. The oversubscription rate (in terms of requested EU budget) is more than 8:1.

| | FP7 | Horizon 2020 |
|--|----------|---|
| Overall success rate | 19% | 12% (23% increase in applications between 2014 and 2015) |
| Average time-to-grant (excluding ERC) | 303 days | 202 days (15% reduction between 2014 and 2015) |

Only one in four high quality proposals (evaluated above threshold) in Horizon 2020 is funded; some EUR 41.6 billion more would be necessary to fund all high quality proposals received to date.

Horizon 2020 attracts many newcomers. 49% of the organisations participating in signed grants have not participated in FP7. These newcomers count for 21% of the participations and receive over 14% of the total funding. Nearly 90% of all projects (in pillar 2 and 3) contain at least one SME. 44% of the participating organisations in pillar 2 and 3 are SMEs, and nearly 25% of the funding, goes to them.

Industry participation in total (SME and non-SME) has increased from 30% of all participations in FP7 to 33% of all participations in Horizon 2020. The increase is due entirely to the increased SME participation. This shows the attractiveness of Horizon 2020 (including its funding model) for SMEs. Despite some concerns from research organisations on the new funding model (in particular on the single flat rate for indirect costs), their participation

rate is similar to FP7 (22% versus 24%). The same holds for university participation (34% in Horizon 2020 versus 37% in FP7)¹³⁹.

Large vs. small projects

Recital 23 of the Horizon 2020 Regulation indicated that there should be an appropriate balance between small and large projects within the priority 'Societal challenges' and the specific objective 'Leadership in enabling and industrial technologies'. It is noted that there is no legally sanctioned definition of 'small' and 'large' projects.

In FP7, there were on average of 10.7 partners per project within FP7 Cooperation (average EC contribution: EUR 3.7 million). Across the whole programme, there were on average of 5.2 partners per project (average EC contribution: EUR 1.7 million)¹⁴⁰.

For Horizon 2020 so far, a preliminary analysis undertaken on this indicates a better balance between large and small projects in Horizon 2020 - in the case of 'Research and Innovation Actions' projects - than in FP7 collaborative projects (in terms of number of proposals, EU contribution and number of participants).¹⁴¹ The share of participants from EU-13 countries, or involving newcomers, was higher in large projects in FP7 and has improved substantially in Horizon 2020. In Horizon 2020 (for both types of actions), the share of participants from EU13 and of newcomers is higher in large projects.

The following table summarizes the results in terms of several variables.

| type of project | category | Number of projects | Total EC contribution | Total number of Participants | Total number of participants from EU 13 | Share of participants from New Member States | Total number of new comers | Share of participants which are new comers |
|--|----------|--------------------|-----------------------|------------------------------|---|--|----------------------------|--|
| FP7 - Collaborative Projects | Large | 2204 | € 5 880 664 597.78 | 29056 | 2281 | 7.9% | N/A | |
| | Small | 3794 | € 18 776 147 693.30 | 42808 | 2295 | 5.4% | N/A | |
| Horizon 2020 - Research and Innovation actions | Large | 527 | € 1 943 476 742.74 | 7894 | 751 | 9.5% | 1561 | 19.8% |
| | Small | 899 | € 5 120 568 745.48 | 10207 | 561.0 | 5.5% | 1676 | 16.4% |
| Horizon 2020 - Innovation actions | Large | 201 | € 542 737 120.02 | 2290 | 181 | 7.9% | 797 | 34.8% |
| | Small | 371 | € 2 420 000 653.11 | 4618 | 302 | 6.5% | 1424 | 30.8% |

¹³⁹ All figures here are taken from the Horizon 2020 Annual Monitoring Report for 2015.

¹⁴⁰ FP7 Ex-Post Evaluation Staff Working Document.

¹⁴¹ The analysis was carried out only on Research and Innovation Actions and Innovation Actions in both Pillars two (Industrial Leadership) and three (Societal Challenges) of Horizon 2020. For FP7, only Collaborative projects in any priority were included in the analysis. The identification of small or large projects was based on the number of participants. The number of participants in each project was normalised by million of Euros of EC contribution to allow for comparisons between types of action and with the FP7. For each type of action or instrument, the average was estimated on the normalised number of participants. If the number in a project was below or equal to the average, the project was considered "small", if it was above the average, the project was considered "large". Source: RTD A5 based on CORDA data extracted on 11.08.16.

Issues for consideration

Horizon 2020 brought about considerable simplification (e.g. funding model, simpler SME validation, simplified time recording, electronic proposal submission, evaluation, grant management).

- How can further simplification be achieved, for example by moving to results-based funding?
- What lessons can be learnt from national practices in R&I funding regarding simplification?
- Given that a number of different Commission bodies are implementing Horizon 2020, how can a coherent approach to maximising the programme's impact on achieving policy goals be ensured?

Selected stakeholder views¹⁴²

The results of the simplification survey addressed to all participants of signed Horizon 2020 grants in September 2015, show that an overwhelming majority of the respondents having experience with FP7 appreciate the new simplified funding model of Horizon 2020. More than 77% of the respondents consider the single reimbursement rate in a project as a beneficial simplification. More than 74% welcome the single flat rate for indirect costs. Overall, 75% of the respondents to the recent Simplification Survey consider the Horizon 2020 rules as simpler than in FP7. When asked about their experience with other European, national or regional research funding programmes, only 20% indicated that they know other funding programmes that are simpler than Horizon 2020. The highest level of satisfaction is achieved with regard to the Participant Portal. 89% of the respondents consider its introduction as beneficial.

Other stakeholder views include the following small sample:

- *"We would like to acknowledge the challenges involved in implementing an ambitious Programme such as Horizon 2020 and congratulate the Commission for the large efforts and clear improvements made in particular the faster time-to-grant, the revamped participant portal and the improved on-line submission procedure. The Model Grant Agreement and its annotated version provide excellent guidance for participants in everyday work, even if improvements are still needed. The Commission's continuous efforts towards simplification since 2014 as well as its openness for dialogue on the 'glitches' in the system and workable solutions for all parties have also been much appreciated".*
- *"We welcome the simplification measures introduced in Horizon 2020. However, current and future FPs should aim to further clarify, simplify and increase transparency in areas such as strategic programming, the number of funding instruments, the use of external structures (such as Joint Technology Initiatives (JTIs) and Public-Private Partnerships (PPPs)), the evaluation of projects, and also the monitoring and*

¹⁴² Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

evaluation of programmes. Further simplification and more clarity should also help address the key issue of the low success rates in Horizon 2020".

- *"Steps towards simplification have been taken for Horizon 2020. The participant portal and its integrated use for the whole process from proposal submission to final reporting is one of the most visible examples to ease programme navigation as well as the harmonization of funding rates and alleviations with respect to time sheets. At the same time, new barriers have been identified in the legal and financial implementation of Horizon 2020 in areas such as internally invoiced costs, equipment costs, personnel costs... These issues should be analysed and where possible corrected during Horizon 2020, or otherwise addressed in the next framework programme".*

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Interim Evaluation of FP7

Recommendations put forth by the Expert Group on the Interim Evaluation of the Seventh Framework Programme

On 12 November 2010, the Expert Group on the Interim Evaluation of the Seventh Framework Programme, chaired by Rolf Annerberg, presented its report with 10 recommendations to the European Commission. The expert group issued the following 10 recommendations:

1. To advance the European Research Area and Innovation Union objectives, integrating the research base by overcoming fragmentation in research is vital, while simultaneously achieving a sharper division of labour between what is done at EU level and what is undertaken in national programmes. European research and innovation efforts must concentrate on themes where critical mass is vital for success and where breakthroughs require cross-border solutions, while also allocating sufficient resources to R&D topics which promise radical innovations. Addressing the 'Grand Challenges' confronting the European Union should increasingly be at the heart of EU research policy, starting in the last three years of FP7, but more emphatically so in a successor programme. This process could be structured according to who sets the research agenda and to take account of the 'smart, sustainable, inclusive' *leitmotif* for Europe 2020, although they will need to work together to address the 'Grand Challenges' as follows:

- Science for science - the researchers set the agenda
- Science for competitiveness - industry sets the agenda
- Science for society - civil society actors set the agenda

2. To develop and implement high quality research infrastructures. Research infrastructures (RIs) are pivotal for the Knowledge Triangle, and as such are a pillar for implementing the ERA, but there needs to be coherence between what is funded by FP7 under the heading of *Capacities*, the ESFRI and capacity building undertaken as part of Cohesion policy and what is being considered in the context of Joint Programming. More effort should be made to boost RIs during the latter stages of FP7, especially the Integrated Infrastructure Initiatives (I3) that have the greatest scope for added value at European level. In addition there should be a focus on promoting their impact by establishing synergies between training instruments and utilisation of RIs and by stimulating industrial and third country access.

3. The level of funding should, at least, be maintained. Although the straitened budgetary conditions following the severe economic crisis will mean tough choices have to be made in public spending, the

competitive challenges that the EU faces require sufficient investment in long-term economic development and there should be no reduction in funding for FP7 in its latter stages. There is a compelling case for continued substantial funding of research in the Eighth Framework Programme, not least as one of the key tools to achieve the Europe 2020 goals. A reasonable level of funding per year could be that reached in the last year of FP7. In relative terms, this would mean that the percentage of the total EU budget that FP7 will have when it ends should be regarded as a minimum. Funding at this rate would help to overcome the problem that many individual proposals adjudged to be excellent are not funded which, coupled with the substantial effort needed to prepare a proposal, may deter some of the best researchers from applying.

4. A well-articulated innovation strategy needs to ensure that instruments and priorities encourage participation from a broad spectrum of small and large enterprises, universities and research and technology organisations. The research and innovation strategy also has to take into account the need to support European enterprises' efforts to integrate in global innovation networks. The open, international character of the FP7 could therefore be expanded. Specific actions should be taken in the context of the evolving financial crisis to channel financial support for research and innovation to areas of crucial importance for European competitiveness. An increased emphasis on monitoring progress in FP7 projects is needed if the intended impact is to be achieved. Innovation also requires more attention to the distinctive needs of industry, among which reductions in administrative burdens are vital.

5. Simplification needs a quantum leap, and the Expert Group calls for all Directorates- General and agencies rapidly to implement the short-term simplification measures recently put forward in a Communication by the Commission and to ensure that they are applied rigorously from 2011-2013. Coherence of procedures and approaches between Commission Directorates General and the Executive Agencies responsible for administering FP7 is of crucial importance. The Expert Group proposes that the Commission consider the upcoming revision of the Financial Regulations as an opportunity to create more flexible conditions for research in subsequent FPs. In addition the Group pleads for the Commission to switch from its present low-risk/low-trust attitude to a more trust-based and risk-tolerant approach.

6. The mix of funding measures in FP7 and successor programmes should strike a different balance between bottom-up and top-down approaches to research, with greater emphasis in the specific programme *Cooperation* during 2011-2013 on more open calls. It is also important to ensure that education does not become the forgotten side of the Knowledge Triangle and thus that the linkages between research and innovation are adequately complemented by research training.

7. A moratorium on new instruments should be considered until the existing ones have been sufficiently developed and adequately evaluated, and care should be taken to avoid a confusing proliferation of instruments.

8. Further steps to increase female participation in FP7 should be taken in its remaining years, in particular:

- Measures to boost female participation should be reinforced throughout project lifecycles, paying particular attention to overcoming gender-specific obstacles, which women face.
- The Commission should reinvigorate its approach to promoting female scientists and should aim to galvanise Member States to address gender gaps, especially where female researchers face specific obstacles, while ensuring that it redoubles its efforts to achieve gender balance with a specific strategy for the remainder of FP7. It should accept its responsibilities in a leadership role, with the support of the Member States, to use positive measures for the training of female scientists, including a dedicated scheme under the Marie Curie actions.
- The 40% target for female participation in Programme and Advisory Committees should be sensitively but rigorously implemented.

9. To pave the way for increased participation from Member States that are underrepresented

greater prominence should be given to improved connections between the Structural Funds and the FP. Moreover, within the FP, the importance of the Marie Curie Actions for developing the potential for scientists from EU12 should be stressed, as should the scope for using infrastructures.

10. Opening of the FP7 to international cooperation is of great value. As other regions rapidly strengthen their research and innovation capacities (with Asia perhaps being the most notable example), but also as the urgency to address global challenges grows, the ability of European research and innovation to link up with other regions, markets and research and innovation agendas and to meet global needs for innovative solutions to 'Grand Challenges' becomes increasingly important. A review based upon a thorough analysis of the current strategy towards international cooperation is needed. The international perspective must be integrated into all programmes and instruments.

Commission responses to the specific recommendations in the FP7 Interim Evaluation

The Commission responded to those recommendations in its Communication of 9.2.2011 as follows:

To advance the European Research Area (ERA) and Innovation Union objectives, integrating the research base....

The need to overcome research fragmentation and build critical mass in research, both public and private, are still major issues despite the many achievements such as JTIs, ERA-NETS, article 185 activities, co-funding mechanism in the Marie Curie training activities and now first steps towards Joint Programming.

Future EU research programmes must provide a clearer focus on the major research items for science, technological leadership and industrial competitiveness and focus on the large societal challenges. In turn this will provide multiple benefits, including more coherent priority setting, a better capacity to leverage private sector investments, enhanced European added value and a stronger base for measuring impact. Such an approach

needs to be developed within the framework of the European Research Area, identifying areas of common or convergent interest, while ensuring better alignment of research capacities.

The Innovation Union sets out how the Europe 2020 objectives of smart, sustainable and inclusive growth can be achieved through a strategic and integrated approach to research and innovation. The forthcoming Green Paper on a Common Strategic Framework for EU Research and Innovation funding will launch a wide public debate on the key issues to be taken into account in future programmes.

To develop and implement high quality research infrastructures.....

The Commission recognises that infrastructure funding will be improved through better alignment of the FP, with funding from the European Investment Bank and Structural Funds.

FP7 support for new research infrastructures targets the preparatory phase for projects in the Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI) and, for some of these projects, possible synergies with Cohesion Policy have been worked out and information disseminated to project consortia. The Commission is confident that synergies should bring results before the end of FP7.

Support for Integrating Activities (I3) will continue to be provided for the last years of FP7. The reinforcement of training related to research infrastructures in the People programme is an interesting possibility to be considered. Following the Europe 2020 Strategy a work package on innovation could be included in all research infrastructure projects thereby favouring greater involvement of industry. The work programme 2012 will better highlight the possibility for researchers from third countries to benefit from access to European research infrastructures.

The development of e-Infrastructures will connect researchers, instruments, data and computation resources throughout Europe, creating a seamless "online ERA". As an integral part of the Digital Agenda flagship initiative, this work will continue in the second half of FP7 including development of online services for computation and data-intensive research, the upgrade of the GÉANT network and further development of the PRACE supercomputing infrastructure.

The level of funding should, at least, be maintained.....

The Europe 2020 strategy acknowledges very clearly that research and innovation are the key engines of societal progress and economic prosperity. In order to meet the objectives of this strategy, the key challenges which need to be addressed at EU level and the challenge laid down by our competitors planning huge and ambitious investments for Research, Development and Innovation (RDI), there must be a credible funding level provided to the research and innovation framework.

As proposed in the Budget Review, a common strategic framework will ensure a more efficient use of the EU's research and innovation funding by enhancing its EU added value, making it more results oriented, and by leveraging other public and private sources of funding.

A well-articulated innovation strategy is needed....

The Commission agrees with the recommendation which is convergent with the orientations provided in the Communication on Innovation Union within the context of the Europe 2020 Strategy.

In recent years, the approach to align FP funding priorities with the technology needs of industry, namely through encouraging European Technology Platforms and the support to Joint Technology Initiatives and Public-Private Partnerships, have not only increased the industrial relevance of FP research but also, more fundamentally, have helped whole industry sectors to align behind shared research strategies. As set out in the Innovation Union, future EU programmes should strengthen this, along with stronger knowledge transfer mechanisms and the launch of European Innovation Partnerships to bridge the gap with demand-side measures (such as standard setting, procurement and regulatory frameworks).

While Innovation Union commitments will only be fully implemented in the next generation of spending programmes, the Commission is already investing significant effort in enhancing the innovation impact of the current Framework Programme. This will be achieved in the remaining FP7 work programmes, including through funding for projects which take research results closer to market (e.g. demonstration projects) and additional emphasis on innovation impacts in evaluating proposals. In addition, further funding will be provided for both SME specific projects and topics which are attractive to SMEs or organisations that are 'new comers' to FP7.

Simplification needs a quantum leap....

The Commission has acknowledged the need for further simplification. The Commission Communication on simplifying the implementation of the FPs, presenting a set of short term and longer term options, has triggered an intensive inter-institutional debate. While there is also a strong plea for stability and continuity as regards the applicable rules for FP7, a broad consensus emerges that fast progress should be made on three potential wins already on FP7:

- A re-definition of the criteria for the acceptance of average personnel cost methodologies, removing the criteria for acceptable deviations between average costs in a personnel category and the actual costs related to the individual persons working in the projects. This would allow for the acceptability of majority of average personnel cost methodology actually applied as usual accounting practice by beneficiaries, in particular in industry, including the cost-centre based methods;
- Provision of a possibility for owners of SMEs and natural persons not receiving a salary registered in the accounts to reimburse the value of their work brought into FP7 projects by way of a flat rate based on the allowances for Marie Curie fellowships in the People specific programme;

- Establishment of a clearing committee between the Directorates-General in the Commission implementing the research framework programmes, in order to achieve a uniform interpretation and application of the rules and procedures for implementing research grants;

On 24 January 2011, the Commission adopted the required implementing decisions to set the above simplification measures in operation without further delay and with retroactive effect for ongoing FP7 grants. The issue of interest on pre-financing is addressed in the Commission proposal COM (2010)815 for the revision of the Financial Regulation. The revision of the Financial Regulation, as proposed by the Commission, is also essential for achieving more radical simplification ('quantum leap') in the next research and innovation funding programmes.

The mix of funding measures in FP7 and successor programmes should strike a different balance between bottom-up and top-down approaches to research....

Significant parts of FP7 already provide bottom-up approaches to research. These include the Marie Curie Actions for researcher training and mobility and the European Research Council for curiosity-driven research. Also noteworthy is the Future and Emerging Technology scheme which, through top-down thematic calls combined with bottom-up open calls is supporting multidisciplinary exploratory research in ICT.

The move towards more bottom-up funding is set to continue, with the Commission proposal for further open, challenge-driven calls for proposals in the final years of FP7. Beyond this, the Innovation Union has committed to strengthen the role of the ERC and the issue of bottom-up versus top-down approaches will feature strongly in the orientation debate on the next FP.

What is most important for the FP as a whole however is to ensure a proper balance between bottom-up and top-down approaches. Further to the comments above (2.1 and 2.4) concerning future activity strongly focused on major challenges, it is important to remember that this will only succeed if it allows creativity and ingenuity to flourish at the projects' and researchers' levels.

The Commission reaffirms its support for the knowledge triangle concept and points to the ongoing work under the European Institute of Technology as also providing a major boost for the education component. Also, important will be the 'university-industry' forum and the 'knowledge alliances' announced in the Innovation Union Communication, as well as the development of appropriate skills for researchers to innovate as provided by the MCA.

A moratorium on new instruments should be considered....

The remainder of FP7 will continue to work with the current legal base and the existing set of instruments. However, the Commission will examine the current portfolio of instruments to identify areas for simplification, possible redundancy and potential gaps. Novel approaches such as prizes or innovative procurement schemes should also be considered.

This work will be supported in a number of ways including discussions within the European Research Area Committee (ERAC) and the forthcoming 'Communication on Partnerships'. The resulting ideas will be reflected in the Commission's proposals for the next FP.

Making the best possible use of the EU budget will require gearing funding towards more European added value, stronger impact and enhanced leveraging. A common strategic framework as mentioned earlier will aim to ensure that all EU research and innovation funding works towards common goals and according to a shared strategy. This will in itself necessitate a development of a coherent and streamlined portfolio of instruments.

Further steps to increase female participation in FP7 should be taken in its remaining years...

The Commission attaches great importance to this issue although notes, since the FP is only a small part of total European research activity, the limits to what it can achieve on its own. Real progress necessitates a common approach actively supported by funding agencies and researchers across the European Research Area. In this context, the Commission accepts the challenge of taking a leading role. Further to the current activities - notably the 40% target; monitoring, awareness and promotion activities; and successes under the Marie Curie Actions - a series of additional activities are proposed.

The Commission will:

- Fully implement the target to achieve 40% female participation in all evaluation and advisory committees – it will also seek the support of Member States to achieve this target for Programme Committees;
- Launch new analyses with the support of Member States and research institutions to identify, by end 2011, the cultural and situational factors which help shape female researcher participation, as well as measures to overcome these;
- Reinforce monitoring in all stages of the project life-cycle;
- Under the Marie Curie Actions, reinforce the role of a dedicated Career Restart Panel, helping those who wish to resume a career in research after a break, for example due to maternity leave.

To pave the way for increased participation from Member States that are under-represented (through) improved connections between the Structural Funds and the FP....

A specific example of progress already being made is the Synergies Expert Group (SEG), set up to find synergies between FP7, the Structural Funds and the Competitiveness and Innovation Framework Programme. With members from academic, policy and practical backgrounds, as well as the education corner of the knowledge triangle it will advise on both the current programming period (2011-2013) and into the next one, as well as on

the future of FP7 regional actions. The SEG will benefit from recent analysis of synergies undertaken by the ERAC (European Research Area Committee).

The Europe 2020 flagship initiatives on Innovation Union and the Digital Agenda have significant implications for achieving a better alignment of EU policies and activities, including research, innovation and cohesion funding.

The Structural Funds should provide support for capacity building, such as for research infrastructures and actions to deploy high-speed internet across Europe, thereby broadening the base of EU research and innovation and building capacities for a knowledge-based society.

Opening of FP7 to international cooperation....

FP7 is already very open to international collaboration and involves participants from more than 160 countries. But both in finance and total numbers of participants the scale of this collaboration is relatively small, notably with the leading and emerging research nations. This is a serious missed opportunity which must be addressed.

Building on the experience of existing initiatives such as EU bilateral S&T agreements and coordinated calls there is an urgent need for a more strategic approach.

To this end the Commission will carry out a major review - to report by the end of 2011 - of its strategy for international collaboration. This will examine how to build critical mass and specialisation, in areas of European need and comparative advantage, taking into account the proposal above (2.1) for a future focus on major challenges. In this context, it will also be essential to better define the common and respective roles of Member States and the Framework Programme as well as the means, such as through the Strategic Forum for International S&T Cooperation, to identify areas of common interest and approaches.

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

FP7 Ex-Post Evaluation

Introduction

On 19 January 2016, the Commission has adopted a package on the ex-post evaluation of FP7, consisting of a Communication responding to the recommendations of an external High Level Expert Group (HLEG) and a Staff Working Document in which the Commission services have evaluated FP7 on the basis of the 5 evaluation criteria of the Better Regulation package (efficiency, effectiveness, coherence, relevance and EU added value).¹⁴³

The High Level Expert Group presented their evaluation of FP7 on 19 November 2015. Their report shows the impacts FP7 has had on job creation and GDP growth. In the report entitled "Commitment and Coherence"¹⁴⁴, the HLEG listed 5 recommendations: 1) Ensure focus on critical challenges and opportunities in the global context, 2) Align research and innovation instruments and agendas in Europe, 3) Integrate the key components of research funding more effectively 4) Bring science closer to citizens and 5) Establish strategic programme monitoring and evaluation.

Based on the Commission evaluation and the HLEG Report, the Council of the EU adopted on 27 May 2016 its conclusions: "*FP7 and the Future Outlook: Research and innovation investments for growth, jobs and solutions to societal challenges - Council conclusions*"¹⁴⁵, which emphasise that cooperation, excellence and impact as the fundamental principles of current and future EU R&D&I Framework Programmes.

Main findings of FP7 Ex-Post Evaluation¹⁴⁶

- **FP7 addressed transnational European societal challenges.** E.g. in the area of environment, health, food safety, climate change, security, employment, poverty and exclusion; and facilitated the establishment of a common scientific base in these areas, which address societal challenges that could not have been fully resolved by Member States alone.
- **FP7 contributed to increasing the competitiveness of Europe's industry.** Over the course of FP7, the participation of private partners increased. The Joint Technology Initiatives and other Public-Private Partnerships boosted industry participation, made it possible to realise strong leverage effects, and contributed greatly to the competitiveness of Europe's industries in areas as diverse as pharmaceuticals,

¹⁴³ https://ec.europa.eu/research/evaluations/index_en.cfm?pg=fp7

¹⁴⁴ https://ec.europa.eu/research/evaluations/pdf/fp7_final_evaluation_expert_group_report.pdf#view=fit&pagemode=none

¹⁴⁵ <http://data.consilium.europa.eu/doc/document/ST-9527-2016-INIT/en/pdf>

¹⁴⁶ As presented in the Commission Staff Working Document on the FP7 Ex-Post Evaluation and its executive summary.

aeronautics and fuel cells and hydrogen. In addition, the Risk-Sharing Finance Facility improved access to loan finance for research and innovation-focused companies through loan agreements for EUR 11.3 billion signed with more than one hundred companies.

- **FP7 had a positive impact on growth and jobs.** Given that FP7 only accounts for a small proportion of total public RTD expenditure in Europe, its economic impacts are quite substantial, through the leverage effect of various instruments, impact on GDP and effects on employment. It is estimated that FP7 will increase GDP by approximately EUR 20 billion per year over the next 25 years, or EUR 500 billion in total through its indirect economic effects and create over 130,000 research jobs and 160,000 additional jobs indirectly. There is also evidence of positive impacts in terms of micro-economic effects with participating enterprises reporting innovative product developments, increased turnover, improved productivity and competitiveness. It is however too early to make a final assessment of the market impact of FP7 projects.
- **FP7 was particularly effective in strengthening scientific excellence.** FP7 projects have so far generated 170,000 publications, with an open access rate of 54% for all scientific peer reviewed publications created during the life time of FP7. The share of publications that is in highly-ranked journals lies above the EU average. In some programmes, up to 30% of publications arising from FP7-funded projects rank among the top 5% of highly-cited publications in their disciplines - well above the European and US averages. More than 1,700 patents and more than 7,400 commercial exploitations have so far resulted from FP7 projects. FP7 promoted ground-breaking research through the European Research Council (ERC). The numbers of publications in top-rated scientific journals that acknowledge ERC funding, as well as the number of Nobel Prizes and Fields Medals received by ERC grantees, all demonstrate that ERC grants have quickly become a hallmark of scientific excellence.
- **FP7 trained and involved leading international scientific and technological talent.** FP7 was an open system that allowed more than 21,000 new organisations to receive EU funding. FP7 strengthened the training and long-term mobility of researchers, enhanced the quality of doctoral training and helped improve working conditions for researchers in the EU. FP7 supported 50,000 researchers, including 10,000 PhD candidates from 140 countries (of which more than a third were fellows from third countries). The programme stimulated the mobility of researchers across Europe. It also contributed to sustainable employment for researchers in Europe and helped increase the participation of women researchers and of international researchers in beneficiary research teams.
- **FP7 was effective in fostering inter-disciplinary research and increased Europe-wide research and innovation collaboration and networking.** Collaborative research projects brought together players from different disciplines and the share of researchers participating in projects from different priorities almost doubled over the course of the Programme, leading to durable inter-sectoral collaborations.
- **FP7 made substantial progress as regards the gender dimension.** Under FP7, a target of 40% of the under-represented sex was set for experts' panels and other groups. The overall proportion of women

evaluators was slightly higher than the target (40.4%). In total 38% of the workforce of FP7 were women. At the same time, the HLEG report found that in FP7 the share of female project coordinators was 19.2%, showing that whilst progress has been made, 'glass ceiling effects' persist.

- **FP7 contributed effectively to increasing the level of research investment.** It did so notwithstanding the difficult economic situation in the latter part of FP7. Between 2007 and 2013, the share of EU-28 GDP dedicated to R&D increased, with FP7 compensating for the sharp decline in national public funding for research and innovation in certain Member States. According to the external evaluation of the High Level Expert Group, through short-term leverage effect and long-term multiplier effects each euro spent by FP7 generated approximately EUR 11 of estimated direct and indirect economic effects through innovations, new technologies and products.
- **FP7 engaged SMEs strategically,** with funding of around EUR 6.4 billion, above the 15% target for the cooperation programme. Results of econometric analyses show that SMEs participating in the FP7 scored 38% higher than the control group with regard to employment growth and operating revenue.
- **FP7 was open to the world** involving participants from 170 countries. It widened EU participation and contributed to the achievement of ERA. On average in FP7 collaborative projects, 11 organisations from six different countries and nine different regions participated.
- **FP7 enhanced the alignment of research activities between Member States.** It achieved this through common strategic research agendas, aligned national plans and joint calls. Initiatives to coordinate and integrate national programmes mobilised over EUR 2.75 billion in national funding.
- **FP7 provided the knowledge base to support key EU policies.** To date, there are more than 350 cases where FP7 projects have been exploited for policy support. FP7 also led to more than 550 standards and contributed to EU flagship initiatives through more than 1,700 patent applications.

Shortcomings identified in the Commission Staff Working Document

The Staff Working Document on the ex-post evaluation of FP7 has highlighted a number of shortcomings in the implementation of FP7:

- **FP7 did not succeed in delivering large-scale simplification.** The level of complexity of FP7 was unsatisfactory. Although the measures introduced during the course of the Programme on a piecemeal basis proved beneficial, the variations in rules and procedures between different parts of the Programme hindered its efficiency. This is demonstrated in part by the high error rate associated with FP7.

- **The different components of FP7 operated too much as isolated silos.** Although FP7 had a transparent structure around four Specific Programmes with explicit priorities, the different components of the Programme were unduly rigid. This led to inefficiency due to overlaps between the objectives of different parts of the Specific Programmes.
- **FP7 was not effective in building synergies with related European funding programmes.** One of the goals of FP7 was to ensure complementarity with other programmes such as the CIP and the EIT, as well as the Structural Funds. However, the separate legal bases and differences in implementation rules meant that progress was more limited than required.

Recommendations by High Level Expert Group and the Commissions response to these

The High Level Expert Group made recommendations in five areas¹⁴⁷, listed in the table below. The EU's current research and innovation programme, Horizon 2020, takes the recommendations into account as follows¹⁴⁸:

| Recommendations | Horizon 2020 |
|---|--|
| Ensure focus on critical challenges and opportunities in the global context. | <ul style="list-style-type: none"> - focuses on society's major challenges - boosts private sector participation, including SMEs - maximises synergies between different areas of research and innovation and new digital technologies |
| Align research and innovation instruments and agendas in Europe | <ul style="list-style-type: none"> - aligns national research strategies - better coordination with EU regional funding - helps EU countries reform their research and innovation strategies - identifies obstacles to research and innovation - ensures that research proposals support innovation |
| Integrate the key components of research funding more effectively | <ul style="list-style-type: none"> - focuses on better consistency among funding arms - ensures cross-cutting issues are considered - simplifies access to research and innovation funding - applies single set of rules consistently - coordinates effectively across the Commission in managing funding |
| Bring science closer to citizens | <ul style="list-style-type: none"> - better communication to the general public on science issues in general and on Horizon 2020 in particular - strengthens open access to research publications and data - involves citizens in research strategy and topics |
| Establish strategic programme monitoring and evaluation | <ul style="list-style-type: none"> - better monitoring and evaluation of funding and socio-economic impacts - improves feedback loop from project results to policy making |

In addition to already undertaken initiatives in Horizon 2020, the European Commission in the response listed the following areas for further initiatives:

¹⁴⁷ https://ec.europa.eu/research/evaluations/pdf/fp7_final_evaluation_expert_group_report.pdf#view=fit&pagemode=none

¹⁴⁸ The Commission response is presented in Commission Communication on FP7 Ex-Post Evaluation.

- Implement a new strategic focus for Horizon 2020 in order to maximise its contribution to the Commissioner Moedas' objectives of 'Open Innovation, 'Open Science' and 'Open to the World';
- Explore the need for, and the feasibility of, a European Innovation Council as a means to boost innovation and streamline existing instruments;
- Facilitate the elaboration of important projects of common European interest, which can foster vast deployment of research into mature technologies;
- Use the Policy Support Facility and Cohesion Policy capacity building support to assist Member States in implement effective reforms of their research and innovation systems;
- Continue to foster synergies between Horizon 2020, the Structural Funds and LIFE programmes, and report on this issue in the context of the Horizon 2020 interim evaluation; Promote potential synergies with the European Fund for Strategic Investments (EFSI);
- Ensure that new Commission proposals are 'fit for innovation' by applying the 'Better Regulation' Guidelines, and in particular the 'Research and Innovation Tool' of the impact assessment guidelines;
- Improve the framework conditions for better innovation ecosystems in the EU;
- Continue to identify and implement simplification measures;
- Ensure data quality and coherence to strengthen monitoring and evaluation systems, in line with the 'Better Regulation' requirements;
- Support Member States in the national evaluation of the impact of EU Framework Programmes.

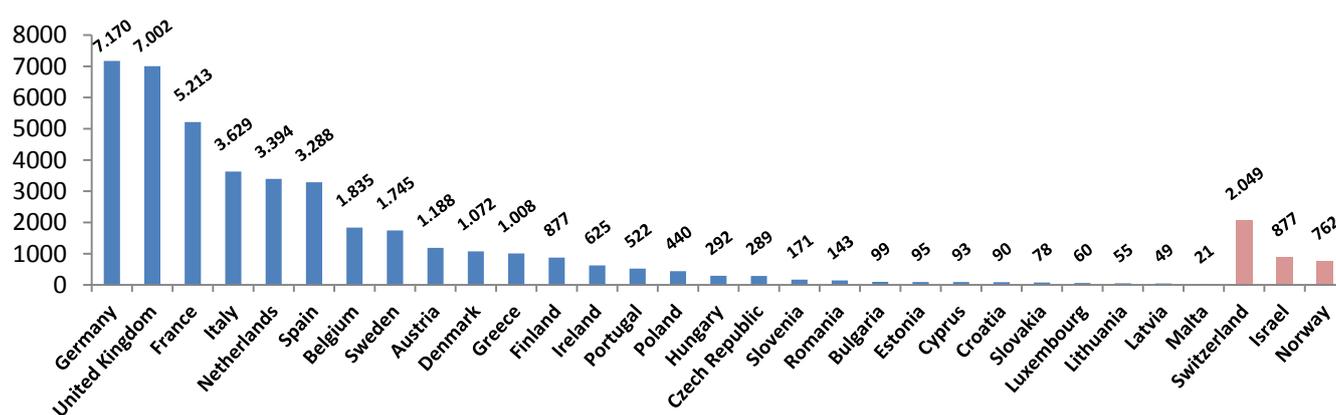
Key facts and figures

In total during FP7, 136,000 eligible proposals were submitted to calls for proposals, from which 25,000 projects were funded. FP7 featured more than 134,000 participations from 170 different countries. The participations came in 86% of the cases from EU countries, 8% from Associated Countries and 6% from the rest of the world. In total 29,000 organisations participated, of which 72% were newcomers. Of these universities and research organisation received 70% of the funding; 25% private sector, of which half to SMEs, and 5% to public bodies and others. In total SMEs received EUR 6.4 billion in FP7.¹⁴⁹ The tables and graphs below show the distribution of funds between types of organisations, Member States and different specific parts of FP7.

Distribution of committed EC contribution¹⁵⁰

| Organisation | Committed EC contribution in FP7 EUR billion | Number of participations |
|---|--|--------------------------|
| Higher and Secondary Education Institutions - HES | 19,678 | 50,239 |
| Non-profit Research organisations - REC | 12,235 | 33,256 |
| Private for profit - PRC | 11,162 | 40,834 |
| Public body - PUB | 1,193 | 6,193 |
| OTH - Other | 1,067 | 4,215 |
| Total | 45,335 | 134,737 |

FP7 EC Contribution, million EUR, Member States and top 3 Associated Countries¹⁵¹



¹⁴⁹ Commission Staff Working Document on FP7 Ex-Post Evaluation, page 13.

¹⁵⁰ Commission Staff Working Document on FP7 Ex-Post Evaluation, page 13.

¹⁵¹ Commission Staff Working Document on FP7 Ex-Post Evaluation, page 15.

FP7 EC Contribution allocated in open calls in EUR million¹⁵²

| All Countries, FP7 Signed Grant Agreements: Participation and Contribution by Priority Area (committed funds) | | | |
|--|--|-------------------------|--|
| Specific Programme | Priority Area | Signed grant agreements | EU financial contribution to grant agreements (EUR) |
| COOPERATION | Health | 1008 | 4.791.666.619 |
| | Food, Agriculture and Fisheries, and Biotechnology | 516 | 1.850.804.919 |
| | Information and Communication Technologies | 2328 | 7.875.038.393 |
| | Nanosciences, Nanotechnologies, Materials and new Production | 804 | 3.236.447.326 |
| | Energy | 374 | 1.851.309.964 |
| | Environment (including Climate Change) | 494 | 1.719.305.065 |
| | Transport (including Aeronautics) | 701 | 2.272.243.197 |
| | Socio-economic sciences and Humanities | 253 | 579.553.418 |
| | Space | 267 | 713.287.662 |
| | Security | 319 | 1.331.371.746 |
| | General Activities | 26 | 312.687.984 |
| Subtotal: COOPERATION excluding JTI (59% of total funding) | | 7090 | 26.533.716.293 |
| COOPERATION | JTI-IMI (Innovative Medicines Initiative) | 56 | 930.895.602 |
| | JTI-ARTEMIS (Embedded Computing Systems) | 38 | 142.246.025 |
| | JTI-CLEAN SKY (Aeronautics and Air Transport) | 474 | 198.090.904 |
| | JTI-ENIAC (Nanoelectronics Technologies 2020) | 63 | 468.962.267 |
| | JTI-FCH European Hydrogen and Fuel Cell Technology Platform) | 152 | 443.791.407 |
| Subtotal: COOPERATION JTI (5% of total funding) | | 783 | 2.183.986.206 |
| Total: COOPERATION (63% of total funding) | | 7873 | 28.717.702.498 |
| IDEAS | European Research Council (17% of total funding) | 4539 | 7.710.443.822 |
| PEOPLE | Marie-Curie Actions (11% of total funding) | 10705 | 4.777.221.466 |
| CAPACITIES | Research Infrastructures including eInfrastructures | 341 | 1.528.321.724 |
| | Research for the benefit of SMEs | 1029 | 1.249.585.007 |
| | Regions of Knowledge | 84 | 126.689.334 |
| | Research Potential | 206 | 377.734.056 |
| | Science in Society | 183 | 288.397.372 |
| | Support for the coherent development of research policies | 27 | 28.213.463 |
| | Activities of International Cooperation | 157 | 173.417.040 |
| Total: CAPACITIES (8% of total funding) | | 2027 | 3.772.357.995 |
| EURATOM | Fusion Energy | 4 | 5.248.981 |
| | Nuclear Fission and Radiation Protection | 134 | 352.824.123 |
| Total: EURATOM (1% of total funding) | | 138 | 358.073.104 |
| Total | | 25282 | 45.335.798.885 |

¹⁵² Commission SWD on FP7 Ex-Post Evaluation, page 11.

Issues for consideration

- How can the evaluations of EU programmes be made more relevant for, and responsive to, society at large?

Stakeholder views

In general FP7 was well received¹⁵³. The overall satisfaction with FP7 was high (80%) among those who participated in the consultation. The key strengths of the programme can be summarised as follows:

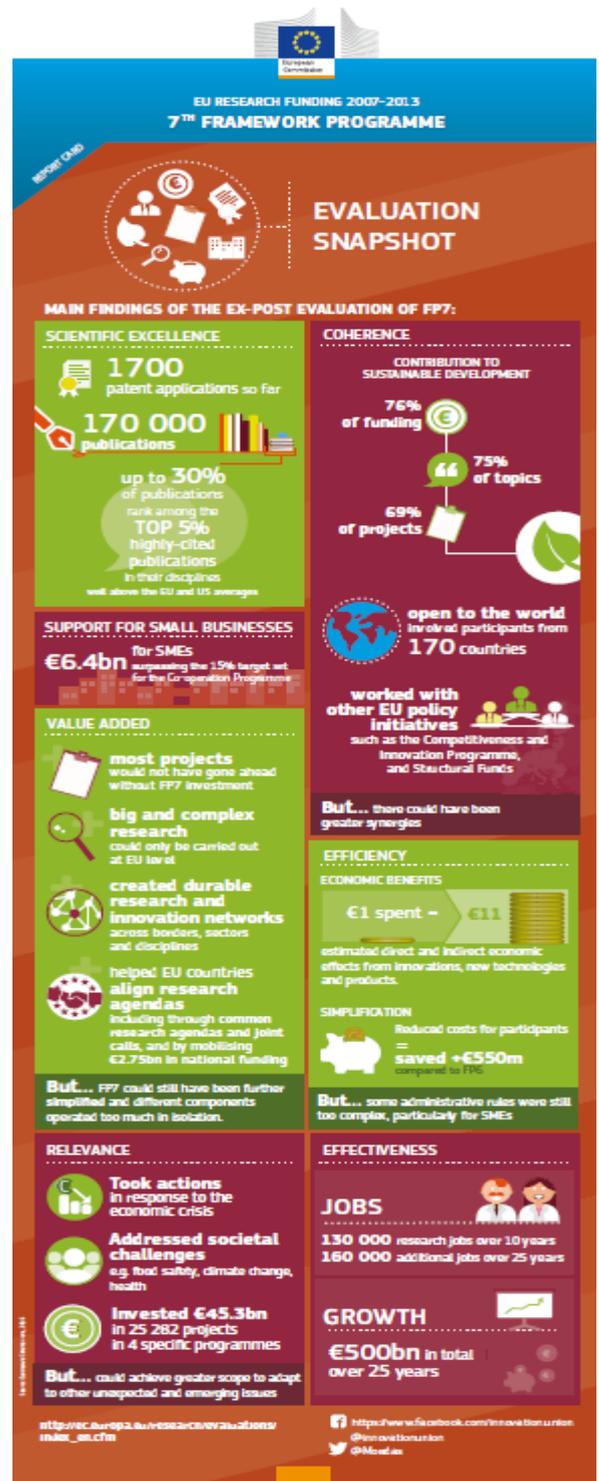
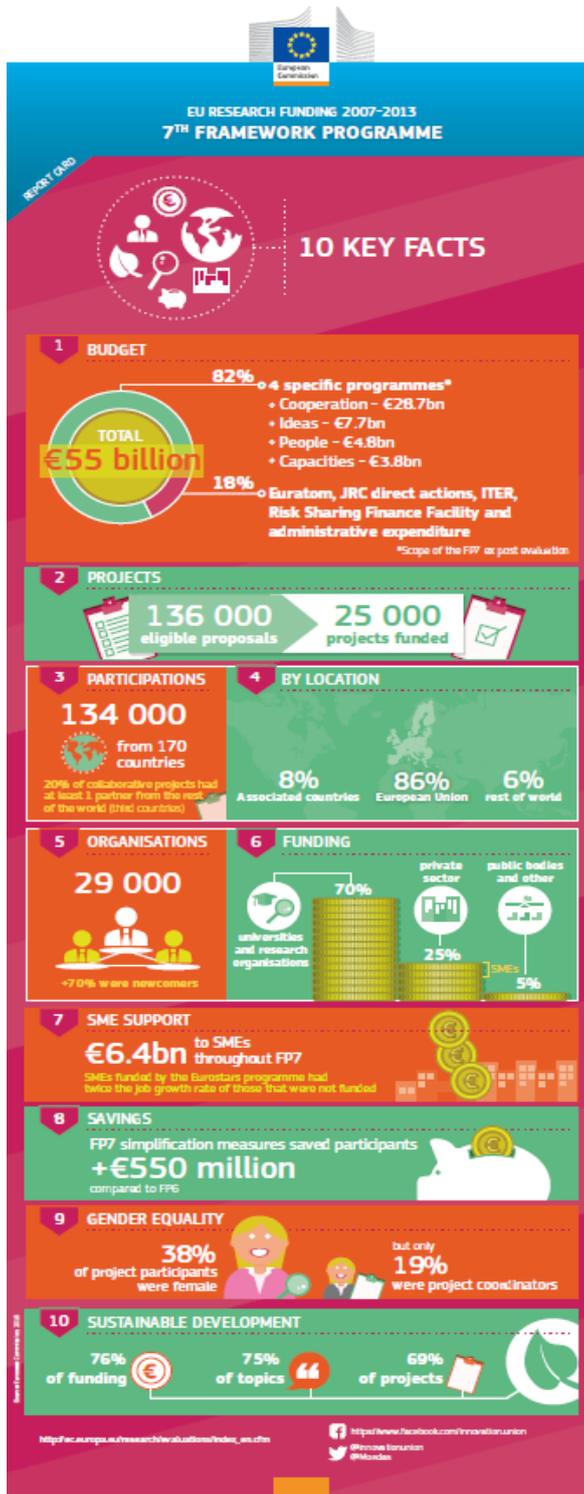
- Creating the European Research Area through cooperation and competition: Networking people and organisations over the geographic, sectorial and disciplinary borders (international, inter-sectorial and interdisciplinary collaboration) and funding the highest quality research through competition
- Joint Agenda-setting: Joining forces in solving the grand challenges together (e.g. through JTIs, PPPs, ETPs)
- The European Research Council was a great success
- The Marie Curie Actions made an important impact for the future of research through training and creating opportunities for mobility

At the same time there were some shortcomings:

- Administrative burden was high and financial and legal rules were cumbersome
- Societal impact was not addressed to a sufficient extent
- Perception of sometimes narrow topics and of difficulty to enter for newcomers: more straightforward for large organisations with experience of applying.
- Regarding the impact of the programme, according to the respondents, the biggest impact of FP7 was on scientific excellence and on technological and social innovations.

¹⁵³ A full overview of the stakeholder consultation can be found Annex I to the Commission Staff Working Document on FP7 Ex-Post Evaluation, page 4 .

Annex: Visual summaries of FP7 Ex-Post Evaluation





EU RESEARCH FUNDING 2007-2013 7TH FRAMEWORK PROGRAMME

REPORT CARD



BENEFITTING SOCIETY

INVESTMENT

+€28.7 billion

by the Cooperation programme

leading to new technologies and products, improving life and tackling our biggest challenges, including:

INFORMATION AND COMMUNICATION TECHNOLOGIES

€7.9bn
2328 projects

Advancing the state of the art in:



PHOTONICS



ROBOTICS



ARTIFICIAL INTELLIGENCE



INTERNET OF THINGS



QUANTUM COMPUTING

HEALTH RESEARCH

€4.8bn
1008 projects

Improving health care:



NEW SCREENING METHODOLOGIES for Diabetes and Alzheimer's disease



GENOMIC PROGNOSTIC TEST to avoid unnecessary, expensive breast cancer treatments



PORTABLE PET SCAN to measure important body functions such as blood flow

ENERGY AND ENVIRONMENT

€3.6bn
868 projects

Improving energy efficiency and security of supply, reducing pollution and addressing climate change:



INVESTING IN RENEWABLES solar, wind, biomass addressing



PERFORMANCE OF MATERIALS

SECURITY

€1.3bn
319 projects

Increasing our knowledge:



EXTREME WEATHER IMPACTS



INTELLIGENCE AGAINST TERRORISM



CYBER CRIME AND CYBER TERRORISM

SOCIO-ECONOMIC SCIENCES AND HUMANITIES

€0.6bn
253 projects

Increasing understanding:



MIGRATION



RADICALISATION



ECONOMIC AND FINANCIAL CRISIS, BANKING



INTERNATIONAL RELATIONS

http://ec.europa.eu/research/eu-observatory_en/

<https://www.facebook.com/eu-observatory>
[@euobservatory](https://twitter.com/euobservatory)



EU RESEARCH FUNDING 2007-2013 7TH FRAMEWORK PROGRAMME

REPORT CARD



FP7 FOR EXCELLENT SCIENCE



134 000

participations from the EU and worldwide

in **+25 000** projects

FUNDING FOR MANY AWARD-WINNING RESEARCHERS

Funding from the European Research Council included:



11 Nobel Laureates and 5 Fields Medallists

45% of researchers coming to the EU from industrialised countries stayed in Europe after the end of their Marie Skłodowska-Curie fellowship

ERC funding excellent basic research



Marie Skłodowska-Curie actions helped boost the careers and mobility of 50 000 researchers



170 000 publications with world-class results so far



up to **30%** of publications rank among the **TOP 5%** highly-cited publications in their disciplines



54% in open access

well above the OECD and US averages

http://ec.europa.eu/research/eu-observatory_en/

<https://www.facebook.com/eu-observatory>
[@euobservatory](https://twitter.com/euobservatory)



EU RESEARCH FUNDING 2007-2013
7TH FRAMEWORK PROGRAMME

REPORT CARD



FP7 FOR
GROWTH & JOBS

JOBS



130 000
research jobs over 10 years
160 000
additional jobs over 25 years

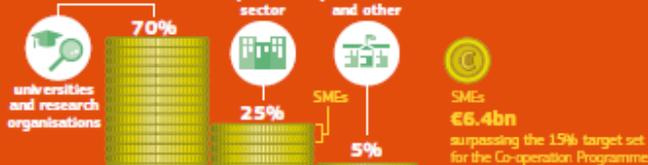
GROWTH



€500 billion
over 25 years
or
€20 billion
in additional annual GDP

PARTICIPATING ORGANISATIONS

EC funding going to:



5 JOINT TECHNOLOGY INITIATIVES

Large-scale public-private partnerships boosted EU-level industrial research and innovation

INNOVATIVE MEDICINES INITIATIVE

50+ consortia for biomedical R&D, opening up routes to commercialisation for SMEs



CLEAN SKY

Helped the aeronautics industry turn demonstrator projects into new products – tested two new engine designs



ENIAC

Nanoelectronics innovation, e.g. for electric cars and energy efficiency



FUEL CELLS AND HYDROGEN

Putting Europe at the forefront of clean transport, deploying:
• 150 new types of cars
• 45 buses types
• hydrogen refuelling stations



ARTEMIS

Bringing industry and academia together to develop new embedded computing technologies

3 CONTRACTUAL PUBLIC-PRIVATE PARTNERSHIPS

To boost industry participation in FP7



Factories of the Future



Energy-efficient Buildings



Green Cars

http://ec.europa.eu/research/evaluations/index_en.cfm

<https://www.facebook.com/innovationunion>
@InnovationUnion
@Innovates



EU RESEARCH FUNDING 2007-2013
7TH FRAMEWORK PROGRAMME

REPORT CARD



FUNDING BY
EU MEMBER STATE

€45.3bn
awarded through
open calls for proposals

€4.1bn
12 Candidate and
Associated Countries

€40.5bn
28 EU Member States

€644m
Rest of the world

FP7 FUNDING

| BE | BG | CZ | DK |
|--------------------------|--------------------------|--------------------------------|---------------------------------|
| BELGIUM €1835m | BULGARIA €99m | CZECH REPUBLIC €289m | DENMARK €1072m |
| DE | EE | IE | EL |
| GERMANY €7170m | ESTONIA €95m | IRELAND €625m | GREECE €1008m |
| ES | FR | HR | IT |
| SPAIN €3288m | FRANCE €5213m | CROATIA €90m | ITALY €3629m |
| CY | LV | LT | LU |
| CYPRUS €93m | LATVIA €49m | LITHUANIA €55m | LUXEMBOURG €60m |
| HU | MT | NL | AT |
| HUNGARY €292m | MALTA €21m | NETHERLANDS €3394m | AUSTRIA €1188m |
| PL | PT | RO | SI |
| POLAND €440m | PORTUGAL €522m | ROMANIA €143m | SLOVENIA €171m |
| SK | FI | SE | UK |
| SLOVAKIA €78m | FINLAND €877m | SWEDEN €1745m | UNITED KINGDOM €7002m |

Note: Statistics as of Nov. 2015

http://ec.europa.eu/research/evaluations/index_en.cfm

<https://www.facebook.com/innovationunion>
@InnovationUnion
@Innovates



EU RESEARCH FUNDING 2007-2013 7TH FRAMEWORK PROGRAMME

REPORT CARD



BOOSTING RESEARCH CAPACITY



50 000 researchers supported by Marie Skłodowska-Curie actions including **10 000** PhD candidates from **140** countries — more than 30% from outside the EU

SUPPORTED THE DEVELOPMENT OF RESEARCHERS' CAREERS



95 / 100 grant recipients in employment **2** years after the end of their fellowships



COMBINED THE BEST TALENT



doubled share of researchers participating in projects from different disciplines



INCREASED EUROPE-WIDE COLLABORATION AND NETWORKING



29 000 organisations participated

72% were newcomers



FP7 invested **€1.5bn** in research infrastructures



Capacities-Regions of Knowledge programme Improved the research and innovation capacity of Europe's regions with **€127 million** funding in **84** projects.

The **13** Member States that joined since 2004 received on average **30% more** than other Member States in FP7 funding per million euros invested nationally in R&D.



http://ec.europa.eu/research/evaluations/index_en.htm

<https://www.facebook.com/innovationunion>
@innovationunion
@Moecas



EU RESEARCH FUNDING 2007-2013 7TH FRAMEWORK PROGRAMME

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DISPELLING SOME MYTHS

CLAIMS ABOUT FP7 EVALUATION BY INDEPENDENT EXPERT GROUP

“FP7 is only suitable for large industry organisations and big universities”

Participation

12 400+

- SMEs
- Smaller research bodies
- Civil society organisations



A large share of the Cooperation theme focused on science and technology, but this is not the whole picture.



Socio-economic sciences and humanities

€580m from the Cooperation programme and **15%** of ERC grants

“FP7 is only about science and technology; there are no funding opportunities for other scientific disciplines”



No restrictions on discipline in the People programme for training and career development



€288m

to boost Science in Society, in areas like education, gender equality and public engagement



€1.5bn

investment in research infrastructures

“For a successful project proposal, it is necessary to include partners from almost all EU countries”

FP7 did not have a quota system or make it a pre-condition to include specific EU countries.

The average collaborative project had partners from **6** different countries.

“To win a grant, it is important to have good contacts to lobby”

Independent panels of experts reviewed and evaluated proposals, ensuring:



Sound and objective evaluation of a project's quality



Lobbying is impossible

“FP7 projects are so work-intensive that they fail to produce scientific publications”



+ 170 000 scientific publications published to date

on average **6.8** publications/funded project



“FP7 does not fund the most innovative ideas, rather well established researchers”



All proposals were evaluated according to their scientific and/or technological excellence



more than **70%** of participants were newcomers

Source: Innovation Union 2014

http://ec.europa.eu/research/evaluations/index_en.htm

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@innovationunion
@Moecas



EU RESEARCH FUNDING 2007-2013 7TH FRAMEWORK PROGRAMME

REPORT CARD



WHAT'S NEXT

RECOMMENDATIONS BY INDEPENDENT EXPERTS

IN ADDITION TO MEASURES ALREADY TAKEN IN HORIZON 2020, THE COMMISSION WILL:

Focus on critical challenges

Support open innovation, open science and openness to the world. Maximise synergies between different areas of research and innovation and new digital technologies, and explore the idea of a European Innovation Council



Align research and innovation agendas across Europe

Help Member States to reform their research and innovation strategies through the Policy Support Facility, and ensure that Commission proposals support innovation



Build synergies with other research and innovation funds

Coordinate effectively between different sources of EU funding, and introduce a second wave of simplification to make it easier to access financing



Bring science to citizens

Strengthen open access to research publications and data, and get more citizens involved in defining research strategies and topics



Monitor and evaluate funding results

Support Member States in assessing the impact of funding, and explore how new text and data mining tools can improve monitoring and evaluation



Source: European Commission, 2016

http://ec.europa.eu/research/evaluations/index_en.cfm
Find out more: <http://ec.europa.eu/programmes/horizon2020/>

 <https://www.facebook.com/InnovationUnion>
 @InnovationUnion
@Moedas

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Alignment with national R&I activities

The issue papers are supporting background documents prepared by the services of the Commission in the R&I family DGs for the use of the High Level Group on maximizing the impact of EU R&I programmes. They do not necessarily represent the official position of the Institution.

Introduction

Coordination of the European Union and the Member States' research and technological development activities has its roots in the Treaty on the Functioning of the European Union (Article 181 TFEU) which calls for such cooperation in order to ensure that national policies and Union policy are mutually consistent. As research and innovation policy is a shared, 'parallel' competence (Article 4.3 TFEU), Member States continue to have autonomy in designing and implementing their national R&I policies.

While previous EU Framework Programmes for R&I included specific visible priorities/provisions for supporting the implementation of the European Research Area (ERA) policy framework, i.e. coordination between the EU and Member States and better alignment of Member States' R&I policies, Horizon 2020 follows an integrated approach whereby overarching policy objectives related to coordination/alignment are embedded/mainstreamed across the three Horizon 2020 pillars. Consequently, over the past years, there have been a number of instruments and initiatives oriented towards coordination, collaboration, and alignment of national strategies and programmes in further developing the ERA and tackling societal challenges while also strengthening European competitiveness.

Horizon 2020 is an important "blueprint" for strategic R&I policy making at national level, both in terms of priorities and procedures. An example is the European Research Council (ERC) as, since 2007, some 11 Member States have launched new funding schemes inspired by the ERC. The ERC has also enhanced or consolidated the priority given to basic/frontier research in some national strategies. Increasing competition between EU countries and institutions to host ERC grantees is leading to major reforms in the way research funding is allocated and to more attractive conditions for the best researchers.

Through EU-led initiatives such as the ERA and the European Semester, Member States increasingly have a joint understanding of the importance of R&I for tackling Europe's productivity slowdown and to unlock its potential for growth and job creation. Member States also show a greater awareness of the need for higher investments in R&I and for evidence-based R&I policy reforms to increase the quality and impact of these investments. Through the European Semester process, the Commission assesses the R&I policies of the Member States and,

where appropriate, issues country-specific recommendations. R&I-related recommendations¹⁵⁴ were issued to 13 Member States in 2016. The Horizon 2020 Policy Support Facility¹⁵⁵ complements this work by providing assistance to Member States in designing and implementing the necessary policy reforms. This includes mutual learning exercises, in which groups of Member States join forces to discuss common policy challenges, exchange information and identify good practice. Recent examples of such mutual learning exercises include fiscal incentives for R&D, performance-based funding of public research and innovation procurement. A mutual learning exercise was also launched on the alignment and interoperability of research programmes, under the guidance of the GPC.

The most visible "testimonials" for coordination between the EU and Member States and alignment between Member States are "partnership approaches", where the EU and Member States join forces in a variable geometry for the preparation and implementation of joint initiatives, either as Public-Public-Partnerships (P2Ps) or Public-Private-Partnerships (PPPs), including the European Institute of Technology (EIT). About 15% of the Horizon 2020 budget or roughly EUR 10 billion will be invested in the mentioned partnership approaches (PPPs incl. EIT and P2Ps) with additional national and private investments.

P2P approaches under Horizon 2020 include two instruments (Article 185 initiatives and ERA-NETs) and one policy process: the Member-States driven Joint Programming Process and the associated 10 Joint Programming initiatives (JPIs) which are also supported by Horizon 2020.

- **Joint Programming** is a process whereby Member States agree, on a voluntary basis and in a partnership approach, on common visions and Strategic Research Agendas (SRA) to address major societal challenges. On a variable geometry basis, Member States commit to JPIs where they implement together joint SRAs. Ten JPIs were established by the Council between 2009 and 2011. These involve cross-border collaboration and the alignment of national, publicly-funded programmes. Horizon 2020 supports JPIs via ERA-NET Co-Fund actions and Coordination and Support Actions.
- **Article 185** initiatives enable the EU to participate in research programmes undertaken jointly by several Member States, as well as in the structures created for the execution of such joint programmes. Article 185 initiatives represent the closest integration of national and EU programmes thus far. There are currently four supported within the context of Horizon 2020, involving a contribution of almost EUR 1.5 billion from the EU and at least EUR 2 billion from participating countries. A further Article 185 initiative, known as PRIMA and focusing on sustainable food and water management systems in the Mediterranean area, is under preparation and expected to start implementation in 2018.
- The **ERA-NET** instrument under Horizon 2020 supports public-public partnerships in preparing, implementing and coordinating joint activities by financing coordination activities of national / regional programmes as well as topping up national contribution to joint calls (no more than one joint call a year) and actions of a transnational nature. The Horizon 2020 Work Programmes for 2014-17 includes some

¹⁵⁴ http://ec.europa.eu/europe2020/making-it-happen/country-specific-recommendations/index_en.htm

¹⁵⁵ <https://rio.jrc.ec.europa.eu/en/policy-support-facility>

60 ERA-NET actions. These involve a contribution from the EU of EUR 500 million for joint calls and other joint activities and are expected to leverage 3-5 times as much from national funding sources

Socio-political context

In the current socio-political context a stronger coordination role of the EU concerning national R&I policy may not be successful. However, the past experiences with "partnership approaches", especially the P2P budget increases on national and EU level demonstrate political willingness and openness to this form of soft coordination.

Two recent evaluations on ERA-NETs¹⁵⁶ and Joint Programming¹⁵⁷ underlined both the potential of P2Ps for a more coherent and impact-oriented European R&I fabric, but also the current weaknesses. The evaluations highlighted amongst others that P2Ps are overcoming barriers on national level for reinforced transnational cooperation at R&I programme level. The identified main weaknesses of the current P2P approach concern their strategic positioning within the respective national and EU research and innovation policy frameworks, which continues to remain unclear and their limited coherence within a broader partnership approach between the EU and its Member States.

More concretely, the recent Joint Programming evaluation concluded that: "the Joint Programming process offers the opportunity to create scale and scope in Europe of societal challenge R&D but this will only become a reality if national, transnational and EU policies and priorities are developed in a more collaborative way and that the deliberations for the next Framework Programme offer the option to design and implement a multi-level approach to joint programming leading to a critical mass of coordinated societal challenge R&D across Europe and at the EU/international level".

In a similar vein, the evaluation of the ERA-NET Cofund instrument concluded: "we strongly believe that more efforts need to be devoted to embedding ERA-NETs in a coordinated and coherent strategy across thematic areas and in synergy with other instruments and initiatives. This will fully exploit their potential in achieving ERA objectives".

Another key conclusion from both evaluations concerns the diverging R&I needs in different regions of Europe and the potential of P2Ps to address this issue. The ERA-Net Cofund evaluation recommended here to "better exploit the potential of ERA-NET Cofund actions in supporting the widening strategy, [notably that] Participating states and the Commission services should promote a proactive approach engaging low-performing countries at the topic selection stage for ERA-NET Cofund actions, i.e. in the joint vision development and strategic agenda setting to promote a stronger role for low-performing countries".

In addition, the Joint Programming evaluation underlined the potential of P2Ps to address the growing regional diversity in Europe by recommending that "for those countries that are marginal or selective players in JPIs,

¹⁵⁶ Available at: <https://www.era-learn.eu/publications/ec-publications/analysis-of-era-net-cofund-actions-under-horizon-2020>

¹⁵⁷ Available at <https://www.era-learn.eu/publications/ec-publications/evaluation-of-joint-programming-to-address-grand-societal-challenges-final-report-of-the-expert-group>

explore the potential synergies with their Smart Specialisation Strategy to enable more strategic participation and/or complementary actions".

It also found that: "The ERA-NET Cofund evaluation, frequent feedback from users as well as experience from the preparation and implementation of Art.185 demonstrate that the complexity of the instruments and initiatives is high and calls for simplification and less red-tape. The complexity has increased due to the shift from the Union supporting the coordination to systematically co-funding the initiatives".

Key facts and figures of the Framework Programmes

According to the ex-post evaluation of FP7¹⁵⁸ a significant effort has been made to align Member State activities by developing common strategic research agendas, aligning national plans, defining and implementing joint calls, using instruments such as the ERA Networks (ERA-NETs and ERA-NET Plus actions) and Article 185 initiatives. Member States, as well as some Associated and Third Countries, put in place incentives at national level to foster the participation of their researchers in the FP.

Some Member States also aligned the priorities of their national research strategies with the ones in FP7. Stakeholders indicated that one of the key achievements of FP7 was the joint agenda-setting through joining forces in solving the grand challenges together.

Both EU and Member States' support to P2Ps has significantly increased over the past years. EU support for P2Ps increase from EUR 380 million in FP6 (2.1% of the budget) to EUR 802 million in FP7 (1.4% of the budget) and EUR 2.5 billion in Horizon 2020 (around 3.1% of the budget). In parallel, national funding increased from EUR 1.25 billion in FP6 to EUR 2.9 billion under FP7, and an expected EUR 6 to 8 billion under Horizon 2020. On average, 20% of national R&D funding invested in transnational cooperation (mostly competitive) is invested in European P2Ps, with substantial diversity at Member States level.¹⁵⁹ The larger Member States invest usually less (Germany with 10%) and smaller Member States invest significantly more (Cyprus with nearly 100%).

¹⁵⁸ https://ec.europa.eu/research/evaluations/pdf/archive/fp7-ex-post_evaluation/staff_working_document_1_en_autre_document_travail_service_part1.pdf#view=fit&pagemode=none

¹⁵⁹ ERA Progress Report 2016.

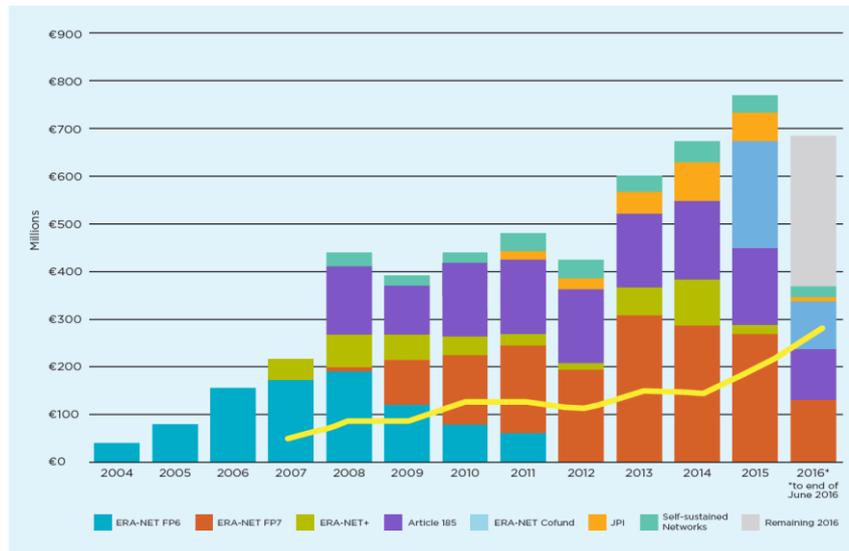


Figure 1: National Joint Call Budget (with EU Contribution for co-funding of calls overlaid in yellow) for all calls closed 2004-2016, by network type.

Since 2004, more than 5,500 projects with a cumulative budget of about EUR 5 billion from national sources have been implemented through P2Ps. The number of currently active projects emanating from P2Ps is in the same order of magnitude as the Research and Innovation actions (RIAs) financed through Horizon 2020 in the Work Programme 2014-2015 and cover a wide range of topics.

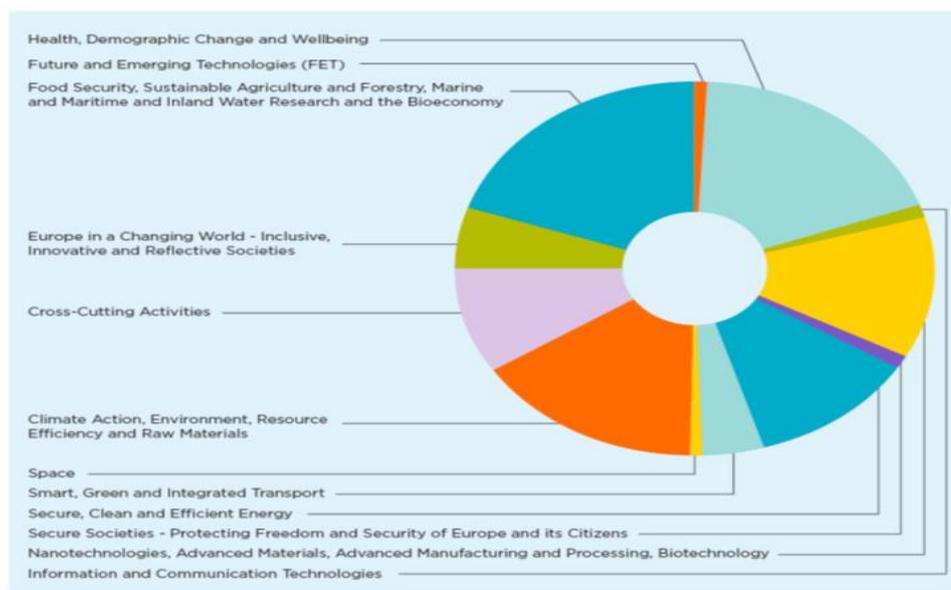


Figure 2: Thematic Coverage of Active Networks (90 active between July 2015 and June 2016)

Issues for future consideration

- To what extent and how should the Framework Programme support the implementation of European Research Area priorities at **national/regional** level?
- How can public partnerships help deliver on the objectives of excellence, openness and impact?
- How can the coherence between current alignment instruments be improved, their impact further increased and the implementation simplified?

Selected stakeholder views¹⁶⁰

During a joint workshop between DG RTD and all EU Member States in November 2016 a number of key issues have been identified and agreed upon that need to be addressed in the elaboration of a revised P2P approach for FP9.

These key issues include:

1. Rationale: new narrative for P2Ps
2. Aims/Objectives: from instrument-based to ambition-based planning
3. Scope/Focus: better coherence amongst P2Ps/partnering instruments
4. Governance: better process for selection, preparation and implementation
5. Finance: achieve more stable long-term financial arrangements
6. Impact: more focus on impact-based implementation

Member States often point out that, in the case of some countries (especially small countries), participation in an increasing number of P2Ps causes difficulties mainly due to the lack of administrative capacity and available national funding. The large number of different P2Ps is difficult to understand for potential participants and national authorities. It might lead to duplication of topics addressed by the wide range of initiatives within Horizon 2020 addressing global societal challenges.

¹⁶⁰ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Contribution towards achieving the ERA

Introduction

The Lisbon Treaty strengthens EU action in the field of research, in particular by setting the objective of creating a genuine European Research Area (ERA) to facilitate the free movement of researchers, scientific knowledge and technologies by removing fiscal and legal obstacles to cooperation in the field of research. The ERA is conceived as a unified research area open to the world based on the internal market, in which researchers, scientific knowledge and technology circulate freely. Through the ERA, the Union and its Member States will strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges.

According to Article 14 of the Horizon 2020 Regulation, it shall support the achievement and functioning of the ERA. Compared to FP7, support to the achievement and functioning of ERA now is recognised as a cross-cutting issue across the programme.¹⁶¹

The December 2014 conclusions of the Competitiveness Council 2014 on the ERA Progress Report state that the conditions for the completion of the ERA are now in place. However, as for the EU internal market, further work is needed to ensure that it functions in an optimal way. As a result, the ERA Roadmap 2015-2020 identifies a limited number of key implementation priorities which are likely to have the biggest impact on Europe's science, research and innovation systems (see table below). Supported through Horizon 2020, the ERA priorities are intended to spur reform of Member States' research and innovation systems. This is done notably through ERA National Action Plans intended to drive political reform and action at national level. The ERA Progress Report 2016, shows that progress has been made in the domain of all ERA priorities.

¹⁶¹ Article 14 of Regulation 1291/2013 , L 347/110, 20.12.2013.

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| 1 | Effective national research systems – 'Effectively designed and efficiently functioning national research and innovation systems responsive to the specific objectives of each individual Member State are central to ERA implementation' (ERAC) |
| 2 | Optimal transnational co-operation and competition |
| 2a | Jointly addressing grand challenges – 'At the European level, the Commission and Member States should work together to clarify the division of labour between the EU, Member States and transnational levels' (GPC) |
| 2b | Research Infrastructures – 'Make optimal use of public investments in RI by setting national priorities compatible with the ESFRI priorities and criteria taking full account of long term sustainability' (ESFRI) |
| 3 | An open labour market for researchers – 'In an ERA which achieves this goal, research is an attractive career option across Europe and researchers are properly equipped with flexible skills matching current and future needs' (SGHRM) |
| 4 | Gender equality and gender mainstreaming in research – 'Translating national equality legislation into effective action to address gender imbalances in research institutions and decision making bodies and integrating the gender dimension better into R&D policies, programmes and projects' (Helsinki Group) |
| 5 | Optimal circulation and transfer of scientific knowledge – 'Fully implementing knowledge transfer policies at national level', 'Promoting Open access to scientific publications' (new group replacing the Working Group on Knowledge Transfer) |
| 6 | International cooperation – 'Develop and implement appropriate joint strategic approaches and actions for international STI cooperation on the basis of Member States' national priorities' (SFIC) |

Data source: Council of the European Union (2015).

Table 1: ERA priorities

Socio-political context

As defined in the Innovation Union flagship initiative launched in 2010, the EU requires around one million more researchers in order to meet the target of 3% of GDP being invested in research and innovation by 2020. Member States are putting strategies in place to train enough researchers to meet their national R&D targets and to promote attractive employment conditions. Barriers to cross-border research activity – for example, barriers to the cross-border functioning of national programmes or to the portability of grants awarded in one country are to be removed. More and more research and innovation activities are conducted in an open, collaborative and cross-border way. The ERA is designed to be the backbone of a well-functioning science and innovation system in Europe.

According to a study of the European Parliament, entitled 'Mapping the cost of non-Europe 2014-2019'¹⁶² the impact of deepening EU cooperation on the basis of the ERA framework could lead to an efficiency gain of around 22 billion euro per year, between 2010 and 2030.

Key facts and figures on the Framework Programmes

The High-Level Expert Group report on the FP7 Ex-Post Evaluation found that: "FP7 made a significant effort to coordinate Member States activities by developing common strategic research agendas, aligning national plans, defining and implementing joint calls, using instruments such as the ERA-NETs and Article 185 initiatives, which set common agendas and achieve the funding scale required for tackling important societal challenges. The collaborative approach strengthened the European Research Area by catalysing a culture of cooperation and constructing comprehensive networks fit to address thematic challenges".

The report also concluded that FP7 had a positive influence in terms of enhancing employability and mobility of researchers in Europe and beyond, contributing to the free movement of knowledge and opening of the ERA to the world, and also attracted leading international talent. For example, over 50,000 Marie-Curie fellowships were granted to researchers (including 10,000 PhD candidates) representing 150 different nationalities located in 86 countries. Cross-border cooperation supported through FP7 helped to reach critical mass, foster research on transnational societal challenges, facilitate networked specialisation of research teams, improve knowledge sharing and increase the visibility of research results, amongst other things.

The High Level Expert Group report concluded that: "FP7 clearly had a positive impact on the structure, working and performance of Member States' research and innovation system but strengths and weaknesses remain to be very unevenly distributed across Europe".

Horizon 2020 provides stronger support to Member States and the main stakeholders in implementing the ERA reform agenda across key ERA priorities. The ERA Progress Report 2016¹⁶³ summarises this as follows:

| ERA priority | Horizon 2020 support | State of play |
|---|---|---|
| More effective national research systems | New 'Policy Support Facility' tool ¹⁶⁴ | The 2016 ERA Progress Report shows on the basis of a quantitative analysis that "most countries have made progress in the field of research excellence (average increase 6.4% over the period 2010-2013 and almost all of them have adopted national strategies for |

¹⁶² European Parliament, Mapping the cost of non-Europe 2014-2019, 3rd Edition, page 56, 2015

¹⁶³ European Commission, 3rd ERA Progress Report: The European Research Area: time for implementation and monitoring Progress; 2016

¹⁶⁴ The Policy Support Facility provides topic-specific (mutual learning exercises) or country-specific (peer reviews of national R&I systems, or specific support to a policy reform) support at the request of Member States. Two Member States and one associated country have already been reviewed, while many other requests are arising. Recurrent feedback received on the PSF work has shown that the operational recommendations formulated by leading experts and policy practitioners prove valuable as catalysers and to support countries in implementing national R&I reforms. For example, the renewed Science Agenda of Bulgaria pays particular attention to the recommendations formulated by the dedicated PSF Peer Review.

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| | | <p>research and innovation. Several Member States are redefining their National R&I strategies further based on a broad concept of innovation, encompassing education, research and innovation to achieve greater efficiencies</p> |
| <p>Optimal transnational co-operation and competition on common research agendas, grand challenges and infrastructures</p> | <p>Public-Public Partnerships¹⁶⁵, European Strategy Forum for Research Infrastructures</p> | <p>The Framework Programmes since FP6 provide support to P2Ps, rising from EUR 380 million in FP6 (2.1% of the budget) and mobilising around EUR 1.25 million national funding to about EUR 2.5 million in Horizon 2020, representing 3.1% of its budget and expected to mobilise EUR 6 to 8 million national funding for transnational R&I projects.</p> <p>Participating countries consider the P2Ps as a cornerstone of the programme and key to the achieving of the ERA: ten Joint Programming Initiatives¹⁶⁶ have been launched to date and all have adopted Multiannual Implementation Plans. In addition, in 2014-2016, some 48 ERA-NET Cofund actions were selected for funding.</p> <p>The European Commission has been working with the European Strategy Forum on Research Infrastructures (ESFRI) and the major result of this work is the ESFRI Roadmap.</p> <p>First published in 2006 and after its updates in 2008, 2010 and 2016, the ESFRI Roadmap identifies vital needs for new European Research Infrastructures for the next ten to twenty years. It is doing so in various scientific macro-domains, ranging from health and environment to social and cultural domains. The ESFRI Roadmap consists currently of twenty- one ESFRI Projects that are well advanced from a maturity point of view and twenty nine projects that have reached already their implementation phase, so-called ESFRI Landmarks.</p> |

¹⁶⁵ Public-Public Partnerships cover Article 185 initiatives under both FP7 and Horizon 2020 (Union participation in multiannual programmes jointly undertaken by Member States: European and Developing Countries Clinical Trials Partnership (EDCTP) 1 and 2; European Metrology Programme (EMRP) and EMPIR; Eurostars1 and 2; Active and Assisted Living (AAL) 1 and 2, BONUS, ERA-NET Cofund actions supporting joint calls and other joint actions between R&I programmes of the Participating States as well as Joint Programming Initiatives of Member States on societal challenges .

¹⁶⁶ These are Member State-led joint research initiatives where participating countries pool funding and launch joint research programmes/calls/other activities in a defined area. They are supported under Horizon 2020 e.g. with ERA-NET Cofund actions.

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| | | <p>13 pan-European facilities are based already on the new EU Regulation - the European Research Infrastructure Consortium, ERIC - which entered into force in 2009 and at least four more ERICs are expected to be launched in 2017.</p> <p>Horizon 2020 funding aims at supporting the different phases of the research infrastructure life cycle from the preparation, implementation and long-term sustainability to the efficient operation and transnational access and use of research infrastructures. Preliminary results indicate that the number of national research infrastructures (networked thanks to Horizon 2020 support) was 363 by the end of 2015. The target by the end of Horizon 2020 is 900.</p> <p>According to the ERA Progress Report 2016 transnational funding has increased on average by 7.8% over the period 2010-2014</p> |
| <p>An open labour market for researchers facilitating mobility, supporting training and ensuring attractive careers</p> | <p>Euraxess, Marie Skłodowska-Curie actions and Resaver pan-European pension scheme</p> | <p>The number of research positions advertised on EURAXESS Jobs (as at November 2016) comprised 278,518 job vacancies and 64,777 fellowships. According to the ERA Progress Report 2016 the number of Euraxess posts has increased by 7.8% a year on the period 2012-2014.</p> |
| <p>Gender equality and mainstreaming in research</p> <p>Encouraging gender diversity to foster science excellence and</p> | <p>Gender integration across Horizon 2020, Science with and for Society funding scheme</p> | <p>Horizon 2020 integrates gender as a cross-cutting issue and funds institutional change in research organisations through the 'Science with and for society' funding scheme under Horizon 2020.</p> <p>According to the ERA Progress Report 2016 the number of women grade A professors has increased on average by 3.4% over the period 2007-2014.</p> |

| relevance | | |
|---|--|---|
| Optimal circulation and transfer of scientific knowledge for access and uptake of knowledge by all | Communication and dissemination of programme results, demonstration and pilot projects | <p>Open access to peer-reviewed scientific publications resulting from Horizon 2020 is mandatory since 2017. The use of a Data Management Plan is required for projects participating in the Open Research Data Pilot. Based on 2014-2015 figures 65% of the projects covered by the scope of the pilot on Open Access participate in the pilot and 34.6% opted out for IPR reasons, personal data protection concerns, national security or other reasons. Furthermore, outside the areas covered by the pilot, a further 11.9% of projects participate on a voluntary (opt-in) basis. In order to comply with the open access publications requirement, beneficiaries must, at the very least, ensure that their publications can be read online, downloaded and printed.</p> <p>According to the ERA Progress Report 2016 for the year 2014 approximately 52% of EU-28 publications were available in Open Access.</p> |
| International cooperation | General openness to participation in programmes by any researcher in the world | According to the ERA Progress Report 2016 the number of scientific co-publications with non EU countries increased on average by 4.1% over the period 2005-2014. |

Issues for future consideration

- Are you of the opinion that, in recent years, enough progress has been made towards the completion of the ERA?
- Do you see it as a key task of the FP to contribute to the completion of the ERA by providing funding to initiatives of a structuring nature such as Joint Programming?
- What measures other than EU funding, legislative or non-legislative, could encourage the realisation of ERA, complementary to the ERA partnership put in place in 2012?

Stakeholder views

Amongst those position papers and stakeholder views on the Horizon 2020 Interim Evaluation received to date which explicitly mention ERA, there is a consensus that the Commission must keep working towards the achievement of the ERA.

Here is a small sample of views:

- *"It was only in May 2015 that the Member States adopted their joint ERA Roadmap. Since then, it is apparent that the ERA and its priorities have barely been mentioned in the EU Commission's discussions surrounding research policy, and that new strategies are already under consideration in the context of the Horizon 2020 interim evaluation. The Roadmap and the most recent ERA Progress Report clearly show that the shaping of the ERA is an open-ended process which is impossible to complete, and that the Member States as well as the Commission must continue to pursue the stated objectives".*
- *"There is still much work to be done to reduce barriers in Europe, especially at Member State level. There are additional focus areas requiring action to realise ERA that are not being sufficiently prioritised at the moment, such as better linkages between education, research and innovation. We call upon the Commission to continue working towards the realisation of ERA, to develop synergies between the open science agenda and ERA, and to use the European Semester to incentivise Member States to take action".*
- *"Europe is confronted with significant internal disparities in terms of research and innovation performance as identified in the Innovation Union Scoreboard, among other sources. Cooperation on both sides of the innovation divide is crucial to spread excellence across Europe and to realise the full potential of the European Research Area".*

Issue paper for the High Level Group on maximising the impact of EU research and innovation programmes

Social Sciences and Humanities and Responsible Research and Innovation

Introduction

In support of its general objective "to build a society and a world-leading economy based on knowledge and innovation"¹⁶⁷, Horizon 2020 pays more specific attention to society in two ways:

1. To call for the embedding of the Social Sciences and Humanities (SSH) in all research for the purpose of performing social and economic analysis of the challenges facing society (e.g. migration, recovery from the economic crisis); SSH is at the core of Societal Challenge 6 'Inclusive, Innovative and Reflective Societies' and is also a cross-cutting issue in Horizon 2020;
2. To focus more specifically on the interface between science and society with the aim of optimising it as much as possible; this is more specifically the aim of Part V 'Science with and for Society' of Horizon 2020 and it is also the aim of the 'Responsible Research and Innovation' (RRI) cross-cutting issue all across Horizon 2020.

A- Social Sciences and Humanities

The Social Sciences and Humanities (SSH) were funded for the first time as a dedicated programme under the Fourth Framework Programme (FP4), a trend that continued throughout the Seventh Framework Programme (FP7)¹⁶⁸. In contrast, Horizon 2020 represents a new approach whereby SSH research is both part of an SSH-intensive thematic priority (the Societal Challenge on 'Europe in a Changing World: Inclusive, Innovative and Reflective Societies', otherwise known as Societal Challenge 6) and a cross-cutting issue integrated across the entire Horizon 2020.

Societal Challenge 6 has therefore a strong, though not exclusive, SSH component. It develops research on issues such as migration, democracy, youth, unemployment, culture, fairness, thus covering many of the key items of Commission President Juncker's 'agenda for jobs, growth, fairness and democratic change'.

¹⁶⁷ Regulation (EU) No 1291/2013

¹⁶⁸ There is some confusion about the use of the title of 'SSH'. The use of SSH is very misleading since the research which was funded between 1994 and 2013 from FP4 to FP7 was not meant to support SSH communities (the FP is not meant to support any specific disciplines like biology or physics). It was meant to support research on important societal issues such as social exclusion, economic growth, employment, governance of the EU and so on. The title of the research programme under FP6 "Citizens and Governance in a Knowledge Based Society" was a much better capture of the purpose of this research than the often-used "SSH" shorthand in FP7 for instance.

In addition, the SSH are integrated across Horizon 2020 in order to help find adequate solutions to contemporary societal problems in areas like health, energy, transport. Such research under Horizon 2020 is carried out in response to societal needs¹⁶⁹, and a particular focus is put on the impacts and results of projects – thereby demonstrating the capacity of the SSH to cooperate with other sciences in order to provide concrete solutions to social needs.

Examples of the pivotal role of SSH in major societal challenges include Health (in providing the economic and social analysis necessary for reforming public health systems); Transport (in analysing the socio-economic aspects of transport, prospective studies and technology foresight); and Climate Action (in tackling the cultural, behavioural, socio-economic and institutional change in order to move to a more self-reliant and resource efficient economy)¹⁷⁰.

B – Responsible Research and Innovation

Responsible Research and Innovation (RRI) encourages societal actors (researchers, policy-makers, businesses and citizens, etc.) to work together during the whole research and innovation (R&I) process to better align R&I and its outcomes with the values, needs and expectations of society. In practice, it means taking action in the five following domains: public engagement (where SSH researchers can also make valuable contributions), science education, gender equality, ethics, and open access/data. Where relevant, it also involves institutional changes to governance frameworks¹⁷¹.

RRI is referred to several times in the regulation establishing Horizon 2020:

Recital 22: "With the aim of deepening the relationship between science and society and reinforcing public confidence in science, Horizon 2020 should foster the informed engagement of citizens and civil society in research and innovation matters by promoting science education, by making scientific knowledge more accessible, by developing responsible research and innovation agendas that meet citizens' and civil society's concerns and expectations and by facilitating their participation in Horizon 2020 activities. The engagement of citizens and civil society should be coupled with public outreach activities to generate and sustain public support for Horizon 2020".

Article 12 on "External advice and societal engagement" provides that: "for the implementation of Horizon 2020... inputs will be provided from... transparent and interactive processes that ensure that responsible research and innovation is supported".

¹⁶⁹ Annex 1 of the Horizon 2020 Regulation states: "Social sciences and humanities research will be fully integrated into each of the priorities of Horizon 2020 and each of the specific objectives, and will contribute to the evidence base for policy making at international, Union, national, regional and local level. In relation to societal challenges, social sciences and humanities will be mainstreamed as an essential element of the activities needed to tackle each of the societal challenges to enhance their impact".

¹⁷⁰ Recital 12 of the Horizon 2020 Specific Programme states that SSH research is an important element in addressing all the societal challenges.

¹⁷¹ <http://ec.europa.eu/research/swafs/index.cfm?pg=about>.

RRI is a cross-cutting issue within Horizon 2020, and Article 14 on "Cross-cutting actions" states: "linkages and interfaces shall be implemented across and within the priorities of Horizon 2020. Particular attention shall be paid in this respect to... responsible research and innovation including gender".

Annex I on "Broad lines of the specific objectives and activities" states that: "The relationship between science and society as well as the promotion of responsible research and innovation, science education and culture shall be deepened and public confidence in science reinforced by activities of Horizon 2020 favouring the informed engagement of citizens and civil society in research and innovation".

RRI is directly relevant to and coherent with Commissioner Moedas' 3 Os Strategy¹⁷² (Open Science, Open Innovation, Open to the World), and notably for Open Innovation and Open Science. As underlined by Commissioner Moedas, "an invention becomes an innovation only if users become a part of the value creation process. Notions such as 'user innovation'... emphasize the role of citizens and users in the innovation processes as 'distributed' sources of knowledge. This kind of public engagement is one of the aims of the Responsible Research and Innovation programme in Horizon 2020"¹⁷³. Citizen science aims to encourage citizens to become involved in the science itself: "Citizen Science can contribute to the Commission's goal of Responsible Research and Innovation, as it reinforces public engagement and can re-direct research agendas towards issues of concern to citizens"¹⁷⁴.

In 2014 the Rome Declaration on RRI in Europe¹⁷⁵ argued that good marketing cannot be relied upon for R&I acceptability, that diversity in R&I is "vital for enhancing creativity and improving scientific quality", and that "early and continuous engagement of all stakeholders is essential for sustainable, desirable and acceptable innovation". Building on the Lund Declaration of 2009 (which called for an emphasis on tackling societal challenges) and the Vilnius Declaration of 2013 (which underlined the need for resilient partnerships with all relevant actors for research to serve society)¹⁷⁶, it called on "European Institutions, EU Member States and their R&I Funding and Performing Organisations, business and civil society to make Responsible Research and Innovation a central objective across all relevant policies and activities, including in shaping the European Research Area and the Innovation Union".

A meeting of all Commissioners involved in R&I in May 2016 reiterated the need to promote RRI throughout the Horizon 2020 Work Programme; all parts of Horizon 2020 are therefore expected to make efforts to embed RRI to bring science closer to society and vice-versa. In 2017, as part of the interim evaluation activities of Horizon 2020, the European Economic and Social Committee found very strong support for the involvement of civil society organisations in Horizon 2020 (81%)¹⁷⁷. The relevance of RRI to R&I policy is therefore high.

¹⁷² See the accompanying Issue Papers on Open Science, Open Innovation and Open to the World.

¹⁷³ <https://ec.europa.eu/digital-single-market/en/news/open-innovation-open-science-open-world-vision-europe>

¹⁷⁴ *Ibid.*

¹⁷⁵ https://ec.europa.eu/research/swafs/pdf/rome_declaration_RRI_final_21_November.pdf.

¹⁷⁶ See The Lund Declaration (2009), <http://www.vr.se/download/18.7dac901212646d84fd38000336/> and The Lund Declaration (2015), <http://www.vr.se/download/18.43a2830b15168a067b9dac74/1454326776513/The+Lund+Declaration+2015.pdf>.

¹⁷⁷ Draft Information Report – Section for the Single Market, Production, and Consumption: Interim evaluation of Horizon 2020; European Economic and Social Committee. INT/807.

Socio-political context

A- Social Sciences and Humanities

Europe is currently confronted with a series of major socio-economic challenges. These include growing economic and cultural interdependencies, an ageing population and demographic change, social exclusion, inequalities and poverty, increased migration flows, a growing digital divide, slow recovery from the crisis and insufficient innovation, instability in the EU neighbourhood, violence and radicalisation, and a decreasing sense of trust in institutions and the political establishment as well as among citizens within and across borders. These are big and pressing challenges calling for a common European approach that is both effective and sustainable. The evidence base and innovative solutions put forward by the SSH communities in collaboration with innovators, entrepreneurs and other key stakeholders are important building blocks of this approach. The European wide research funded under the programme has considerable policy relevance in key areas at national and European levels¹⁷⁸.

B – Responsible Research and Innovation

The accelerating pace of the co-evolution of science and society makes new ways of conducting R&I ever more important at all levels of governance. RRI aims to ensure that R&I deliver smart, inclusive and sustainable solutions to societal challenges by engaging new perspectives, new innovators and new talent.

In the 'real world', these aspirations lead to the emergence of different kinds of R&I infrastructures and modes of R&I, such as citizen science, open innovation platforms¹⁷⁹, Living Labs¹⁸⁰, and programmes dedicated to RRI launched by research institutes. These aim to engage and open up R&I to stakeholders including SMEs, third-sector organisations, policy makers, citizens, end-users and students. In this way, the beneficiaries of R&I can contribute to research (e.g. agenda setting, scientific research, analysis of results and policy development) and to innovation (e.g. ideation, concept design, rapid prototyping, and verification of results).

Key facts and figures of the Framework Programmes

A- Social Sciences and Humanities

In FP7, some EUR 580 million was allocated to collaborative SSH projects under the Cooperation part of the programme (the lowest of the 10 Cooperation thematic areas, and around 1% of the overall programme budget). This resulted in 253 projects selected for funding, with an average EU budgetary contribution of EUR

¹⁷⁸ See the analysis of the ex-post evaluation of FP7 and FP6 projects by the IMPACT EV consortium; <http://impact-ev.eu/wp-content/uploads/2015/08/D3.2-Report-3.-Impact-evaluation-of-FP6-last-call-and-FP7-SSH-research-projects.pdf>

¹⁷⁹ See for instance <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/support-measure/manner-suomi/six-city-programme-6aika-open-innovation-platforms-spearhead-project>.

¹⁸⁰ See for instance, <http://www.enoll.org/> and http://www.iemed.org/llista_activitats-en/the-mediterranean-as-an-open-living-lab?set_language=en.

2.3 million and involving 11 partners on average¹⁸¹. The SSH theme saw a very high competition for funding, with an average success rate of around 8% (significantly lower than the average FP7 Cooperation programme success rate of 20%, and the overall FP7 success rate of 19%)¹⁸².

On the thematic coverage of the SSH theme, the High Level Expert Group for the FP7 Ex-Post Evaluation found that: *"The research areas covered a broad variety of issues such as the knowledge economy, social cohesion, demographic changes, social trends and lifestyles, Europe's changing role in the world, conflicts, peace and human rights, roles of citizens in Europe, socio-economic and scientific indicators, as well as societal foresight activities. On the other hand, embedding SSH in other themes and areas of research has been modest"*¹⁸³. Accordingly, a guiding principle of Horizon 2020 is to better embed the SSH across the programme.

In Horizon 2020, it has to be recalled that Societal Challenge 6 covers not only SSH relevant research such as on migration, polarisation, employment etc, but also ICT research topics, innovation policy topics and a whole array of other actions, such as COST, which makes its coordination a very challenging task. During the period 2014-2015, the budget devoted to socio-economic research topics under Challenge 6 in the Work Programme was EUR 127 million, compared to a total budget of EUR 310 million for the entire Societal Challenge, around 41% of the budget. An overview of statistics for completed calls under Societal Challenge 6 is as follows:

| EUROPE IN A CHANGING WORLD – INCLUSIVE, INNOVATIVE AND REFLECTIVE SOCIETIES | | | | |
|--|---|-------------|-------------|--------------|
| | Summary | 2014 | 2015 | Total |
| Budget | | | | |
| | Estimated total budget in WP (EUR million) | 149.3 | 160.7 | 309.95 |
| | EU contribution to signed grants in calls (EUR million) | 117.8 | 139.1 | 256.9 |
| | Average EU contribution per signed grant (EUR million) | 2.4 | 1.5 | 1.8 |
| Participation signed grants | | | | |
| | Number of signed grants | 49 | 95 | 144 |
| | Total number of participations | 499 | 644 | 1 143 |
| | Newcomer participations (newcomer/overall) | 17.2% | 28.1% | 23.4% |
| | EU-13 participation (EU-13/overall) | 15.2% | 13.4% | 14.2% |
| | Associated countries participation (associated countries/overall) | 7.0% | 8.2% | 7.7% |
| | Third Countries participation (Third Countries/overall) | 5.0% | 11.5% | 8.7% |
| | Private sector participation (private/overall) | 13.2% | 21.6% | 17.9% |
| | SMEs participation (SME/overall) | 11.6% | 20.5% | 16.6% |
| Implementation | | | | |
| | Time-to-Grant (% of projects within TTG benchmark) | 78.3% | 83.9% | 88.2% |
| | Success Rate (projects/proposals) | 8.9% | 4.2% | 5.1% |
| | Success Rate (€ allocated/requested) | 9.6% | 4.4% | 5.9% |
| KPIs | | | | |
| | Number of publications in peer-reviewed high impact journals | 21 | 0 | 21 |
| | Number of patent applications | 0 | 0 | 0 |

¹⁸¹ For a comprehensive overview and profiling of SSH projects funded under FP7, see the Net4Society reports available at: <http://www.net4society.eu/public/reports.php>

¹⁸² The High-Level Expert Group report concluded that: *"In FP7-COOPERATION, SSH showed comparably low adjusted success rates, a comparably high average score of successful proposals and very little chance for resubmission of proposals. This indicates an area in which a substantial number of high quality proposals did not receive funding and an increase of budget would be justified"*.

¹⁸³ High-Level Expert Group report, p.68

| | | | |
|---|-----|-----|-----|
| Number of patents awarded | 0 | 0 | 0 |
| Number of prototypes and testing activities | N/A | N/A | N/A |
| Number of joint public-private publications | N/A | N/A | N/A |
| New products, processes, and methods launched into the market | N/A | N/A | N/A |

An important and distinctive aspect of this research is its policy relevance. A very high proportion of this research is done in areas such as migration, polarisation, employment, growth, official statistics, education, diplomatic actions and so on, which are core policies of the EU (and of Member States). Many of the research topics are thus developed in cooperation with the “policy Directorates General” of the Commission and the European External Action Service. The regular publication of “Policy Reviews” which highlight the main research results of the funded projects (recently in areas like terrorism, migration, poverty, inequalities, the EU as a global actor, Central and Eastern Europe 25 years after the fall of the Berlin Wall¹⁸⁴) gives the opportunity to review policy options at EU level in key areas. As a consequence, many researchers active in the European projects are regularly used by Commission DGs and the EEAS for their expertise.

A number of projects funded under FP7 have created spin-off companies, while around 80% of projects have published articles in peer-reviewed journals (an average 16 articles per project)¹⁸⁵. Projects funded so far under Horizon 2020 have focused on areas including the economic crisis, social cohesion, youth unemployment, e-government, social innovation and cultural heritage (including digital). The IMPACT EV project has reviewed FP6 and FP7 projects in SSH and although it concludes that the research has had scientific, social and policy impacts, it calls for a new bolder policy to increase in particular the social and policy impacts of the research.

In the area of SSH integration within Horizon 2020, the SSH monitoring reports for 2014 and 2015¹⁸⁶ show that EUR 2.1 billion were allocated to topics ‘flagged’ for SSH integration in the Industrial Leadership and Societal Challenges pillars of Horizon 2020¹⁸⁷. From this, EUR 433 million was allocated to SSH partners. The monitoring reports draw, in particular, two important conclusions. The first one is that the budget for SSH partners in Horizon 2020 is concentrated in a few countries (nearly 2/3 of the budget benefitting SSH partners go to 7 countries (UK, DE, NL, IT, BE, ES and FR). This situation points to the need to develop policies that should help many EU (in particular in Southern Europe and Central and Eastern Europe) and associated countries to participate more effectively in Horizon 2020. The second important conclusion is that SSH integration in Horizon 2020 is very limited for some SSH disciplines, in particular in the arts and the humanities. Opening the research topics to a wider contribution from all SSH disciplines thus remains as a challenge in the years ahead.

¹⁸⁴ http://ec.europa.eu/research/social-sciences/index.cfm?pg=library&lib=policy_reviews

¹⁸⁵ See p.30 and 36 of the EC Staff Working Document for the FP7 Ex-Post Evaluation for further details.

¹⁸⁶ SSH monitoring report 2014: https://ec.europa.eu/research/social-sciences/pdf/other_pubs/integration_ssh_h2020.pdf and for 2015: <https://ec.europa.eu/programmes/horizon2020/en/news/integration-social-sciences-and-humanities-horizon-2020-participants-budget-and-disciplines-2nd>

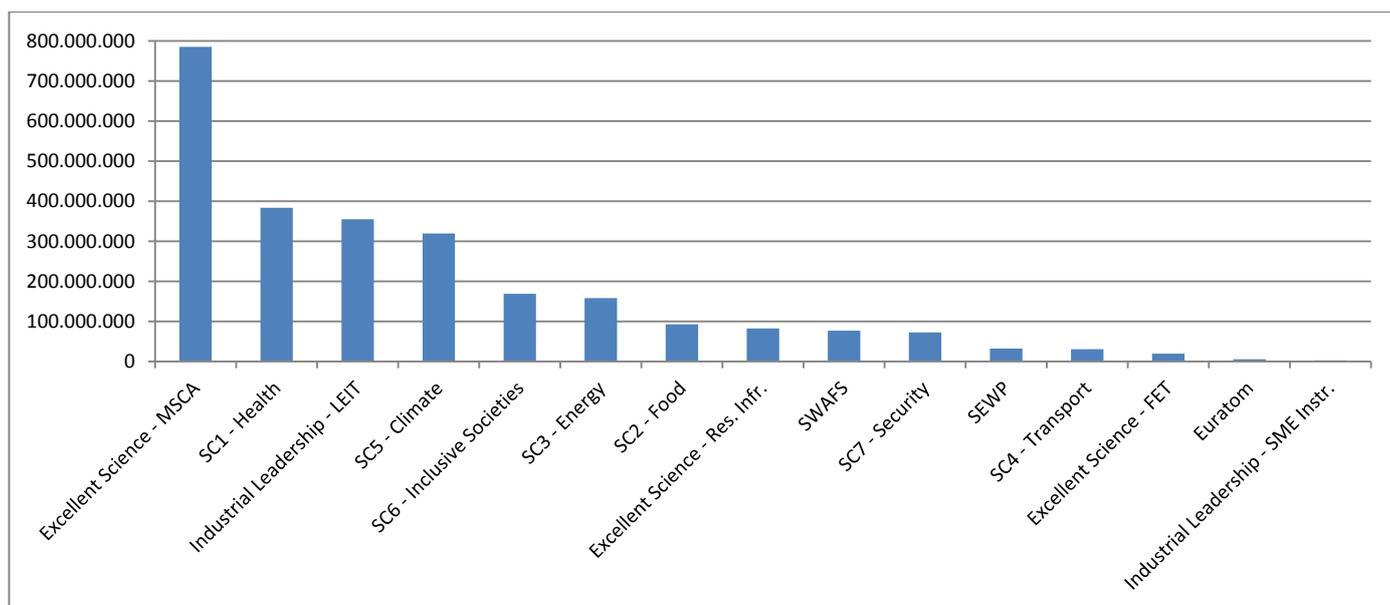
¹⁸⁷ Horizon 2020 Annual Monitoring Report 2015, p. 63.

B – Responsible Research and Innovation

The Key Performance Indicator (KPI) for RRI in Horizon 2020 is "instances where citizens, Civil Society Organisations (CSOs) and other societal actors contribute to the co-creation of scientific agendas and scientific contents"¹⁸⁸. This KPI is a proxy for actions across the five dimensions of RRI. As of 1 January 2017, according to the CORDA database which allows identification of funded projects (under flagged topics) that are RRI relevant, around 11% of Horizon 2020 projects (for which data is available, i.e. not missing), are RRI relevant.

The EC contribution to these flagged projects is EUR 2.7 billion; which equates to almost 14% of the Horizon 2020 budget¹⁸⁹. More than two-thirds of the RRI-flagged EC contribution goes to the Marie Skłodowska-Curie (30.4%), followed by the Health Societal Challenge (14.8%), Leadership in Enabling and Industrial Technologies (13.7%), and the Climate Societal Challenge (12.4%)¹⁹⁰.

Figure 1: EC contribution (EUR) to RRI-flagged projects in Horizon 2020 budget lines



Source: CORDA data, 1 January 2017¹⁹¹

An additional source of information is the level of participation of CSOs in Horizon 2020. A recent study¹⁹², which developed a bespoke method to identify CSOs and subtypes (using CORDA data up to April 2015), found that

¹⁸⁸ <https://ec.europa.eu/programmes/horizon2020/en/news/horizon-2020-indicators-assessing-results-and-impact-horizon>.

¹⁸⁹ Where EUR 19.3 billion EU contribution (eCorda data extraction 19/01/2017) are allocated to Horizon 2020 projects and 784 projects have an RRI flag (eCorda data extraction 19/01/2017).

¹⁹⁰ This figure excludes the Public Private Partnerships implemented through 'Joint Undertakings', and so-called 'ad-hoc' calls.

¹⁹¹ Where EUR 2.5 billion are allocated to 751 RRI-flagged projects excluding joint actions and grants to identified beneficiaries (eCorda data extraction 19/01/2017). These figures do not, however, take into account the 34% of Horizon 2020 projects that currently lack "RRI flags" in the CORDA database, which suggests that the EC contribution to RRI-flagged projects could be higher than indicated above.

civil society organisation (CSO) types 1 (individuals and non-profits) and 2 (publicly financed and oriented towards society) made up 2.7% of project participants but received just 0.7% of total funding; 5.3% of participants receiving 1.6% of funding were CSO types 3 (financed by business and oriented towards society) and 4 (financed by business and oriented towards business).

To summarise, RRI is a cross-cutting issue that is relatively new to Horizon 2020 and data suggests it is now integrated in around 11% of total Horizon 2020 projects (hence with a significant budget associated to it). RRI is highly policy relevant and there is policy support to involve citizens and CSOs in Horizon 2020. However the embedding of RRI across the different Horizon 2020 programme parts is uneven and remains a challenge. Moreover, CSO involvement in Horizon 2020 is low, peripheral, and CSOs only rarely take a lead role within projects¹⁹³. As such, crucial opportunities to better align R&I with the values, needs and expectations of society are being missed, and political commitment to RRI and operationalising this commitment at Commission level is required.

Issues for future consideration

- How to enhance the social and policy relevance of European R&I Framework Programmes in areas of key concern for European citizens (such as migration, unemployment, European identity, terrorism)?
- How to deepen the embedding of SSH and RRI across the R&I Framework Programme; including the links between SSH and STEM (science, technology, engineering and mathematics)?

Selected stakeholder views¹⁹⁴

The High Level Expert Group report for the FP7 Ex-Post Evaluation found that: "highly important concerns of European citizens are only marginally addressed (e.g. social cohesion, European integration and combating unemployment). In addition, themes and topics often follow a technological fixing - the problem approach instead of addressing societal causes and major transformation processes. In order to promote a more positive public perception of science and better adoption of new knowledge and innovations, the EU programme will have to address citizens' concerns better and involve them in a more substantial role in the future".

The report further concluded that: "Solid mechanisms to strategically embed SSH and RRI throughout Horizon 2020 are required...Targeted and tailored communication of science results to key audiences is crucial for ensuring that societal benefits of science and research materialise. Focusing on quality rather than quantity of dissemination activities and fostering sustained engagement of policy makers, researchers, innovators and other societal actors will be crucial to maintain and increase citizen trust in scientific innovations, ensure their take up,

¹⁹² "Study on network analysis of civil society organisations' participation in research framework programmes" (CONTRACT NO. RTD-B6-2014-SI2.687781) - D5: Draft final report.

¹⁹³ "Study on network analysis of civil society organisations' participation in research framework programmes" (CONTRACT NO. RTD-B6-2014-SI2.687781) - D5: Draft final report.

¹⁹⁴ Position papers submitted via the Horizon 2020 Interim Evaluation public consultation can be found at the following address: https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020interim_stakeholder

support the strategic transfer of research insights into European policy making and advance the wider societal impacts of Horizon 2020".

Many position papers submitted for the interim evaluation of Horizon 2020 emphasise a need to further reinforce the integration of SSH and RRI throughout the programme. A small selection of views is as follows:

- *"In order to benefit from SSH as a tool to help addressing great challenges (such as migration and radicalisation), stakeholders and groups involved in the development of the work programme (e.g. evaluators, advisory groups) should include relevant SSH experts from the very beginning....SSH experts should be systematically included in evaluation panels to ensure adequate evaluation of proposals with an SSH component*
- *"The research funded under Societal Challenge 6 significantly contributes to the implementation of the Europe 2020 strategy and to what European citizens massively expect from the EU: employment, equality, peace, cultural development, creativity and curiosity, respect for and from others. Societal Challenge 6 research has a clear European added value, since it often calls for comparative approaches, analysing different situations in a number of European countries or regions. This kind of research cannot be carried out on a national level or by individual researchers – European consortia are a pre-requisite to adequately address these research themes... However, the budget available to societal research under Societal Challenge 6 is not sufficient and does not adequately reflect the political importance of the topics and the potential of the research community".*
- *"The integration of Social Science and Humanities has been improved in Horizon 2020, but there is still need for a greater inclusion of SSH in consortia and projects. SSH perspectives should be included during the formulations of calls, and the concept of impact should be adjusted to make it easier to integrate SSH research in Societal Challenges and Industrial Leadership".*
- *"Responsible Research and Innovation needs to be considered throughout the programme, which is an important source of funding for this area. RRI should be taken more seriously as a cross-cutting principle from now on".*
- *"In order to mainstream RRI, particular attention should be paid not only to the aims and expected results of the funded research projects, but also to the quality of work of the involved researchers. One of the main objectives is recruiting new talent for science and to pair scientific excellence with social awareness and responsibility, so more attention should be paid to young researchers, currently hired only for the duration of the project funding".*
- *"Policies and initiatives should be implemented in Horizon 2020 to further mainstream RRI. In Science with and for Society, this could include an ERA-Net on RRI/open science, funding for structural changes directed at 'early-stage' institutions, and training on RRI. In Horizon 2020, efforts could be made to open*

up to more CSOs, incorporate RRI in evaluation criteria, and improve the career prospects/working conditions of young scientists".

- *"We would like to insist on the necessity of taking a dual approach: on the one hand... RRI principles should be incorporated in other programmes, in particular in Societal Challenge and Industrial Leadership pillars. This means that some of the calls should clearly take into account RRI... On the other hand, it is necessary to keep a specific SwafS programme that can support projects not covered, or specifically focused on, by thematic areas of other pillars, but which can help to better analyse, develop and spread SWAFS and RRI principles (including best practices, research on RRI, etc)".*