Horizon 2020
EU framework programme for research and innovation

European Implementation Assessment

STUDY

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Horizon 2020
EU framework programme for research and innovation

European Implementation Assessment

In May 2016, the Committee on Industry, Research and Energy (ITRE) of the European Parliament decided to undertake an implementation report on Horizon 2020, the EU framework programme for research and innovation (2014-2020) (Regulation EU No 1291/2013). Soledad Cabezón Ruiz (S&D, Spain) was appointed rapporteur.

Implementation reports for European Parliament committees are routinely accompanied by European implementation assessments, drawn up by the Ex-Post Impact Assessment Unit of the Directorate for Impact Assessment and European Added Value, within the European Parliament's Directorate-General for Parliamentary Research Services.

Abstract

Horizon 2020, the EU framework programme for research and innovation (2014-2020) is aimed at building a society and an economy based on knowledge and innovation across the Union, while contributing to sustainable development. The programme supports the implementation of the Europe 2020 strategy and other Union policies, as well as the achievement and functioning of the European Research Area (ERA).

The introduction to this European implementation assessment (EIA) presents basic information on the implementation of Horizon 2020, including policy on gender equality and international cooperation.

In addition, the annexes contain the input to the EIA received from external experts, who prepared analyses of the implementation of the three Horizon 2020 priorities: excellent science, industrial leadership, and societal challenges. The implementation of each priority was analysed from two perspectives:

a) a research and industry perspective prepared by experts from the Centre for Strategy and Evaluation Services (CSES) and the Centre for Industrial Studies (CSIL);

b) economic and financial perspective prepared by experts from the Europe Economics consortium.
AUTHORS:

- Opening analysis written by Dr. Anna Zygierewicz, Ex-Post Impact Assessment Unit
- Briefing paper on The implementation of Horizon 2020 - Excellent science - Research and industry perspective, written by CSES and CSIL.
- Briefing paper on The implementation of Horizon 2020 - Excellent science - Economic and financial perspective written by Europe Economics
- Briefing paper on The implementation of Horizon 2020 - Industrial leadership - Research and industry perspective written by CSIL & CSES
- Briefing paper on The implementation of Horizon 2020 - Industrial leadership - Economic and financial perspective written by Europe Economics
- Briefing paper on The implementation of Horizon 2020 - Societal challenges - Research and industry perspective written by CSES and CSIL.
- Briefing paper on The implementation of Horizon 2020 - Societal challenges - Economic and financial perspective written by Europe Economics

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Annexed briefing papers:

Annex I – The implementation of Horizon 2020 - Excellent science - Research and industry perspective.

Annex II – The implementation of Horizon 2020 - Excellent science - Economic and financial perspective.

Annex III – The implementation of Horizon 2020 - Industrial leadership - Research and industry perspective.

Annex IV – The implementation of Horizon 2020 - Industrial leadership - Economic and financial perspective.

Annex V – The implementation of Horizon 2020 - Societal challenges - Research and industry perspective.

Annex VI – The implementation of Horizon 2020 - Societal challenges - Economic and financial perspective.
Selected acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>CULT</td>
<td>European Parliament, Committee on Culture and Education</td>
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<tr>
<td>DG</td>
<td>European Commission, Directorate-General</td>
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<tr>
<td>EASME</td>
<td>Executive Agency for Small and Medium-sized Enterprises</td>
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<td>EC</td>
<td>European Commission</td>
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<td>EEAS</td>
<td>European External Action Service</td>
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<td>EIGE</td>
<td>European Institute for Gender Equality</td>
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<td>EIT</td>
<td>European Institute of Innovation and Technology</td>
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<td>ERA</td>
<td>European Research Area</td>
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<td>ERC</td>
<td>European Research Council</td>
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<tr>
<td>ERCEA</td>
<td>European Research Council Executive Agency</td>
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<tr>
<td>CULT</td>
<td>European Parliament, Committee on Culture and Education</td>
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<tr>
<td>EU-13</td>
<td>Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Malta (MT), Poland (PL), Romania (RO), Slovakia (SK) and Slovenia (SI)</td>
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<tr>
<td>EU-15</td>
<td>Austria (AT), Belgium (BE), Denmark (DK), Finland (FI), France (FR), Germany (DE), Greece (EL), Ireland (IE), Italy (IT), Luxembourg (LU), Netherlands (NL), Portugal (PT), Spain (ES), Sweden (SE) and United Kingdom (UK)</td>
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<tr>
<td>EUROSTAT</td>
<td>Statistical office of the European Union</td>
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<td>FET</td>
<td>Future and emerging technologies</td>
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<td>FP7</td>
<td>Seventh framework programme</td>
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<td>H2020</td>
<td>Horizon 2020</td>
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<td>HEI</td>
<td>Higher education institution</td>
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<td>ICT</td>
<td>Information and communication technologies</td>
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<td>INCO</td>
<td>International cooperation</td>
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<td>ITRE</td>
<td>European Parliament, Committee on Industry, Research and Energy</td>
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<td>JRC</td>
<td>Joint Research Centre</td>
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<td>JTI</td>
<td>Joint technology initiative</td>
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<td>JU</td>
<td>Joint undertaking</td>
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<td>KIC</td>
<td>Knowledge and innovation community</td>
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<td>MFF</td>
<td>Multiannual financial framework</td>
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<td>MS</td>
<td>Member State</td>
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<td>MSCA</td>
<td>Marie Skłodowska-Curie actions</td>
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<td>OJ</td>
<td>Official Journal of the European Union</td>
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<td>R&amp;D</td>
<td>Research and development</td>
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<td>R&amp;I</td>
<td>Research and innovation</td>
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<td>REA</td>
<td>Research Executive Agency</td>
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<td>RPO</td>
<td>Research performing organisations</td>
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<td>S&amp;T</td>
<td>Science and technology</td>
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<td>SME</td>
<td>Small and medium-sized enterprise</td>
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<td>US/USA</td>
<td>United States of America</td>
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<td>WP</td>
<td>Work programme</td>
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Executive summary

Horizon 2020 and its predecessor programmes, including the previous 7th framework programme, are designed to help boost innovation in all EU Member States: Horizon 2020, the EU framework programme for research and innovation (2014-2020), is aimed at building a society and an economy based on knowledge and innovation across the Union, whilst also contributing to sustainable development. The programme supports the implementation of the Europe 2020 strategy and other Union policies, as well as the achievement and functioning of the European research area (ERA). The budget for Horizon 2020 for 2014-2020 amounts to €74.83 billion.

This European implementation assessment (EIA) of Horizon 2020 (H2020) was prepared three years after the beginning of the programme’s implementation. The EIA contains seven analyses: an opening analysis prepared in-house by EPRS is followed by six briefing papers drafted by external experts.

The opening analysis presents the level of innovation in the EU Member States, basic information on Horizon 2020 rules, and main achievements in the implementation of the programme. The analysis also focuses on selected aspects of H2020, including the gender equality and international cooperation as important horizontal measures throughout the programme.

The six briefing papers focus on the implementation of the programme’s three priorities: excellent science, industrial leadership and societal challenges, analysing each of them from the research and industry and the economic and financial perspectives:

a) The first and second briefing papers analyse the implementation of the **excellent science** priority. Both papers focus on four elements: a) the European Research Council, b) future and emerging technologies, c) Marie Skłodowska-Curie actions, d) research infrastructures. The first analysis is prepared from the research and industry perspective, and the second from the economic and financial perspective;

b) The third and fourth briefing papers analyse the implementation of the **industrial leadership** priority. Both papers focus on two elements: a) leadership in enabling, and industrial technologies, b) innovation in SMEs. The third analysis is prepared from the research and industry perspective, and the fourth from the economic and financial perspective;

c) The fifth and sixth briefing papers analyse the implementation of the **societal challenges** priority. Both papers focus on three elements: a) health, demographic changes and wellbeing, b) secure, clean and efficient energy, c) Europe in a changing world – inclusive, innovative and reflective societies. The fifth analysis is prepared from the research and industry perspective, and the sixth from the economic and financial perspective.
Key findings

- The general opinion of the implementation of the Horizon 2020 programme is positive. Positive opinions resulted from all three programme priorities: excellent science, industrial leadership and societal challenges. However, oversubscription and low success rate emerged as the most likely binding constraints to future participation both from industry and research organizations.

- The excellent science priority is well structured and the activities financed within the priority are of very high quality overall. However, there is room for improvement in the implementation of the priority, e.g. some areas have a low (or very low) success rate and very low levels of newcomers. More could also be done to integrate different parties in the excellent science priority and to encourage sustainable research-industry partnerships.

- Thanks to the use of more business-friendly instruments, such as the SME Instrument and the Fast Track to Innovation, the industrial leadership priority sees a large business participation, constituting 60% of the signed grants. However, in terms of funding, non-research private sector entities still receive less than 30% of the available budget. Data on outputs from the first projects under the industrial leadership priority show a predominance of publications in peer reviewed journals over patents, which raises some concerns about the achievements of market and commercialisation outcomes. This also implies that it is necessary to establish more clearly what are the expected outputs of each call.

- The societal challenges priority is also a quite successful part of the H2020. Also in this priority SME involvement was enhanced, but the participation of the business sector varies considerably between challenges and this should be considered further. Information and communication technologies (ICT) and big data emerge as overarching themes in all societal challenges, but their contribution need to be even further considered. The improvements are expected mainly in relation to the Social Sciences and Humanities elements.

- In general terms and for the three priorities, a visible concentration of H2020 grants to a selected number of grant holders, regions and Member States exists. This may be efficient in terms of achieving ‘excellent’ research. It is, however, not clear how additional objectives should be achieved together with the objective of ‘excellence’ (reduce regional disparity, creating a market for knowledge, gender equality). There is also a need to encourage dissemination of the results, so that a wider community can benefit.

- There is a need to ensure consistent use of the terms ‘input’, ‘output’, ‘result’, and ‘impact’, and to monitor the proposed projects’ outputs to avoid ‘over-promising’. Concerns also exist regarding the monitoring of project outputs. Critical views were expressed regarding the dissemination of results. It is also unclear how social benefits (‘spill-overs’ and externalities) are measured.

- Despite being mainstreamed into the different parts of the H2020 work programme, international cooperation has progressed significantly slower than in the previous programme, FP7.
• The gender equality focus has relatively positive results, although more effort is needed to achieve target levels. The only target reached is the share of women in the advisory groups, while the share of women in the project evaluation panels, among project coordinators, and the gender dimension in the research and innovation content, remain below target levels.

• Implementation of synergies and complementarities between H2020 and other national or regional programmes in Member States has just started and it is too early to assess the impact on participants. Thus far, national initiatives have been limited to supporting unsuccessful SME applicants, while further progress should be considered in other areas.

• The budget is one of the biggest problems of the H2020. Less than one third of the positively evaluated proposals could be financed. Oversubscription may discourage leading researchers and organisations from applying for H2020 grants. There is a need to clearly establish research priorities.

• The simplifications introduced in the H2020 generally work well. They are particularly appreciated during the application process, but the absence of a negotiation stage is considered a weakness. The simplifications in budget preparation and grant management are also welcomed. Nevertheless, some improvements are expected, e.g. in auditing.

• Participants are dissatisfied with the evaluation process, particularly in relation to the insufficient number of business representatives included in some evaluator panels and to the lack of detailed evaluation assessment reports. However, the negative perception about the evaluation process has to be judged within the context of a considerably increased number of applications received, which generated a trade-off between rapidity of response and quality of the evaluation reports.

• As in FP7, proposal writing organisations/agencies play an important role in supporting participation, particularly from the private sector. On the one hand, organizations may bring allocation efficiency, facilitate collaboration between industry and research and lower barrier to entry for newcomers. On the other, they may increase the cost of participation and rise some concerns about the effective involvement and interest of business in implementing the proposed projects.
Methodology of the opening analysis

The opening analysis (which precedes the annexes on specific priorities) is based on an analysis of the Horizon 2020 programme documents. The analysis is also based on implementation data and reports from the European Commission and other sources. The opinions and recommendations of selected stakeholders on Horizon 2020 implementation are also presented.

The European Parliament Industry Research and Energy (ITRE) Committee secretariat, EPRS, and the European Commission peer reviewed the opening analysis. The author would like to thank all contributors for their comments and recommendations.

Chapter 1. Innovativeness in the EU: a comparative analysis of Member States

Research and development (R&D) and innovation are key elements of the Europe 2020 strategy for smart, sustainable and inclusive growth. The strategy set a target of ‘improving the conditions for innovation, research and development’, with the aim of ‘increasing combined public and private investment in R&D to 3 % of GDP’ by 2020.¹

Meeting these targets remains a challenge, as according to Eurostat, in 2015:²

- EU R&D intensity (R&D expenditure as a percentage of GDP), stood at 2.03 %, compared with 2.04 % in 2014 and 1.74 % in 2005. Intensity also varied between EU Member States, from 0.48 % to 3.26 % in 2015 (see Annex 1);
- the highest R&D intensities were recorded in Sweden (3.26 %), Austria (3.07 %) and Denmark (3.03 %), all with R&D expenditure above 3 % of GDP, closely followed by Finland (2.90 %) and Germany (2.87 %). Belgium (2.45 %), France (2.23 %), Slovenia (2.21 %) and the Netherlands (2.01 %) registered R&D expenditure between 2.0 % and 2.5 % of GDP. At the opposite end of the scale, seven Member States recorded a R&D intensity below 1 %: Cyprus (0.46 %), Romania (0.49 %), Latvia (0.63 %), Malta (0.77 %), Croatia (0.85 %), Bulgaria and Greece (both 0.96 %);
- the business enterprise sector continues to be the main focus of R&D expenditure, accounting for 64 % of total R&D conducted in 2015, followed by the higher education sector (23 %), the government sector (12 %), and the private non-profit sector (1 %);
- in total, EU Member States spent almost €300 billion on R&D.

¹ Smarter, greener, more inclusive? Indicators to support the Europe 2020 strategy, Eurostat, 2016 edition.
² R&D expenditure in the EU remained nearly stable in 2015 at just over 2 % of GDP, Eurostat news release no 238/2016 of 30 November 2016.
The European Innovation Scoreboard 2016 groups Member States based on their innovation performance (see Annex 2):

- **Innovation leaders** are Member States where innovation performance is more than 20% above the EU average. Sweden (the EU leader), followed by Denmark, Finland, Germany and Netherlands belong to this group;

- **Strong innovators** (previously known as ‘innovation followers’), are Member States with innovation performance between 90% and 120% of the EU average. This group includes: Austria, Belgium, France, Ireland, Luxembourg, Slovenia, and the United Kingdom (UK);

- **Moderate innovators** are Member States where innovation performance is between 50% and 90% of the EU average. Croatia, Cyprus, the Czech Republic, Estonia Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Spain, belong to this group;

- **Modest innovators** are Member States with innovation performance below 50% of the EU average. The group includes Bulgaria, and Romania.

In comparison to the Innovation Union Scoreboard 2015, in the 2016 report, the Netherlands moved to the innovation leaders group and Latvia to the moderate innovators group.²

The 2016 scoreboard shows that ‘the most innovative countries perform best on all measures: from research and innovation inputs, through business innovation activities up to innovation outputs and economic effects, which reflects a balanced national research and innovation system’. Nevertheless, some Member States take the lead:³

- **Quality of academic research** – Sweden is the best performing country, followed closely by the United Kingdom, the Netherlands, Belgium, Luxembourg and Denmark. These countries are open to cooperation with partners from abroad, researchers are well networked at the international level, and the quality of research output is very high. Sweden also leads in the human resources area of innovation, followed by Slovenia, Ireland, the United Kingdom, Finland and Latvia.

- **Financial framework conditions** – Finland leads this measure, followed by Estonia, Sweden, the Netherlands and Denmark. These countries are characterised by a public sector ready to perform or support R&D activities, and by the availability of risk capital for private companies to develop new technologies.

- **Companies that invest heavily in innovation** – Germany is the overall leader, followed by Estonia, Austria and Finland. In these countries, companies invest more in innovation activities, both for science-based R&D activities and non-R&D innovation activities, including investment in advanced equipment and machinery.

³ Due to breaks in series comparisons should, however, be preferably made within the same report. The time series of the 2016 report show that the Netherlands had already become an innovation leader in 2013.

⁴ **Innovation performance compared: How innovative is your country?** Fact Sheet, 14 July 2016, European Commission.
- **Innovation networks and collaboration** – Belgium is the top performer, followed by Denmark, the Netherlands, Sweden and Finland. Companies in these countries have more versatile innovation capabilities as they combine in-house innovation activities with joint innovation activities involving other companies or public sector organisations. Their research systems are also geared towards meeting the demand from companies, as highlighted by high co-publication activity levels.

- **Innovation in small and medium-sized companies (SMEs)** – here, Ireland leads, followed by Germany, Luxembourg, France, and Austria. These countries are characterised by high shares of SMEs involved in innovation activities: they introduce more innovative products and generate more new jobs in fast-growing, young companies.

The [Regional Innovation Scoreboard 2016](#) groups Europe’s regions (NUTs 1 and NUTs 2) into four innovation performance groups; as does the [European innovation scoreboard](#). The scoreboard underlines that ‘despite the variation in regional performance within countries, regional performance groups largely match the corresponding European Innovation Scoreboard country performance groups’. All [regional innovation leaders](#) (36 regions) are located in seven EU Member States, out of which five are in a group of [innovation leaders](#) and two in the strong innovators group (see Annex 2).

The Member States’ research and innovation potential, despite some recent convergence, remains heterogeneous, with large gaps between innovation leaders and modest innovators. Activities under H2020 should help close the research and innovation divide in Europe by promoting synergies with the European Structural and Investment Funds (ESI Funds) and also through specific measures to unlock excellence in low performing research, development and innovation (RDI) regions, thereby widening participation in Horizon 2020 and contributing to the construction of the ERA ([Council Decision No 2013/743/EU](#), Annex I, F. Widening participation).

The [Global Innovation Index 2016](#) placed seven EU Member States among the world’s ten most innovative countries; in the following order: Sweden, the United Kingdom, Finland, Ireland, Denmark, the Netherlands and Germany. The lowest ranked Member States: were Croatia (placed 47) and Romania (48). Member States’ scores vary from 63.6 points for Sweden to 37.9 points for Romania (Annex 4). Describing the situation in Europe (not just the EU-28), the authors of the report pointed out that: ‘Europe benefits from comparatively strong institutions and well-developed infrastructure, while room for improvement is found in business sophistication and knowledge and technology outputs. Europe does particularly well in environmental performance, ICT access, and school life expectancy. At the same time, there is room for improvement in R&D financed by businesses, R&D financed by foreign firms, high-tech exports, and international patent filings’.

The international position of the EU-28 as regards innovation is not improving. The authors of the European Commission report [Science, Research and Innovation performance of the EU](#) pointed out that the economic crisis deepened the output gap between the EU and the United States, as well as South Korea and China. The report urges the enhancement of business’ capacity to innovate in the EU. The report also points out that the EU remains the largest producer of scientific publications in the world (27 %), before China and the USA, and has a higher number of highly cited publications than the USA. The report also underlines that intra-European cooperation continues to dominate.
Chapter 2. Basic information on Horizon 2020

Origin of the programme (treaties and strategy)

The Treaty on European Union (Article 4.3 of the consolidated version) lays down that ‘in the areas of research, technological development and space, the Union shall have competence to carry out activities, in particular to define and implement programmes; however, the exercise of that competence shall not result in Member States being prevented from exercising theirs’.

The Treaty on the Functioning of the European Union (TFEU, Title XIX: Research and technological development and space, Article 179-190) lays down in Article 179.1 that ‘the Union shall have the objective of strengthening its scientific and technological bases by achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry, while promoting all the research activities deemed necessary by virtue of other Chapters of the Treaties’.

Article 180 of TFEU determines activities, which the EU should carry out, complementing those carried out in the Member States:

a) implementation of research, technological development and demonstration programmes, by promoting cooperation with and between undertakings, research centres and universities;

b) promotion of cooperation in the field of Union research, technological development and demonstration with third countries and international organisations;

c) dissemination and optimisation of the results of activities in Union research, technological development and demonstration;

d) stimulation of researchers’ training and mobility in the Union.

Article 182.1 states that ‘a multiannual framework programme, setting out all the activities of the Union, shall be adopted by the European Parliament and the Council, acting in accordance with the ordinary legislative procedure after consulting the Economic and Social Committee’.

Europe 2020. A strategy for smart, sustainable and inclusive growth established seven flagship initiatives to catalyse progress in the European Union, including Horizon 2020, as the financial instrument that supports the implementation of the Europe 2020 strategy and other Union policies, as well as the achievement and functioning of the European research area (ERA).

Horizon 2020 is not the only EU programme supporting research and innovation, although the largest fully dedicated to supporting R&I activities. More information can be found in the EPRS publications: Overview of EU Funds for research and innovation and Guide to EU funding 2014-2020.
General objective and priorities of the programme

Three legal acts define the main objectives and the rules of the Horizon 2020 programme:

- The Horizon 2020 regulation (Regulation No 1291/2013);
- The Rules for participation (Regulation No 1290/2013);

Horizon 2020 is complemented by the research and training programme (2014-2018) (Council Regulation No 1314/2013) for matters of nuclear research and training.

The general objective of Horizon 2020 (Regulation EU No 1291/2013) is to build a society and a world-leading economy based on knowledge and innovation across the whole European Union, while contributing to sustainable development.

This general objective should be pursued through three mutually reinforcing priorities dedicated to: a) excellent science; b) industrial leadership; c) societal challenges. Each of these priorities have corresponding specific objectives (described in Parts I-III of Annex I of the above mentioned regulation):

- Priority I excellent science: aiming at reinforcing and extending the EU science base excellence, and consolidating the ERA, to make the EU research and innovation system more competitive on a global scale;
- Priority II industrial leadership: aiming at speeding up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European SMEs to grow into world-leading companies;
- Priority III societal challenges: responding directly to the policy priorities and societal challenges that are identified in the Europe 2020 strategy and that aim at stimulating the critical mass of research and innovation efforts needed to achieve the Union's policy goals.

The general objective is also pursued through two further specific objectives:

- Science with and for society;
- Spreading excellence and widening participation;

The following contribute to the general objective:

- European Institute Of Innovation And Technology (EIT);
- Joint Research Centre (JRC).
Programme budget

The Horizon 2020 programme budget for 2014-2020 was estimated at €77.03 billion in current prices and later decreased to €74.83 billion\(^5\) (see Annex 4\(^6\)). As a comparison, the previous seventh framework programme (2007-2013) had a budget of €55.6 billion and the first framework programme (1984-1987) had just €3.27 billion.\(^7\)

Out of the €74.83 billion seven year budget, around €19 billion was planned for 2014 and 2015,\(^8\) and around €20.5 billion for 2016 and 2017.\(^9\) With the latest decisions, the work programme with calls for 2017 will have a budget of €8.5 billion.\(^10\)

The European Commission estimated, that every euro\(^11\) spent within the seventh framework programme generated around €11 in positive economic effects. Estimates for the Horizon 2020 are not yet available, due to the short period of implementation of the programme.

Institutional framework of Horizon 2020 implementation

Horizon 2020 is implemented by several European Commission Directorates-General (DGs), as well as executive agencies and other bodies. As explained in detail in the EPRS publication *Horizon 2020 budget and implementation: A guide to the structure of the programme*:

1) The overall Horizon 2020 budget is managed by nine different DGs within the European Commission;

2) Horizon 2020 implementation is executed by 22 bodies, implementing different parts of the Horizon 2020 budget:
   - five European Commission DGs;
   - four executive agencies;
   - four public-public partnerships (P2Ps);\(^12\)
   - seven public-private partnerships (PPPs);
   - the European Institute of Innovation and Technology (EIT);
   - the European Investment Bank (EIB).

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6 The budget including Euroatom 2014-2018 was estimated at €78.63 billion current prices and later decreased to €76.43 billion.

7 *Development of Community research - commitments, 1984 - 2013*, European Commission.

8 *Horizon 2020 launched with €15 billion over first two years*, European Commission, Press release of 11 December 2013.

9 *Commission invests €16 billion in funding for research and innovation over next two years*, European Commission, Press release of 13 October 2015.


11 *Budget focused on results in Research and Innovation*, European Commission.

12 The fifth P2P, *PRIMA*, is currently being discussed.
Basic rules concerning the implementation

Article 8 of EU Regulation No 1291/2013 defines that Horizon 2020 shall be implemented through the consolidated specific programme established by Council Decision 2013/743/EU and through a financial contribution to the EIT (European Institute of Innovation and Technology). It also specifies, that there shall be effective coordination between the three Horizon 2020 priorities.

Horizon 2020 supports ‘direct actions’ and ‘indirect actions’: a) direct actions are research and innovation activities undertaken by the Commission through its Joint Research Centre (JRC); b) indirect actions are research and innovation activities to which the EU provides financial support and which are undertaken by participants.

The rules for participation and dissemination of results laid down in Regulation No 1290/2013 of the European Parliament and of the Council (Art. 11) apply to indirect actions.

Implementation of the Horizon 2020 programme is based on work programmes (Article 8 of the Council Decision). So far there were two biennial work programmes for Parts I to V of the specific programme, with the exception of the implementation of actions under the specific objective ‘the European Research Council (ERC)’: 2014-2015 and 2016-2017. Additionally, annual work programmes are published for the ERC. The JRC has its own work programmes.

Further reading on research and on Horizon 2020 in particular

Information on research as foreseen in the treaties, with historical insight, can be found in the EPRS publication: Research in the European Treaties.

Information on the structure, the budget and the implementation of the programme can be found in the EPRS publication: Horizon 2020 budget and implementation: A guide to the structure of the programme and in the Policy Department publication: Assessment of Horizon 2020 Programme.

Information on the state of implementation of the current policy framework for the establishment of a European Research Area (ERA) can be found in the EPRS publications: The European Research Area and European Research Area. Cost of Non-Europe Report.

Information of the scientific advisory body, supported with a grant from Horizon 2020, can be found in the EPRS publications: Scientific Advice Mechanism and Scientific advice for policy-makers in the European Union.

Information on the joint programming initiative and public-public partnerships can be found in the EPRS publications: The Joint Programming Initiatives, Article 185 initiatives, The ERANET scheme and Public-public partnerships in research: The joint programming process.


Finally, brief information on how to apply for H2020 funding is available in the European Commission video.
Chapter 3. Implementation of Horizon 2020

I – Short presentation of results of and opinions on H2020 implementation

1) The European Commission published two annual reports on the implementation of Horizon 2020 to date: Horizon 2020 Monitoring Report 2014 (SWD(2016) 123) was published in April 2016, and Horizon 2020 Monitoring Report 2015 (SWD(2016) 376) was published in November 2016. According to both reports:

- 192 call deadlines were closed in the first two years of Horizon 2020;
- 25.5% more proposals were submitted in 2015 than in 2014;
- 76,427 eligible proposals were received in 2014 and 2015;
- eligible proposals were submitted by:
  - 39.1% secondary and higher education establishments (HES),
  - 35.2% private for profit companies (PRC),
  - 18.4% research organisations (excluding education) (REC),
  - 3.5% public bodies (excluding research and education) (PUB),
  - 3.8% other entities (OTH);
- 44.9% of eligible proposals scored above the threshold in 2014 and 2015 (53.4% in 2014 alone);
- the success rate for proposals in 2014 and 2015 was 11.8% (13.4% in 2014 only);
- 26.3% of high quality proposals13 were submitted in 2014 and 2015 (31.5% in 2014 and 22.7% in 2015);
- 4,824 projects were signed in 2014, with EU funding of €8.5 billion, and 4,263 projects were signed in 2015 with EU funding of €7.4 billion;
- EU funding received in the signed grants was: 39.6% – HES, 26.9% – REC, 26.7% – PRC, 3.8% – PUB and 3% – OTH;
- organisations based in Germany received 17.7% of EU funding in 2014 and 2015, followed by those in the UK (15.4%) and France (10.2%). Together with Spain (8.6%), Italy (8.0%) and the Netherlands (7.8%), these six Member States have received 67.7% of the funds (see also Annex 5);
- the EU-15 together received 88.6% of the funds; the cumulative EU funding to EU-13 Member States was 4.5%, as well as 6.4% to association countries and 0.5% to third countries;
- 49% of participants were newcomers (those who received no EU funding from FP7); there was more new participants from the EU-13 (30.6%) than from the EU-15 (24.7%).

13 High quality proposals are proposals scoring above threshold in the independent expert evaluators’ evaluation. These proposals are judged eligible for funding and would be funded if sufficient funding was available.
2) According to the latest European Commission papers for the High Level Group on maximising the impact of EU research and innovation programmes, H2020 funds go to the best universities, but not necessarily to the best private sector companies and start-ups: 14

- Universities:
  - according to the rankings (Shanghai, Leiden International Ranking, QS Top World's Universities Ranking, and the Times Higher Education World University Ranking), 20% to 30% of the world's top universities are based in the EU and almost all of them take part in Horizon 2020; additionally, more than half of the non-EU universities participate in H2020;
  - in more detail, 97% of universities from the QS Top European Universities Ranking take part in H2020, and 92% from the Leiden European Ranking; however, only 68% participate from the Leiden International Ranking and 63% from the Shanghai ranking;

- Research institutions:
  - Of the 25 top ‘world’s most innovative research institutions’, eight (32%) are based in the EU, and almost all of them participate in H2020; additionally around one third of the world’s best research institutions take part in H2020;

- Companies:
  - Of the top-50 applicants to the European Patent Office, 38 often take part in H2020;
  - Europe’s top companies investing in R&D frequently participate in H2020 (although the banking sector should be encouraged to participate more);
  - 12% of the MIT smartest companies and 3% of the Forbes ranking of most innovative companies participate in H2020.
  - The top European start-ups and fast growing tech companies on the Wired and Deloitte lists hardly participate in H2020. Of the Wired 100 hottest European start-ups in 2016, only two are participating;
  - The Thomson Reuters, Fortune and the Industrial R&D investors rankings show that: a) the headquarters of most of these big and established companies are based outside the EU, and b) roughly one quarter of these companies take part in H2020, both those with headquarters inside and outside the EU.
  - None of the firms on the unicorns list participate in H2020 (‘unicorns’ are young, fast-growing companies, reaching a capitalisation of 1 billion US dollars or euros).

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14 Issue papers for the High Level Group on maximizing the impact of the EU research and innovation programmes, European Commission, 2017.
3) The European Court of Auditors (ECA) stated, inter alia, in its report concerning the financial years 2014 and 2015 in relation to Horizon 2020, that:

- there have been improvements in H2020 in comparison to FP7, but monitoring and reporting of the programme’s performance remains insufficient;
- the link between H2020 and the 10 new political priorities needs further clarification, particularly in relation to the Europe 2020 strategy priorities;
- there is a need to ensure consistent use of the terms input, output, result, and impact;
- Two of the three main H2020 indicators measure progress against Europe 2020, but their use in measuring the contribution to Europe 2020;
- in relation to the synergy and complementarity between national and European research and innovation programmes, the ECA gave the examples of Bulgaria and Portugal, where areas of complementarity were found, but also limitations at national level;
- H2020 has simpler funding rules than FP7, but some new elements and specific eligibility criteria may increase risk of error;
- The ECA appreciated the creation of the Common Support Centre to achieve efficient and harmonised management of H2020 by the various implementing bodies, but noted that EIT should join the framework.

Based on its findings, the European Court of Auditors prepared recommendations for the European Commission.

A separate, special ECA report was dedicated to the work of the European Institute of Innovation and Technology, based in Budapest (Hungary).

II – Focus on selected Horizon 2020 elements

1. Gender equality

<table>
<thead>
<tr>
<th>Key findings</th>
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<tbody>
<tr>
<td>The share of women in Horizon 2020 advisory groups was 51.9 %, which was above the target level of 50 %.</td>
</tr>
<tr>
<td>The share of women experts registered in the expert database was 31.1 %, and of women participating in the evaluation panels 36.7 %, both below the target 40 %.</td>
</tr>
</tbody>
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15 EU audit in brief. Introducing the 2014 annual reports of the European Court of Auditors, European Court of Auditors, 2015, EU audit in brief. Introducing the 2015 annual reports of the European Court of Auditors, European Court of Auditors, 2016 and Annual report of the European Court of Auditors on the implementation of the budget concerning the financial year 2015 together with the institutional replies, OJ C 375 of 13 October 2016.

16 The European Institute of Innovation and Technology must modify its delivery mechanisms and elements of its design to achieve the expected impact, European Court of Auditors, Special Report No 04/2016.
The share of women participants in H2020 projects was 35.8 % of the total workforce including non-researchers and 34.4 % of project coordinators.

The gender dimension in the research and innovation content was visible in 36.2 % of granted projects.

37 % of evaluators and 52 % of the members of the advisory groups were women.

Rules within Horizon 2020

Gender equality in Horizon 2020 was addressed in Article 16 of Regulation No 1291/2013: ‘Horizon 2020 shall ensure the effective promotion of gender equality and the gender dimension in research and innovation content. Particular attention shall be paid to ensuring gender balance, subject to the situation in the field of research and innovation concerned, in evaluation panels and in bodies such as advisory groups and expert groups. The gender dimension shall be adequately integrated in research and innovation content in strategies, programmes and projects and followed through at all stages of the research cycle’.

Article 14 (1) as one of the cross-cutting issues points to ‘responsible research and innovation including gender’, and Annex I states that ‘promoting gender equality in science and innovation is a commitment of the Union. In Horizon 2020, gender will be addressed as a cross-cutting issue in order to rectify imbalances between women and men, and to integrate a gender dimension in research and innovation programming and content’.

Additionally, Regulation No 1290/2013 laying down the rules for participation and dissemination in Horizon 2020 points out that ‘where relevant and specified in the work programme or the work plan, proposals shall explain how and to what extent gender analysis is relevant to the content of the intended project’ (Article 13.4). It also points that the gender equality should form part of the grant agreements and gender balance should be taken into account when forming groups of experts and evaluating panels.

Article 33.1 of the H2020 General Model Grant Agreement commits funding beneficiaries to taking the proper measures to ensure gender equality, ‘the beneficiary must take all measures to promote equal opportunities between men and women in the implementation of the action. It must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level’. In addition, Article 33.2 provides for sanctions if the beneficiary breaches its obligations.

Article 16, defining provision of transnational or virtual access to research infrastructure, determines that the access provider must, among other things, ‘promote equal opportunities in advertising the access and take into account the gender dimension when defining the support provided to users’.

The three objectives of the gender equality measures in Horizon 2020 are presented in several documents, including Guidance on Gender Equality in Horizon 2020:

- fostering gender balance in Horizon 2020 research teams, to address the gaps in women’s participation in the framework programme’s projects;
- ensuring gender balance in decision-making, in order to reach the target of 40% of the under-represented sex in panels and groups and of 50% in advisory groups;
- integrating gender/sex analysis in research and innovation (R&I) content, which helps improve the scientific quality and societal relevance of the produced knowledge, technology and/or innovation.

Horizon 2020, together with the other 2014-2020 EU funding programmes, should also contribute to reaching the targets and objectives of the EU Strategic Engagement for Gender Equality 2016-2019. The objectives are: a) to increase female labour-market participation and the equal economic independence of women and men; b) to reduce the gender pay, earnings, and pension gaps and thus fight poverty among women; c) to promote equality between women and men in decision-making; d) to combat gender based violence and protect and support victims; e) to promote gender equality and women’s rights across the world.

In addition, within the Science with and for society17 work programme 2014-2017, funds are allocated to projects promoting awareness and implementation of gender equality in the research system and research organisations.

**Results within Horizon 2020**

According to the Horizon 2020 Monitoring Report 2015 (see also Table 1 and Figure 1), following the first two years of implementation of the programme, the share of women in the advisory groups was almost 52%, matching and going beyond the target level of 50%. The gender dimension in research and innovation was represented in 36.2% of the signed grants.

The report also points to the work programme sections in which the gender dimension was particularly important: science with and for society, societal challenge 1 – health; societal challenge 4 – transport; societal challenge 5 – climate action, environment, resource efficiency and raw materials; societal challenge 6 – Europe in a changing world – inclusive, innovative and reflective societies; and societal challenge 7 – secure societies. The gender dimension was much less frequent under Leadership in enabling and industrial technologies (LEIT), although some topics relating to LEIT – NMPB18 and biotechnology took gender issues into account.19

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17 The assessment of the implementation of the science with and for society section of the H2020 was presented in a report prepared by the European Economic and Social Committee. The list of the gendered innovations granted within science with and for society can be found at the European Commission website.

18 Nanotechnologies, advanced materials, advanced manufacturing and processing, and biotechnology.

19 Examples of projects granted funding under H2020: 1) HYPATIA – Gender tools for more STEM careers; 2) GENERA – Gender Equality Network in the European Research Area; 3) PLOTINA – Promoting gender balance and inclusion in research, innovation and training; 4) GEDII – Gender Diversity Impact – Improving research and innovation through gender diversity and 5) LIBRA – Leading Innovative measures to reach gender Balance in Research Activities.
Table 1 – Status of gender equality indicators in H2020

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Status</th>
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<tbody>
<tr>
<td>Percentage of women participants in Horizon 2020 projects</td>
<td>The share of women participants in Horizon 2020 projects was <strong>35.8 %</strong> of the total workforce, including non-researchers.</td>
</tr>
<tr>
<td>Percentage of women coordinators in Horizon 2020 projects</td>
<td>The percentage of women coordinators was <strong>34.4 %</strong>.</td>
</tr>
</tbody>
</table>
| Percentage of women in European Commission advisory groups, expert groups, evaluation panels, individual experts, etc. | – **31.1 %** of the experts registered in the expert database were women;  
– the share of contracts signed with women experts participating in evaluation panels was: **36.7 %**;  
– the share of women in advisory groups was **51.9 %**.                                                                                                                                                                                                                     |
| Percentage of projects taking the gender dimension into account in research and innovation content. | The analysed grants showed that **36.2 %** of the signed grants took the gender dimension into account in research and innovation content.                                                                                                                                                                                                 |

Source: The Horizon 2020 annual monitoring report 2015\(^{20}\).

Figure 1 – Share and number of women and men in advisory groups

Source: The Horizon 2020 annual monitoring report 2015\(^{21}\).

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\(^{20}\) Article 31 of Regulation No 1291/2013, established the main indicators to be used for monitoring Gender equality as a cross-cutting issue as: a) percentage of women participants in Horizon 2020 projects; b) percentage of women project coordinators in Horizon 2020 projects; c) percentage of women in Commission advisory groups, expert groups, evaluation panels, individual experts, etc.; d) percentage of projects taking into account the gender dimension in R&I content.

\(^{21}\) Each member is allowed to participate in only one thematic advisory group, but can also participate in cross-cutting groups, for example - gender.
Opinions on gender equality in Horizon 2020

In its documents, the Advisory Group for Gender underlines the difference between the gender dimension in research and innovation content and the gender balance in the research teams, and provides relevant definitions:

- ‘Gender dimension’ is a dynamic concept that ensures that researchers question gender norms and stereotypes and address the evolving needs and social roles of women and men. Addressing the gender dimension in research and innovation entails taking into account sex and gender in the whole research process, when developing concepts and theories, formulating research questions, collecting and analysing data and using the analytical tools that are specific to each scientific area;

- ‘Gender’ is a key analytical and explanatory variable in research. Gender, as a socio-cultural process, refers to cultural values and social attitudes that together shape and sanction feminine and masculine behaviours. It also has an impact on the design of products, technologies, environments, and knowledge. Gender assumptions often go unquestioned and can unconsciously influence scientific priorities, research questions, and choice of methods. Awareness of gender aspects is therefore a key component of research excellence;

- ‘Sex’ refers to biological characteristics of women and men, boys and girls, in terms of genes, chromosomes, anatomy and physiology. Sex is globally understood as the classification of living beings as male and female, or intersexed. Sex differences and similarities relevant to research and innovation should be thoroughly investigated.

The Advisory Group underlined that the gender dimension ‘contributes to the production of goods and services better suited to potential markets’. To illustrate, examples can be found in its position papers:

- in relation to medical treatment: ‘women and men have different sex- and gender-related risks for developing certain conditions and respond differently to treatment’;

- in relation to smart cities: ‘women and men may use different routes in cities and have different behavioural patterns in transport; researchers have additionally to take into consideration the needs of parents, caretakers, children and the older population.

The Advisory Group found that in the 2014-2015 work programme, gender issues were explicitly mentioned in more than 100 topics. At the same time, however, the Advisory Group suggested improvements to better integrate the gender dimension in the topics and calls of the work programme for 2016-2017. The Advisory Group provided a list of

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23 Gender expertise can encompass issues as diverse as: gender and women studies, gender in specific research fields (gender in medicine, gender in security, gender in ecology, etc.), gender equality in employment, gender equality in research policy development and in research institutions, statistics and indicators, tools development, gender impact assessment, gender budgeting, monitoring and evaluation, Conference on the Gender Dimension in Science and Research, Ready for Dialogue, Berlin, 5 November 2015.
recommendations. An extended list of recommendations was prepared by the Advisory Group dedicated to the future 2018-2020 work programme.

It is worth adding that in Horizon 2020, the applicants may include as eligible costs in their proposals, specific studies on gender, as well as training on gender. The aim is to help researchers develop and share gender expertise in relation to the funded projects.

In its September 2015 resolution, the European Parliament stressed, inter alia, ‘the need for full integration of the gender dimension in research and gender balance in participation into Horizon 2020’. The EP also called on the Commission and the Member States to undertake the necessary actions to overcome the gender gap in R&I.

The European Council, in its conclusions of December 2015, pointed the need to:

- strengthen the implementation, monitoring and evaluation of all gender equality objectives in H2020 relating to gender representation in research teams, and decision-making, as well as the gender dimension in research content, at all possible stages of the research cycle;

- explore the possibility of providing more comprehensive, transparent sex-disaggregated data and gender indicators on participation of evaluators and researchers, as well as of the integration of the gender dimension as a research subject in projects and programmes funded by H2020;

- consider inclusion of gender equality and gender mainstreaming as regular part of National Contact Points (NCP) training and events, as well as in communication and dissemination materials related to H2020.

Gender equality in research and innovation

Gender equality in Horizon 2020 is strongly related to gender equality in R&I in the EU in general. This is why it is worth looking at the current situation in the EU. The European Commission report She figures 2015 showed that, in 2012:

1) PhD graduates:

- women made up 47.3 % of PhD graduates in the EU (EU-28) (from 41.4 % in the Czech Republic to 59.9 % in Latvia);

- women accounted for 28% of PhD graduates in engineering, manufacturing and construction, and 21 % in computing (from 6 % in Hungary to 45 % in Ireland), and for 59 % of the PhD graduates in health and welfare (from 47 % in France to 67 % in Holland);


26 For a better integration of the gender dimension in Horizon 2020 Work Programme 2016-2017, op. cit.

27 European Parliament resolution of 9 September 2015 on women’s careers in science and universities, and glass ceilings encountered (2014/2251(INI)).

2) Employment in science and technology (S&T):

- according to the ERA 2014 survey, around 36 % of research performing organisations (RPOs) introduced gender equality plans;
- in 2011, women accounted for 33 % of researchers (EU-28) – a figure unchanged since 2009 (EU-27);
- women made up less than 45 % of scientists and engineers;
- women are generally more likely than men to work part-time and/or to have ‘precarious contractual arrangements’: in 2012 in the EU, 13.5 % of women in research were in part-time employment (versus 8.5 % of men), and 10.8 % had precarious contracts (versus 7.3 % of men). However, the gender gap in part-time employment rates is far lower amongst researchers in the higher education sector than in the economy as a whole;
- in 2013, women made up only 21 % of top-level researchers (grade A), showing very limited progress compared to 2010 (20 %). At grade C level, the difference against men stands at 10 percentage points, while at grade A level it reaches 58 percentage points. A generational effect exists amongst grade A researchers, in that women tend to occupy a higher proportion of positions in the youngest age group (49 %) relative to the older age groups (22 %);
- in 2014, the proportion of women among heads of HEIs in the EU-28 rose to 20 % from 15.5 % in the EU-27 in 2010. Within the EU-28, women make up 28 % of scientific and administrative board members and only 22 % of board leaders;
- men in the EU tend to have greater success in funding applications in national programmes: in 2013 the success rate for men was 31.8 %, and for women 27.4 %;
- women are less likely than men to hold the corresponding author role in scientific publications or to apply for patents – between 2010 and 2013, only 9 % of patent applications in the EU registered a woman as the inventor; however, as corresponding authors, women and men appear to have relatively similar scores when it comes to the expected impact of their papers and their propensity to co-author papers with international partners (i.e. papers published by authors from at least two countries located within the EU and/or beyond);

3) Gender dimension in research content:

- the gender dimension was the most prevalent in the social sciences – 6 % in the EU-28 in 2010-2013; the humanities and the medical sciences displayed a more modest share of publications with a gender dimension – 3 %; in agricultural sciences, engineering and technology, and natural sciences the gender aspect was generally lacking or minor;
- engineering and technology had one of the lowest proportions of publications with a gender dimension (0.1 % in 2010-2013), but the highest growth rate between 2002 and 2013 (14 %).

In 2005, the Council invited Member States to formulate targets for the participation of women in particular by increasing significantly the number of women in leading positions, with the aim of initially reaching the goal of 25 % in the public sector, as well as boosting their participation in industrial research and technology. This goal is still not reached at
the EU-28 level, as pointed out by the Council in its conclusions on advancing gender equality in the European Research Area in 2015.\(^\text{29}\)

The United Kingdom House of Commons Science and Technology Committee argues that the usual focus on boosting the number of girls taking up careers in science is not enough, as "efforts are wasted if women are subsequently disproportionately disadvantaged in scientific careers compared to men."\(^\text{30}\)

A significant correlation is observed between measures taken at research performing organisation (RPO) level, including gender equality plans, and the existence of national laws, strategies and/or incentives to foster institutional change.\(^\text{31}\) The European Commission, seeing the correlation, underlines in its publication *Gender Equality Policies in Public Research*, the importance of institutional change in research organisations and the role of Member States in the process. Institutional change tends to promote gender equality within RPO with the aim of: a) removing cultural and institutional barriers that generate direct or indirect discrimination against women in scientific careers and decision-making; b) integrating a gender dimension in research content.

The European Commission encourages Member States to create a gender positive legal and political environment and provides incentives for change. However, a lot remains to be done in this area, as data from the European research area survey of 2014 shows, only around 36% of RPOs in the EU (out of 1,200 answering the survey) introduced gender equality plans in 2013. The shares varied across the EU: from 81% in Germany and 79% in Sweden, to 7% in Portugal and 4% in Slovakia.\(^\text{32}\)

The International Day of Women and Girls in Sciences is celebrated on 11 February under the auspices of the United Nations.\(^\text{33}\)

**Further reading**

More information can be found in the EIGE publications: *Integrating gender equality into academia and research organisations. Analytical paper* and the EPRS publication *Women in science and research*.

The European Parliament also prepared a video on *Women in science: how to achieve equality in academia*.

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\(^{29}\) Council Conclusions on Advancing Gender Equality in the European Research Area of 1 December 2015.

\(^{30}\) Why aren’t there more women in science? The industry structure is sexist, The Guardian, 31 May 2016.


\(^{32}\) She Figures 2015, European Commission.

\(^{33}\) International Day of Women and Girls in Science, UNESCO.
2. International cooperation

**Key findings**

- Horizon 2020 is a main opening for the EU to international cooperation in the research and innovation field with non-EU countries.
- International cooperation however decreased under H2020, in comparison with FP7.
- Science diplomacy is an important tool and mechanism for improving relations with key countries and regions (‘an instrument of soft power’), but remains insufficiently utilised in Horizon 2020.

The EU share in global research and development is decreasing. According to the latest European Commission data:

- 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;
- the EU share of world gross expenditure in R&I fell from a quarter in 2000 to one fifth in 2013;
- the EU share of the world’s PCT patents dropped from one third in 2000 to one fourth in 2013;
- the EU share of world output of scientific publications fell from one third in 2000 to a quarter in 2013;
- nevertheless, the EU still leads in terms of highly cited scientific publications, retaining a third of the world share.

**Strategy for international cooperation in R&I**

International cooperation under Horizon 2020 contributes to the implementation of the EU strategy on international cooperation in the field of research and innovation adopted in 2012.

The strategy on international cooperation has three objectives, to:

1) strengthen the Union’s excellence and attractiveness in research and innovation and its economic and industrial competitiveness;
2) tackle global societal challenges;

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34 *Issue papers for the High Level Group on maximizing the impact of the EU research and innovation programmes*, European Commission, 2017 and *Open innovation, open science, open to the world. A vision for Europe*, European Commission, 2016.

35 Further information on the patent cooperation treaty (PCT) can be found at the World Intellectual Property Organisation.

36 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: *Enhancing and focusing EU international cooperation in research and innovation: A strategic approach*, COM(2012) 497.
3) support the Union’s external policies.

The objectives apply in different ways, depending on the partner country and region:

- for European Economic Area (EEA), European Free Trade Association (EFTA), and EU enlargement countries, the focus is on fostering integration in the European research area (ERA);
- for European neighbourhood policy countries, the objective is to support a joint knowledge and innovation space, bringing together R&I cooperation, mobility for academics, and capacity-building;
- for industrialised countries and emerging economies, the objectives include increasing competitiveness, joint tackling of global challenges and increasing participation in international value chains;
- for developing countries, the emphasis is on promoting sustainable development and addressing global societal challenges.

The strategy is structured around six main areas of action:

1) opening up the EU’s flagship R&I programme, Horizon 2020, to researchers and innovators from across the world, and supporting targeted activities on the basis of priority areas for cooperation with international partner countries and regions;
2) improving the framework conditions that underpin international cooperation;
3) playing a leading role in multilateral fora and working with international organisations;
4) reinforcing the partnership with Member States;
5) intensifying synergies with the EU’s external policies;
6) widening communication and strengthening monitoring.

Rules within Horizon 2020

The EU strategy on international cooperation underlines Horizon 2020’s openness to international cooperation, inter alia:

- Horizon 2020 will be fully open to participation from all over the world;
- the European Research Council and Marie Skłodowska-Curie Actions (MSCA) will operate on a fully researcher-driven basis, open to researchers from third countries;
- research infrastructures activity will have a specific focus on international cooperation. Its e-infrastructures component has an inherent international dimension in its support for collaboration through digital means.

However, not all third country participants are automatically eligible for funding.

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37 Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Implementation of the strategy for international cooperation in research and innovation, COM(2016) 657.

38 Ibidem.
The vision expressed in the EU strategy was matched in the Horizon 2020 regulation itself, beginning with Recital 41, which, inter alia, defines that international cooperation activities under the programme ‘should be maintained at least at the level of the seventh framework programme’.

Article 27 of the Horizon 2020 regulation defines the objectives of the international cooperation with third countries and international organisations within the programme:
- strengthening the Union’s excellence and attractiveness in research and innovation as well as its economic and industrial competitiveness;
- effectively tackling common societal challenges;
- supporting the Union's external and development policy objectives, complementing external and development programmes, including international commitments and their related goals, such as the achievement of the United Nations’ Millennium Development Goals. Synergies will be sought with other Union policies.

To reach these objectives, participation in Horizon 2020 was opened to researchers and organisations from all over the world and targeted cooperation activities with certain countries and/or regions were also applied.

**Horizon 2020 and strategy implementation results**

The first report on implementation of the strategy ([COM(2014) 567](#)), showed that, although progress was made since the launch of the strategy, more needs to be done. The conclusions of the report were:
- international cooperation must be better integrated in the Horizon 2020 strategic programming and work programme (WP) development;
- work on removing obstacles to cooperation must continue;
- global approaches are needed to tackle global challenges more effectively;
- sustained focus is needed on improving synergies with Member States and with EU external policies;
- the communication strategy should be refined; and quantitative indicators should underpin the monitoring of the effectiveness of the strategy.

The second report on the implementation of the strategy ([COM(2016) 657](#)), was published in October 2016. The report highlights the actions taken in response to the conclusions of the first report, and gives recommendations for future actions. With regards to the international dimension of Horizon 2020, the report underlined, inter alia, that:
- Horizon 2020 work programmes (WPs) encourage international participation in consortia and the number of topics flagged as particularly relevant for international cooperation has increased, from 12 % of topics in FP7 to over 27 % in the 2014-17 WPs;
- the share of participation by entities from non-associated international partner countries in grant agreements for collaborative actions has fallen from 4.9 % under FP7 to just 2.4 % under Horizon 2020. Only 11.7 % of Horizon 2020 grant agreements include one or more partners from outside the EU Member States (MS) and the Horizon 2020 Associated Countries (AC), compared to 20.5 % under FP7.
The EU contribution to non-MS/AC entities has fallen from 2.0 % of the budget under FP7, to 0.7 % under Horizon 2020. The total budget invested by entities from international, non-associated partner countries in cooperating in Horizon 2020 projects has fallen from €60 million to €29 million a year;

- the fall in international participation in grant agreements is partly explained by a combination of factors:
  - the change in funding rules for Brazil, Russia, India, China and Mexico;
  - recent conflicts and socio-political developments in the EU neighbourhood;
  - some countries became associated to Horizon 2020 while they were not in FP7, i.e. Ukraine, Tunisia, Armenia and Georgia;
  - contrary to FP7, international participation is mandatory in only a few topics flagged for international cooperation;
  - the programme's increased focus on closer-to-market activities required an appropriate balance between engaging in international cooperation and safeguarding the interests of EU companies;

- with regard to the level of mobility of individual researchers:
  - of all the European Research Council (ERC) Principal Investigators, 2.6 % came to EU MS/AC from non-associated international partner countries. A number of early-career scientists were supported by non-MS/AC funding agencies to join research teams run by ERC grantees temporarily, through implementing arrangements now in place with seven countries (Argentina, China, Japan, Mexico, South Africa, South Korea, and the USA);
  - under the individual fellowships initiative of the Marie Skłodowska-Curie Actions (MSCA), non-associated international partner countries received 280 researchers from EU MS/AC, while 521 researchers from these countries obtained fellowships in Europe, corresponding to 20 % of all grantees of individual fellowships. Moreover, entities from non-associated international partner countries participated 459 times in international and inter-sectoral cooperation through R&I staff exchanges (RISE) and 209 times in innovative training networks (ITN), corresponding to 29 % of all RISE participations and 5 % of all ITN participations;

- the priority was to encourage and assist industrialised countries and emerging economies in setting up mechanisms for funding the participation of their researchers in Horizon 2020 actions. There are currently mechanisms in place in several countries, including Australia, China, India, Japan, Mexico, Russia, and South Korea, as well as regions of Brazil and the province of Quebec (Canada), and work is continuing to broaden their scope of application;

- there was a focus on the pre-accession and neighbourhood countries, to promote their integration into the ERA;

- the Commission continued its 'Horizon 2020 – Open to the World' communication campaign, to ensure that the programme is known worldwide.
The ‘external dimension of the ERA serves as a paradigm for the EC to gradually shape a vision of a “Global Research Area” with priorities varying according to the EU’s specific objectives for each region or country’.39

The conclusions of the second report were:

- the objectives of the strategy and the need for coherent action are even more relevant today than when the strategy was issued four years ago;
- the improvements are necessary, with regard to using Horizon 2020 as a vehicle for international cooperation;
- science and technology (S&T) policy dialogues and cooperation roadmaps shall continue to serve as a basis for priority-setting in Horizon 2020 programming, and the international dimension of work programmes should allow international cooperation activities to reach the FP7 level;
- good framework conditions for international cooperation should be ensured within a vision for a ‘global research area’;
- further actions are necessary to widen international participation and strengthen the EU’s role in global multilateral fora and international organisations;
- stronger synergies with the actions of Member States should be sought;
- science diplomacy should be used more extensively as an instrument of the EU’s external policies;
- progress has been made towards achieving the objectives of the strategy, but more needs to be done to tap the full potential of the ‘open to the world’ policy priority.40

The Horizon 2020 Monitoring Report 2015 also observes a significant decrease in international cooperation under Horizon 2020 in comparison to FP7, and points out that despite the increase from 12 % in FP7 to 22 % in Horizon 2020 in topics flagged for international cooperation the results are lower than expected, and this drop is observed both in the share of participations of entities from non-associated third countries and the EU contribution to third country participants.41

The report points out, inter alia, that:

- participation from third countries in signed grants in Horizon 2020 numbered 670 (with the biggest representation from the USA at 81, South Africa at 60, and China at 59), in comparison to participation in FP7 – 4 721 over the seven years of the programme (335 per year in H2020 and 674 per year in FP7);

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39 The list of science and technology agreements signed by the EU with third countries.

40 ‘Horizon 2020 is Open to the World, meaning that researchers and innovators, from all over the world, regardless of their place of origin or establishment can take part in Horizon 2020. Furthermore, in many cases, the EU will fund, at least partly, the participation of the international partners. In addition to this general openness, many calls particularly encourage or require cooperation with non-EU partners or target a certain country or region’, Horizon 2020, International Cooperation Opportunities in the Work Programme 2016-2017, European Commission, 2016.

41 The comparison is made against all FP7 projects except for MSCA and ERC.
- the EU contribution to the participation of signed grants was €73.56 million in Horizon 2020 and €575.64 million in FP7;
- Some 1 787 associated countries participated in signed grants in Horizon 2020 (with the biggest representation from Switzerland at 623, Norway with 456 and Israel at 236), in comparison to participation in FP7 at 8 420;
- the EU contribution to the participations of signed grants was €452.87 million in Horizon 2020 and €2 454.9 million in FP7;
- MSCA participations account for more than half of all participations by third countries in Horizon 2020, however, participation of third countries in MSCA projects numbered 909 in Horizon 2020 against 2 639 in FP7 (with the USA at 381 the biggest participant in Horizon 2020, and at 934 in FP7).

The status of indicators on international cooperation with third countries (excluding Switzerland) shows the difference between Horizon 2020 and FP7 (Table 2).

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>Total</th>
<th>FP7 Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of third country participations in collaborative projects</td>
<td>2.1%</td>
<td>2.8%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>4.3%**</td>
</tr>
<tr>
<td>Share of EU financial contribution attributed to third country participations in collaborative projects</td>
<td>0.5%</td>
<td>1.0%</td>
<td>1.1%</td>
<td>0.8%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Share of budget of topics in the work programme 2014-2015 mentioning at least one third country or region</td>
<td>22%</td>
<td>22%</td>
<td>:</td>
<td>22%</td>
<td>12%</td>
</tr>
<tr>
<td>Share of H2020 grant agreements with at least one third country participant</td>
<td>11.58%</td>
<td>13.22%</td>
<td>10.5%</td>
<td>11%</td>
<td>18.3%</td>
</tr>
<tr>
<td>Total budget invested by third country organisations in H2020 projects</td>
<td>€24.56m</td>
<td>€32.92m</td>
<td>€33.0m</td>
<td>€57.48m</td>
<td>€60.1m/year</td>
</tr>
</tbody>
</table>

*For topics implemented through collaborative projects.
**For the same countries as in Horizon 2020

According the second report on the implementation of the strategy, several co-funding mechanisms have already been negotiated to enable funding from Horizon 2020 for non-EU/non-Associated Country participants: a) a co-funding mechanisms covering all thematic areas: South Korea, Mexico, Russia, Chinese Taipei; b) a co-funding mechanisms covering selected thematic areas: Australia, China, Hong Kong & Macao, India, Japan, c) a co-funding by region: Canada (Quebec), Brazil (São Paulo, Santa Catarina, Minas Gerais, Goiás).
Science diplomacy in general terms

The EU strategy promotes the use of ‘science diplomacy’ as an instrument of soft power and a mechanism for improving relations with key countries and regions.

The Royal Society in the UK states, in its publication: New frontiers in science diplomacy of 2010, that science diplomacy is still a fluid concept, but can usefully be applied to the role of science, technology and innovation in three dimensions of policy: a) science in diplomacy – informing foreign policy objectives with scientific advice; b) diplomacy for science – facilitating international science cooperation; and c) science for diplomacy – using science cooperation to improve international relations between countries.

According to the Royal Society: ‘Science diplomacy seeks to strengthen the symbiosis between the interests and motivations of the scientific and foreign policy communities. For the former, international cooperation is often driven by a desire to access the best people, research facilities or new sources of funding. For the latter, science offers useful networks and channels of communication that can be used to support wider policy goals. Foreign ministries should place greater emphasis on science within their strategies, and draw more extensively on scientific advice in the formation and delivery of policy objectives’.

As previously mentioned, the EU strategy on international cooperation envisages the use of science diplomacy in international R&I cooperation ‘as an instrument of soft power and a mechanism for improving relations with key countries and regions’.  

The second report on the implementation of the strategy on international cooperation underlines that science diplomacy is particularly important in cooperation in areas of conflict and crisis. The strategy gives examples of such cooperation:

- the joint comprehensive plan of action with Iran, which includes R&I cooperation in areas such as renewable energy, climate change and bioeconomy;
- the synchrotron-light for experimental science and applications (SESAME) project which gathers researchers from the Middle East on a ‘third-generation’ synchrotron light source based in Jordan.

The EU played a major role in the development of the SESAME project through technical and financial assistance provided by several EU Member States and the European Commission of more than €12 million. Some €5 million was granted under the 7th framework programme.

In its conclusion, the report states, that ‘science diplomacy shall be used more extensively as an influential instrument of the EU’s external policies to build bridges in times of conflict, help prevent crises and disasters, better understand complex issues and develop shared strategies for good stewardship of our planet. It shall also be used for developing common standards for better market access and improving trade. EU diplomacy must leverage the elevated language of science for its remarkable uniting power’.

42 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Enhancing and focusing EU international cooperation in research and innovation: A strategic approach, COM(2012) 497.

43 EU and Middle-East Building Bridges through Science Diplomacy, News Alert of 13 April 2015.
The European External Action Service (EEAS) recognises the benefits of science diplomacy and underlines, that ‘science cooperation is a fantastic way of developing links of all kinds (human, political, business oriented…), and maintaining them when other kinds of direct relations are difficult (cf. Iran). Scientific exchanges create opportunities to raise awareness among the scientific community in third countries on EU values, visions and priorities’. The EEAS stresses that strengthening the EU’s global position in research, innovation and technology, passes through proactive international cooperation.

The EEAS also recognises the role of Horizon 2020 in the implementation of the new EU global strategy in the area of security and defence presented in 2016. Promoting H2020 activities is an important part of EU public diplomacy, particularly while seeing the role of H2020 in European neighbourhood policy, international policy and development policy.44

The High Level Expert Group evaluating FP7 underlined the significance of science diplomacy and ‘(...) sees an urgent need for a thematically differentiated strategy on international cooperation and increased efforts for bilateral agreements on collaboration in science, technology and innovation (STI). Investments in international cooperation have to be made through the strategic involvement of partners from outside the EU in areas of key importance to European goals. This includes leadership in innovations, global societal challenges, as well as science diplomacy’.45

Science diplomacy in Horizon 2020

Science diplomacy is envisaged as a tool to enhance cooperation with non-EU countries both in programme regulations and in work programmes. The Council decision establishing the specific programme implementing Horizon 2020 stressed the need for the use of diplomacy in the formal and informal international arena with governmental and non-governmental actors. The work programme 2016-2017 states that ‘open to the world means to engage more in science diplomacy and in global scientific and technological collaboration, to remain relevant and competitive, and to lead the way in developing global research and innovation partnerships to address global challenges’.

The data from the Horizon 2020 monitoring report 2015 shows that in 2015, inter alia:
- within SC3 societal challenge 6: Europe in a changing world, a call was launched: ‘Europe as a global actor’ (H2020-INT-2015), with a budget of €34.68 million, with European cultural and science diplomacy being one of the areas of interest, and the objective to exploit the potential of culture and science in EU external relations;
- several high-level events were organised with a special focus on science diplomacy, e.g. ‘Building a knowledge oriented and forward-looking EU neighbourhood’, co-organised with the European Parliament, and ‘Addressing shared challenges through science diplomacy: the case of EU-Middle East regional cooperation’, that took place in Jordan;


Commission DG for Research & Innovation (RTD) was an important contributor to the corporate campaign of the ‘European Year of Development’, managed by the DG for Development & Cooperation (DEVCO).

Further results are expected in the near future. New calls are also to be launched: a) ENG-GLOBALLY-01-2017: Strengthening Europe's position in the global context: science diplomacy and intercultural relations; and b) ENG-GLOBALLY-04-2017: Science diplomacy for EU neighbourhood policies.

The second report on the implementation of the strategy on international cooperation in relation to global societal challenges underlines the EU’s engagement in global health diplomacy. It points out that, under H2020, the EU invested nearly €250 million in topics that contribute directly to the objectives of a range of global health partnerships. In comparison, investments of around €850 million came from other sources. The EU is also engaged (with funding of €683 million) in the second European and Developing Countries Clinical Trials Partnership (EDCTP2), gathering 14 European and 14 African countries in work on the clinical development of new or improved interventions to prevent or treat HIV/AIDS, tuberculosis, malaria and neglected infectious diseases in sub-Saharan Africa.

Assessment of international cooperation in the three programme priorities is presented in the briefing papers in annex.

Further reading
More information can be found in the EPRS publications: EU scientific cooperation with third countries, Science and research. Upgrading EU-US cooperation, Partnership for Research and Innovation in the Mediterranean Area (PRIMA).

3. Expert evaluation of proposals

<table>
<thead>
<tr>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposals were evaluated by independent experts.</td>
</tr>
<tr>
<td>Among the evaluators, representatives from academia dominated.</td>
</tr>
<tr>
<td>Evaluators came from the EU-15 (67 %), and EU-13 (14 %).</td>
</tr>
<tr>
<td>Three Member States (Germany, Italy and the United Kingdom) provided 27 % of the evaluators.</td>
</tr>
<tr>
<td>Women represented 37 % of evaluators and 52 % of members of the advisory groups.</td>
</tr>
</tbody>
</table>

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47 In 2016, the EC organised a public consultation process regarding the implementation of the EDCTP2.
Rules within Horizon 2020

The evaluation of proposals is carried out by independent experts. Experts are chosen from a database based on the call for the establishment of a database of prospective independent experts to assist Commission services with tasks in connection with Horizon 2020. All interested candidates have to register through the Horizon 2020 participant portal. The principles of the work of experts are: independence, impartiality, objectivity, accuracy and consistency. The Commission signs contracts with experts evaluators.

The rules for participation and dissemination (Article 40(2), paragraph 4) provide that ‘when appointing independent experts, the Commission or the relevant funding body shall take appropriate measures to seek a balanced composition within the expert groups and evaluation panels in terms of various skills, experience, knowledge, geographical diversity and gender, and taking into account the situation in the field of the action. Where appropriate, private-public sector balance shall also be sought’.

The Commission and executive agencies responsible for the implementation of Horizon 2020 try to attract experts in various fields. The Executive Agency for Small and Medium-sized Enterprises (EASME), together with calls for experts, published an advertisement ‘Become a Horizon 2020 proposal evaluator’, including short presentations by experienced proposal evaluators. The call was directed at experts in the various fields, from the following sectors: a) local, regional and national administration, including environmental and civil protection agencies; b) industry, business associations and innovation agencies; c) universities and research institutes. This promotion is particularly important, as experts belonging to certain categories (e.g. women, experts from industry), depending on the field, may sometimes be underrepresented in the overall population of experts in the database.

The importance of the evaluation and peer reviewing was underlined by, inter alia, the researchers gathered at the Copenhagen Research Forum II. They underlined that ‘the quality of the peer review panels directly influences the margin of error in the project evaluations. The peer reviewers need to be honest, transparent and fair, working to the highest professional standards’.

Results within Horizon 2020

According to the Horizon 2020 monitoring report 2015, as at the end of August 2016:48

- 121 124 experts were registered in the database, of these 31.1 % were women;
- 16 825 evaluators were contracted to make a total of 591 927 evaluations;
- 5 840 evaluators (35 %) had experience as evaluators in FP7, 9 695 (58 %) were newcomers;
- 6 187 women (37 %) and 10 483 men (62 %) were involved in the evaluations;
- 223 women (52 %) and 206 men (48 %) worked in the advisory groups;
- among evaluators, representatives of academia dominated (38 %), followed by representatives of research centres (24 %) and the private sector (16 %) (Figure 2). In relation to the share of eligible proposals submitted by organisations (39.1 % by

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48 The shares may not sum up to 100 %, as some data were not available.
academia, 35.2 % by the private sector and 18.4 % by research organisations), the underrepresentation of the private sector representatives is even more visible;

- 27 % of the EU-28 evaluators came from only three Member States: Germany, Italy and the United Kingdom, and the share rose to 42 % by adding evaluators from Spain and France (Figure 3). However, those countries’ share in the EU population is even higher – 40.6 % for the first three and 62.7 % for all five;

- among the non-EU-28 evaluators, the USA had the largest representation (20 %) (see Figure 4).

**Figure 2 - Professional and national origin of evaluators in H2020**

![Diagram showing the professional and national origin of evaluators in H2020](image)

**Source:** Horizon 2020 monitoring report 2015
The Commission gathers evaluators’ opinions on the quality of the proposal evaluation process and the procedures applied. In 2014, 3 278 evaluators, out of 8 543 invited, sent responses; in 2015, 1 400 out of 3 319. In both years, evaluators were satisfied with the way in which evaluations were conducted with respect to impartiality, confidentiality and fairness. In particular the level of quality of the evaluation task was rated as ‘excellent’, ‘good’ or ‘satisfactory’ by 96.6 % of respondents in 2014 and 96 % in 2015. The share of respondents, having previously evaluated research proposals for national or international research funding schemes, and rating the EU evaluation process as ‘good’ or ‘excellent’ was 79.2 % in 2014 and 79 % in 2015.

Assessment of the evaluation criteria and processes is presented in the briefing papers in annex.
III – Conclusions

- EU Member States’ innovativeness is heterogeneous, with leaders like Sweden ranked second in the Global Innovation Index, the United Kingdom ranked third, and Finland, fifth, whereas Croatia and Romania ranked 47th and 48th respectively. Appropriate policies should therefore be applied to ensure equal opportunities in access to H2020 funds.

- The distribution of the Horizon 2020 funds between Member States is highly concentrated. After two years, 43.3 % of the Horizon 2020 funds benefited organisations from only three Member States (France, Germany, and the United Kingdom), with the share rising to 67.7 % when Italy, the Netherlands and Spain are added.

- The share of women in advisory groups (51.9 %) matches and even goes beyond the target level of 50 %, but in other panels and groups the share is between 31.1 % and 36.7 %, which means it remains below the 40 % target. The gender dimension in the research and innovation content was visible in 36.2 % of granted projects, but the Advisory Group on Gender stresses that still more can be done to better integrate the gender dimension in the topics and calls of the work programmes.

- International cooperation is not the most successful element of the Horizon 2020 programme. It was expected that international cooperation under Horizon 2020 would be maintained at least at the level of the seventh framework programme, however the results for the first two years show that the level is significantly lower than in the FP7. There were some changes in Horizon 2020 in comparison to the FP7, which could have affected negatively the level of the international cooperation in Horizon 2020, like the change of funding rules for some main partners, the change of the status of e.g. Ukraine (associated country under H2020) or the socio-political instability in the EU neighbourhood. Nevertheless, additional effort should be made to enhance international cooperation in the programme.

- The underrepresentation of the private sector (16 %) in the evaluation panels was visible in comparison to the representation from academia (38 %) and research centres (24 %). Private sector under-representation was even more visible when comparing the share of experts to the share of eligible proposals in Horizon 2020: 39.1 % from higher and secondary education (HES), 35.2 % from the private sector and 18.4 % from research organisations. Gender balance in evaluation panels was also not yet fully in place: 35 % evaluators were women, against 62 % men.
Selected references

EU legal documents


European Parliament resolution of 9 September 2015 on women’s careers in science and universities, and glass ceilings encountered (2014/2251(INI)).

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Annexes

Annex I - Research and development expenditure, 2005 and 2015

<table>
<thead>
<tr>
<th>Country</th>
<th>R&amp;D Intensity (R&amp;D expenditure as % of GDP)</th>
<th>R&amp;D expenditure (in € millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-28</td>
<td></td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td>1.74</td>
<td>2.03</td>
</tr>
<tr>
<td>Austria</td>
<td>2.38</td>
<td>3.07</td>
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<tr>
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</tr>
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<tr>
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</tr>
</tbody>
</table>


* Ireland (2005 and 2014)
## Annex 2 - Occurrence of regional performance groups by country

<table>
<thead>
<tr>
<th>Performance group European Innovation Scoreboard 2016</th>
<th>Regional Innovation Leaders</th>
<th>Regional Strong Innovators</th>
<th>Regional Moderate Innovators</th>
<th>Regional Modest Innovators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36</td>
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</tbody>
</table>

*Source: Regional Innovation Scoreboard 2016.*
Annex 3 - EU Member States among 48 most innovative countries in the world

<table>
<thead>
<tr>
<th>Country</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>66,3</td>
</tr>
<tr>
<td>Sweden</td>
<td>63,6</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>61,9</td>
</tr>
<tr>
<td>United States of America</td>
<td>61,4</td>
</tr>
<tr>
<td>Finland</td>
<td>59,9</td>
</tr>
<tr>
<td>Singapore</td>
<td>59,2</td>
</tr>
<tr>
<td>Ireland</td>
<td>59,0</td>
</tr>
<tr>
<td>Denmark</td>
<td>58,5</td>
</tr>
<tr>
<td>Netherlands</td>
<td>58,3</td>
</tr>
<tr>
<td>Germany</td>
<td>57,9</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>57,1</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>57,1</td>
</tr>
<tr>
<td>Iceland</td>
<td>56,0</td>
</tr>
<tr>
<td>Hong Kong (China)</td>
<td>55,7</td>
</tr>
<tr>
<td>Canada</td>
<td>54,7</td>
</tr>
<tr>
<td>Japan</td>
<td>54,5</td>
</tr>
<tr>
<td>New Zealand</td>
<td>54,2</td>
</tr>
<tr>
<td>France</td>
<td>54,0</td>
</tr>
<tr>
<td>Australia</td>
<td>53,1</td>
</tr>
<tr>
<td>Austria</td>
<td>52,6</td>
</tr>
<tr>
<td>Israel</td>
<td>52,3</td>
</tr>
<tr>
<td>Belgium</td>
<td>52,0</td>
</tr>
<tr>
<td>Norway</td>
<td>52,0</td>
</tr>
<tr>
<td>Estonia</td>
<td>51,7</td>
</tr>
<tr>
<td>China</td>
<td>50,6</td>
</tr>
<tr>
<td>Malta</td>
<td>50,4</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>49,4</td>
</tr>
<tr>
<td>Spain</td>
<td>49,2</td>
</tr>
<tr>
<td>Italy</td>
<td>47,2</td>
</tr>
<tr>
<td>Portugal</td>
<td>46,4</td>
</tr>
<tr>
<td>Cyprus</td>
<td>46,3</td>
</tr>
<tr>
<td>Slovenia</td>
<td>46,0</td>
</tr>
<tr>
<td>Hungary</td>
<td>44,7</td>
</tr>
<tr>
<td>Latvia</td>
<td>44,3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>43,4</td>
</tr>
<tr>
<td>Lithuania</td>
<td>41,8</td>
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<td>Slovakia</td>
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<td>Bulgaria</td>
<td>41,4</td>
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<tr>
<td>Poland</td>
<td>40,2</td>
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<tr>
<td>Greece</td>
<td>39,8</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>39,4</td>
</tr>
<tr>
<td>Turkey</td>
<td>39,0</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>38,5</td>
</tr>
<tr>
<td>Republic of Moldova</td>
<td>38,4</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>38,4</td>
</tr>
<tr>
<td>Chile</td>
<td>38,4</td>
</tr>
<tr>
<td>Croatia</td>
<td>38,3</td>
</tr>
<tr>
<td>Romania</td>
<td>37,9</td>
</tr>
</tbody>
</table>

*Source: Global Innovation Index 2016.*
## Annex 4 – Horizon 2020 - detailed budget

<table>
<thead>
<tr>
<th>Horizon 2020</th>
<th>Estimated budget</th>
<th>Changed budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In %</td>
<td>In € millions*</td>
</tr>
<tr>
<td>I. <strong>Excellent science</strong>, of which:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. European Research Council</td>
<td>17.00</td>
<td>13 095</td>
</tr>
<tr>
<td>2. Future and emerging technologies</td>
<td>3.50</td>
<td>2 696</td>
</tr>
<tr>
<td>3. Marie-Sklodowska-Curie actions</td>
<td>8.00</td>
<td>6 162</td>
</tr>
<tr>
<td>4. European research infrastructures (including einfrastructures)</td>
<td>3.23</td>
<td>2 488</td>
</tr>
<tr>
<td>II. <strong>Industrial leadership</strong>, of which:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Leadership in enabling and industrial technologies</td>
<td>17.60</td>
<td>13 557</td>
</tr>
<tr>
<td>2. Access to risk finance</td>
<td>3.69</td>
<td>2 842</td>
</tr>
<tr>
<td>3. Innovation in SMEs</td>
<td>0.80</td>
<td>616</td>
</tr>
<tr>
<td>III. <strong>Societal challenges</strong>, of which:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Health, demographic change and wellbeing</td>
<td>9.70</td>
<td>7 472</td>
</tr>
<tr>
<td>2. Food security, sustainable agriculture and forestry, marine maritime and inland water research and the bioeconomy</td>
<td>5.00</td>
<td>3 851</td>
</tr>
<tr>
<td>3. Secure, clean and efficient energy</td>
<td>7.70</td>
<td>5 931</td>
</tr>
<tr>
<td>4. Smart, green and integrated transport</td>
<td>8.23</td>
<td>6 339</td>
</tr>
<tr>
<td>5. Climate action, environment resource efficiency and raw materials</td>
<td>4.00</td>
<td>3 081</td>
</tr>
<tr>
<td>6. Europe in a changing world - Inclusive, innovative and reflective societies</td>
<td>1.70</td>
<td>1 309</td>
</tr>
<tr>
<td>7. Secure societies – Protecting freedom and security of Europe and its citizens</td>
<td>2.20</td>
<td>1 695</td>
</tr>
<tr>
<td><strong>Spreading excellence and widening participation</strong></td>
<td><strong>1.06</strong></td>
<td><strong>816</strong></td>
</tr>
<tr>
<td>Science with and for society</td>
<td>0.60</td>
<td>462</td>
</tr>
<tr>
<td>European Institute of Innovation and Technology (EIT)</td>
<td>3.52</td>
<td>2 711</td>
</tr>
<tr>
<td>Non-nuclear direct actions of the JRC</td>
<td>2.47</td>
<td>1 903</td>
</tr>
<tr>
<td><strong>TOTAL EU REGULATION</strong></td>
<td><strong>100</strong></td>
<td><strong>77 028</strong></td>
</tr>
<tr>
<td>Fusion indirect actions</td>
<td>45.42</td>
<td>728</td>
</tr>
<tr>
<td>Fission indirect actions</td>
<td>19.68</td>
<td>316</td>
</tr>
<tr>
<td>Nuclear direct actions of the JRC</td>
<td>34.90</td>
<td>560</td>
</tr>
<tr>
<td><strong>TOTAL EURATOM REGULATION 2014-2018</strong></td>
<td><strong>100</strong></td>
<td><strong>1 603</strong></td>
</tr>
</tbody>
</table>

Source: [Factsheet: Horizon 2020 budget](#) and [Regulation (EU) 2015/1017](#).

* In current prices
### Annex 5 – Six Member States - main beneficiaries of Horizon 2020

<table>
<thead>
<tr>
<th>Member State</th>
<th>Rank in budget share</th>
<th>Total EU financial contribution in million euro</th>
<th>Rank in number of participants in signed contracts</th>
<th>Total number of participants</th>
<th>Top collaborative links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>1</td>
<td>3.031,00</td>
<td>2</td>
<td>5.364</td>
<td>1. United Kingdom 2. France 3. Italy 4. Spain 5. Netherlands</td>
</tr>
</tbody>
</table>

Source: Research and Innovation performance and Horizon 2020 country participation, November 2016.
ANNEX I

THE IMPLEMENTATION OF HORIZON 2020

- EXCELLENT SCIENCE -

Research and industry perspective

Briefing paper
by CSES and CSIL

Abstract

This briefing paper assesses implementation of the first two years (2014-16) of the Excellent Science Priority under the Horizon 2020 Framework Programme. The paper specifically looks at the four different objectives funded under Excellent Science - the European Research Council, Future and Emerging Technologies, Marie Skłodowska-Curie actions, and Research Infrastructures. The participation of research and industry groups respectively is also a key issue for the discussion.
AUTHOR
This study has been written by Malin Carlberg (the Centre for Strategy and Evaluation Services) and Emanuela Sirtori (the Centre for Industrial Studies) at the request of the Impact Assessment Unit of the Directorate for Impact Assessment and European Added Value, within the Directorate General for Parliamentary Research Services (DG EPRS) of the General Secretariat of the European Parliament.

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LINGUISTIC VERSIONS
Original: EN

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Manuscript completed in January 2017
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Abbreviations

BRIC  Brazil, Russia, India, China
EFSI  European Fund for Strategic Investments
EIT  European Institute for Innovation and Technology
ERA  European Research Area
ERC  European Research Council
ERCEA  European Research Council Research Executive Agency
ESFRI  European Strategy Forum on Research Infrastructures
FET  Future and Emerging Technologies
HES  Secondary and higher education establishments
ICT  Information and Communication Technologies
KPI  Key Performance Indicators
MSCA  Marie Skłodowska-Curie actions
MSCA ITN  Marie Skłodowska-Curie actions Innovative Training Networks
NCP  National Contact Point
OTH  Other entities
PI  Principle Investigator
PRC  Private for profit companies
PUB  Public bodies (excluding research and education)
REA  Research Executive Agency
R&I  Research & Innovation
RI  Research Infrastructures
REC  Research organisations (excluding education)
SoE  Seal of Excellence
SSH  Social Sciences and Humanities
S&T  Science & Technology
TTG  Time to Grant
TRL  Technology Readiness Level
WP  Work Programme(s)
Executive summary

The Excellent Science Priority under Horizon 2020 is regarded as well designed. The quality of the research and innovation activities undertaken by the Priority appears overall to be extremely high. The design of Excellent Science fits well with the other Priorities of Horizon 2020 (further coordination could be achieved with the Structural Funds). The design also generally fits well with national R&I programmes, although there is room for improvement in e.g. designing a Seal of Excellence certificate that works for Excellent Science.

Excellent Science is successful in funding high-quality projects. However, on the whole the funding allocation for ERC, FET and MSCA is skewed towards high-capacity EU and European countries. This allocation risks concentrating excellence in R&I in a smaller number of European institutions and regions. It is consequently important to discourage further national disparities. The Priority should clearly be driven by excellence, however lower-capacity regions and institutions need to be encouraged to participate and build capacity, including through but not limited to supporting mobility, career development, and recruitment of researchers in industry. Braindrain has become a serious challenge in a number of EU-13 and Associated Countries, which ought to be tackled. Although braindrain within Europe is a considerable challenge, to encourage international mobility, the ERC, FET and MSCA undertake activities to encourage international researchers to relocate to Europe.

Other major concern, partly related to the above, relates to the low success rates, in particular of the ERC, FET and to a certain degree MSCA, and to what extent these risk damaging the reputation of the Excellent Science objectives in the longer-term. There is equally substantial concern about the low levels of newcomers in Excellent Science compared with Horizon 2020 as a whole.

In terms of participant profiles, by its design, Excellent Science is dominated by higher education institutions. But industry does participate in all areas of Excellent Science too. Although there are examples of effective research-industry collaborations, more can be done to integrate different parties in Excellent Science and to encourage sustainable partnerships.

The administrative simplifications introduced under Horizon 2020 are welcomed, although further reforms are needed, in particular relating to auditing. The EC Directorate-Generals and Agencies responsible for implementing the Excellent Science Priory engage in different kinds of coordination activities, which is positive and encouraged.

Although Horizon 2020 – including Excellent Science – receives a substantially larger budget compared to the 7th Framework Programme, there is some concern that the financial increase and the merging of R&I under the Horizon 2020 umbrella has not paid off as expected. Although opinion is split, it is partly felt that Horizon 2020, including Excellent Science, has an overreliance on the linear model of innovation, and an overly technological perspective of innovation, which risks hampering the inclusion of a sufficiently wide range of R&I actors in the programme.
Chapter 1. Introduction


I – Background

The European Parliament’s Committee on Industry, Research and Energy (ITRE) has launched an own-initiative report on the Implementation of the Horizon 2020 framework programme. As part of this, the Directorate for Impact Assessment and European Added Value has commissioned six briefing papers on the implementation of Horizon 2020 covering the priority parts of Excellent Science, Industrial Leadership and Societal Challenges.

II – Purpose of the study

The purpose of this briefing paper is to assess the initial findings of the research and industry perspective of the implementation of the Horizon 2020 framework programme as regards the priority part (‘Pillar’) of Excellent science. By the “research and industry perspective” we mean to assess how different (public and private) participants consider Excellent Science to be performing from the view of their needs and concerns.

III – Research issues

This report covers the Excellent Science Priority of the Horizon 2020 programme – the European Research Council (ERC), Future and Emerging Technologies (FET), Marie Skłodowska-Curie actions (MSCA) and Research Infrastructures (RI).

The Briefing is primarily intended to throw light on the way that the Excellent Science pillar of Horizon 2020 is being implemented, especially in relation to the involvement of a balanced range of relevant partners – higher education, research organisations, public authorities and private sector businesses. Evidence on participation has therefore been one of the focus points for the investigation. At the same time, potential future developments in the priorities and implementation of the Priority have been of interest.

IV – Methodological approach

The assignment was structured over three phases, an inception phase (preparatory and structuring tasks), a data collection phase and an analysis and reporting phase.

During the data collection phase of the research, a number of Tasks and sub-Tasks were carried out. These covered a review of secondary data and information and an interview programme (see Annex for details).
Chapter 2. Overview of implementation

Key findings

- This chapter first sets out the objectives of each of the four parts of Excellent Science (ERC, FET, MSCA, RI).
- The funding allocated to date is analysed for each of the Excellent Science areas. This chapter also discusses participation and newcomer rates, where there is evidence of distinct differences between the EU-28 countries.
- By design, Excellent Science is dominated by higher education institutions. Chapter 2 looks at industry involvement and research-industry collaboration within the Excellent Science Priority.

Chapter 2 provides an overview of planned versus actual implementation under the Excellent Science Priority. In order to facilitate a discussion on implementation in the latter part of this report, we begin with an analysis of the Work Programmes (WPs) under Excellence Science (section I), which is followed by an assessment of the budget allocation from the research and industry perspectives (II) and an analysis of actual research and industry involvement in the Excellent Science Priority (III).

I – Analysis of objectives and targets of the Programme

Excellent Science is the first priority of Horizon 2020. Its aims are to reinforce and to extend the excellence of the Union’s science base and to consolidate the ERA in order to make the EU’s research and innovation system more competitive on a global scale. It consists of four specific objectives (ERC, FET, MSCA, RI). This section looks at the objectives and targets of the Excellent Science WPs.

European Research Council

The ERC was launched in 2007. Its mission is to encourage the highest quality research in Europe (on the basis of Union-wide competition) through competitive funding and to support investigator-driven frontier research across all fields on the basis of scientific excellence. The ERC represents 17% of the overall Horizon 2020 budget (EUR 13.1 billion). The ERC has published three annual WPs, all offering three types of Grant – Starting Grants, Consolidator Grants and Advanced Grants (not including Proof-of-Concept Grants open to existing ERC grant holders only).

49 In order to compare the amount of EU contribution committed with the general budget allocation, the following approach has been followed: the baseline was provided by the budget reported for each call in the Working Programme reports. This allocated budget has then been compared with the CORDIS database, which provides detailed information on the amount of EU contribution committed per year broken down by call. The information has been compared in order to see whether the amount of funding committed is in line with the original plans. It has to be noted that this approach has some limitations, for example it does not take into account calls supporting transversal type of actions.
Initially in Horizon 2020, the ERC indicated it would allocate approximate budgets per research domain. Just under half of the grant budget was allocated to the Physical Sciences & Engineering (44%), while Life Sciences received an indicative budget of 39% and the Social Sciences & Humanities 17%. However, this preliminary financial allocation has not continued in the succeeding WPs, which state that budgets “will be allocated to each panel in proportion to the budgetary demand of its assigned proposals”. This has in practice lifted any ‘soft ring fencing’ of ERC’s research domain allocations, and has likewise emphasised the excellence criterion, which is the main funding criterion for ERC grants.

Figure 1 shows ERC committed spending in the WPs for 2014-15 and actual projects signed (as available on the publically accessible Cordis database).

**Figure 1 ERC - calls comparison 2015 (in mio. €)**

Source: Cordis and WPs

As of 2018, the ERC will re-introduce its Synergy Grant funding scheme. This is a collaborative grants scheme, originally piloted in 2012 and 2013 (i.e. under the 7th Framework Programme with a budget of EUR 150 million). Synergy Grants “bring together groups of researchers with complementary skills and knowledge and enable them to jointly address a commonly chosen challenging research problem in unconventional ways”⁵¹. Demand for grants was extremely high during the pilot phase, only 1.5% of proposals were selected in 2012, the first year and 3% in the second 2013⁵², thus having even more competitive success rates than the ERC portfolio overall.

**Future and Emerging Technologies**

Future and Emerging Technologies (FET) is a new scheme set up under Horizon 2020 with a total budget of EUR 2,696 million. Its specific objective is to foster radically new technologies with the potential to open new fields for scientific knowledge and technologies and contribute to the European next generation industries, by exploring novel and high-risk ideas building on scientific foundations. Although FET was originally focused on ICT-related research; there is no longer a thematic restriction in place. Instead, FET’s focus is now broadly on “high risk, high impact research and cutting-edge

⁵⁰ ERC Work Programme 2015 and 2016

⁵¹ Press release ERC to re-launch Synergy Grants in 2018, 6 December 2016

⁵² Press release ERC to re-launch Synergy Grants in 2018, 6 December 2016
engineering disciplines, ahead of the mainstream research agendas.”

There are three different FET Actions currently funded:

- **FET Open** supports early-stage joint science and technology research on new ideas for radically new technologies. Funding should support early detection of promising new areas, developments and trends, but also attract new research and innovation players. FET-Open represents 40% of the overall FET budget in Horizon 2020.

- **FET Proactive** supports emerging themes and research groups with the potential to generate a critical mass of inter-related projects that may build a European pool of knowledge and excellence.

- **FET Flagships** support large-scale projects on grand challenges. Two FET Flagships were launched in 2013. Both Flagships have completed their 30-month ramp-up phase and have been granted further EU funding for the next two years.

Figure 2 shows FET committed spending in the WPs for 2014-15 vs actual projects signed.

**Figure 2 FET - calls comparison 2014/2015 (in mio. €)**

Source: Cordis and WPs

---


54 1. The GRAPHENE Flagship, which has a budget of EUR 1 billion, and which aims to commercialise graphene research, thus generating economic growth, new jobs and new opportunities. The core consortium consists of over 150 academic and industrial research groups in 23 countries.

2. The Human Brain Project (HBP), also with a budget of EUR 1 billion (around half of which will be provided by the EU, and the other by Member States and private funding sources), the HBP aims to put in place a cutting-edge, ICT-based scientific Research Infrastructure for brain research, cognitive neuroscience and brain-inspired computing. The Project promotes collaboration across the globe, aims to drive forward European industry.

55 FET Flagships Lessons learned from the first 30 months of their operation. The European Commission (DG Connect) and the GRAPHENE and the HUMAN BRAIN PROJECT FET Flagship October 2016.

56 The EC has launched an evaluation of the FET Flagship instrument that is being carried out as part of the Horizon 2020 interim evaluation. The conclusions will also address the potential capability of the two Flagships in delivering their long-term objectives, and the implementation and the governance model of the Flagships.
Marie Skłodowska-Curie actions

The Marie Skłodowska-Curie actions are the longest-running part of Excellent Science; the objective was established under the 6th Framework Programme. Implementation of MSCA in Horizon 2020 is very similar to that of the Actions in the 7th Framework Programme. MSCA provides research training as well as career and knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers. Like the other Excellent Science parts, MSCAs are bottom-up and open to all domains of research and innovation, from basic research up to market take-up and innovation services. Actions are open to researchers and innovation staff at all stages of their career, as well as to universities, research institutions, research infrastructures, businesses, and other socio-economic actors from all countries, including third countries. Attention is paid to encouraging the strong participation of industry, in particular SMEs.

Figure 3 shows MSCA committed spending in the WPs for 2014-15 and actual projects signed (as available on Cordis).

**Figure 3 MSCA calls comparison 2014/2015 (in mio. €)**

Source: Cordis and WPs

Research Infrastructures

Research Infrastructures (RI) actions aim to support the development, implementation and integration of European research infrastructures. RI are defined as facilities, resources and services that are used by the research communities to conduct fundamental and applied research and foster innovation in their fields. Where relevant, RI may be used beyond research, e.g., for education purpose or to deliver public services. By attracting young people to science, facilitating networking of researchers and achieving excellence in research, RI play a central role in the development of the ERA. RI also contribute to other cross-cutting objectives of Horizon 2020, such as climate action and sustainable development, biodiversity, and social sciences and humanities. Furthermore, e-infrastructures serve a diversified spectrum of researchers, by addressing the computing and data needs of – and fostering economies of scale in the use of ICT systems for – Horizon 2020-funded projects. High-performance computing, big data and cloud technologies, in

---

57 RI include: major scientific equipment (or sets of instruments); knowledge-based resources such as collections, archives or scientific data; e-infrastructures, such as data and computing systems and communication networks; and any other infrastructure of a unique nature essential to achieve excellence in research and innovation.
particular, are key driver of societal changes, scientific advances and productivity gains across the economy.

The European Commission has allocated around EUR 2.5 billion of the Excellence Science priority to support European RI. The RI WP 2014-15 was focused on the implementation of the ESFRI roadmap, by supporting the implementation and operation of ESFRI projects (INFRADEV). By specifically targeting ESFRI projects, INFRADEV calls are based on a combination of a bottom-up approach and top-down investment priorities defined at a high political level. The WP 2016-17 moved the focus onto integrating activities of RI of European interest (INFRAIA). ESFRI and other world class RI could participate in networking, transnational access and joint research activities, but they are not the specific targets of these calls.

The WPs include topics specifically related to e-infrastructures (EINFRA and some INFRASUP calls). They are focused on integrating existing resources in the domains of high-speed networking, high-performance computing, research data processing and software, and to support policy and international cooperation for e-infrastructures. A smaller volume of resources is allocated to fostering the innovation potential of RI, with a focus on instrumentation and industry involvement, and strengthening of international cooperation with strategic third country partners (INFRASUP and INFRAINNOV).

Figure 4 Budget estimated in WP 2014-2015 and 2016-2017 for RI calls


58 The ESFRI roadmap, first published in 2006 and then periodically updated, identifies the new Research Infrastructures of pan-European interest corresponding to the long term needs of the European research communities, covering all scientific areas, regardless of possible location. It is issued by ESFRI, the European Strategy Forum on Research Infrastructures. The forum gathers together delegates nominated by the Research Ministers of the Member and Associate Countries, and including a representative of the European Commission.

59 E-infrastructures are promoted also through other specific actions, including: i) a study on High Performance Computing (2014 budget); ii) the GÉANT Partnership projects, focusing on the development of computer and data intensive collaborative research and education services, comprising a project to strengthen the connectivity to Latin America (2015 budget); iii) the Interactive Computing e-infrastructure of the Human Brain Project (2017 budget).

60 Additional funding is allocated for dissemination events, such as the International Conference on Research Infrastructures and the Presidency event for the launch of the 2016 ESFRI Roadmap, as well as for external expertise.

61 INFRASUP and INFRAINNOV calls were merged during 2014-2015, and were split in 2016-2017.
II – Assessment of budget allocation

According to the Regulation\textsuperscript{62}, Excellent Science has a total indicative budget of EUR 24,441.1 million, which corresponds to 31.7\% of Horizon 2020’s budget.\textsuperscript{63} In 2014, the EC frontloaded EUR 212.2 million of the Horizon 2020 budget in an effort to boost growth and employment. Although the frontloading did not entail any \textit{de facto} overall change in the Horizon 2020 budget for Excellent Science, EUR 106.1 million of the frontload was given to the ERC and EUR 106.1 million to the MCSA. The frontloaded money was 100\% absorbed; however the advancements are likely to result in lower annual funding for Horizon 2020 in its later years than planned at ex-ante staged, but this will be at least partly balanced out as the latter years budgets (2017-20) are higher than the 2014-16 budgets.\textsuperscript{64}

For example, from 2016 the ERC budget is set to rise every year in the years 2017, 2018, 2019 and 2020.\textsuperscript{65}

Table 1 EU funding to date and total number of signed grant agreements (Excellence Science)

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERC</td>
<td>1,061</td>
<td>1,724.8</td>
<td>2,460</td>
</tr>
<tr>
<td>FET</td>
<td>62</td>
<td>219.1</td>
<td>29</td>
</tr>
<tr>
<td>MCSA</td>
<td>1,655</td>
<td>852.2</td>
<td>3,064</td>
</tr>
<tr>
<td>RI</td>
<td>61</td>
<td>391.1</td>
<td>41</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2,839</td>
<td>3,187.1</td>
<td>5,299</td>
</tr>
</tbody>
</table>

Source: Horizon 2020 Monitoring Report 2015

As the EC’s 2015 monitoring report shows (outlined in Table 1), to date a total of EUR 6,030.8 million has been allocated to fund successful proposals, which equals one-quarter of the total indicative budget. Within the Excellent Science Priority, the ERC’s budget dominates; the Council’s funding stands for just over half (55\%) of the Priority, with MCSA making up just over one-quarter (27\%) of funding. RI makes up about 10\% and FET funding 8\%.

The total budget allocated to the ERC for the period 2014-2020 is EUR 13.1 billion, which is a real-term increase of 60\% compared to FP7.\textsuperscript{66} MSCA had a budget of EUR 4.75 billion


\textsuperscript{63} The financial envelope for Horizon 2020 implementation was set at EUR 77,028.3 million in 2013 prices.

\textsuperscript{64} Carlberg and Malan (2016) Assessment Of Horizon 2020 Programme on behalf of the European Parliament DIRECTORATE-GENERAL FOR INTERNAL POLICIES POLICY DEPARTMENT D: BUDGETARY AFFAIRS

\textsuperscript{65} See page 6 https://www.utwente.nl/eciu/TtT_H2020/presentations/Turner.pdf

\textsuperscript{66} ERC website Fact and Figures
under FP7, so it has experienced a small increase of funds under Horizon 2020 (EUR 6.162 billion). No comparison with FP7 can be made with FET as this is a new programme.

The budget allocated to RI has increased from EUR 1.7 billion under FP7 to EUR 2.5 billion in Horizon 2020. In relative terms, the budget share for RI calls has remained unchanged overall, around 3.2% of the total Horizon 2020 budget. RI actions receive around 10% of funding out of the volume going to the Excellence Science part.

Country-level participation rates in Excellent Science

Table 2 shows the success rate per country for Excellent Science and for Horizon 2020 in total. Third countries, the UK, the Netherlands and Austria have the highest allocation of successful applications within Excellent Science. The EU-13 perform marginally better in this part of Horizon 2020, with 9.5% successful applications, compared to 9.7% in Horizon 2020 overall, however the EU-15 equivalent is 12.4% and 13.4% respectively. Bulgaria, Hungary, Malta, Poland, and Slovakia all do slightly better under Excellent Science than across the Programme overall. The only EU-15 country to do this is the UK (with minimal margin).

Table 2: Success rate in terms of applications per Country for Excellent Science and Horizon 2020 total (2014, 2015 and total)

<table>
<thead>
<tr>
<th>Country</th>
<th>2014 Excellent Science</th>
<th>Total 68</th>
<th>2015 Excellent Science</th>
<th>Total</th>
<th>2014 Total</th>
<th>2015 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>15.1%</td>
<td>16.9%</td>
<td>14.8%</td>
<td>13.9%</td>
<td>14.9%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Belgium</td>
<td>13.7%</td>
<td>18.4%</td>
<td>10.0%</td>
<td>13.1%</td>
<td>11.5%</td>
<td>15.5%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>17.9%</td>
<td>10.8%</td>
<td>5.4%</td>
<td>5.6%</td>
<td>10.9%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Croatia</td>
<td>11.0%</td>
<td>11.4%</td>
<td>4.3%</td>
<td>7.5%</td>
<td>7.7%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Cyprus</td>
<td>9.9%</td>
<td>10.9%</td>
<td>9.8%</td>
<td>9.9%</td>
<td>9.8%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>14.3%</td>
<td>15.6%</td>
<td>9.0%</td>
<td>8.4%</td>
<td>11.1%</td>
<td>11.5%</td>
</tr>
<tr>
<td>Denmark</td>
<td>16.1%</td>
<td>16.0%</td>
<td>9.6%</td>
<td>12.1%</td>
<td>12.4%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Estonia</td>
<td>16.7%</td>
<td>16.3%</td>
<td>6.7%</td>
<td>9.3%</td>
<td>10.9%</td>
<td>12.4%</td>
</tr>
<tr>
<td>Finland</td>
<td>10.8%</td>
<td>13.6%</td>
<td>9.4%</td>
<td>9.9%</td>
<td>10.0%</td>
<td>11.6%</td>
</tr>
<tr>
<td>France</td>
<td>15.5%</td>
<td>17.9%</td>
<td>11.0%</td>
<td>13.0%</td>
<td>13.0%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Germany</td>
<td>15.7%</td>
<td>17.2%</td>
<td>11.1%</td>
<td>12.7%</td>
<td>13.1%</td>
<td>14.8%</td>
</tr>
<tr>
<td>Greece</td>
<td>14.4%</td>
<td>13.2%</td>
<td>7.8%</td>
<td>9.4%</td>
<td>10.7%</td>
<td>11.2%</td>
</tr>
<tr>
<td>Hungary</td>
<td>13.1%</td>
<td>11.1%</td>
<td>8.0%</td>
<td>7.2%</td>
<td>10.5%</td>
<td>9.0%</td>
</tr>
<tr>
<td>Ireland</td>
<td>16.2%</td>
<td>15.5%</td>
<td>12.0%</td>
<td>13.1%</td>
<td>13.7%</td>
<td>14.2%</td>
</tr>
<tr>
<td>Italy</td>
<td>10.1%</td>
<td>12.1%</td>
<td>8.0%</td>
<td>9.1%</td>
<td>8.9%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Latvia</td>
<td>8.2%</td>
<td>16.7%</td>
<td>3.8%</td>
<td>6.1%</td>
<td>5.7%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>14.3%</td>
<td>12.0%</td>
<td>4.2%</td>
<td>7.3%</td>
<td>8.0%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>10.9%</td>
<td>18.0%</td>
<td>9.3%</td>
<td>12.5%</td>
<td>10.0%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Malta</td>
<td>24.1%</td>
<td>13.5%</td>
<td>3.2%</td>
<td>7.3%</td>
<td>13.3%</td>
<td>10.0%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>17.4%</td>
<td>17.9%</td>
<td>11.6%</td>
<td>12.9%</td>
<td>14.2%</td>
<td>15.2%</td>
</tr>
<tr>
<td>Poland</td>
<td>13.9%</td>
<td>12.2%</td>
<td>7.4%</td>
<td>7.4%</td>
<td>10.0%</td>
<td>9.3%</td>
</tr>
</tbody>
</table>


68 Also including EURATOM, SWAFs, SEWPs and Pilot on Fast Track to Innovation.
Geographical spread clearly differs notably within Excellent Science. Small countries and newcomers\(^69\) have a lower share of funds. An initial assessment of the geographical distribution of the EU contribution indicates that this challenge is particularly relevant under the ERC. According to the EC’s 2015 monitoring report, the EU-15 countries represent 47% of the total budget allocated under the whole priority compared to less than 1% of the overall budget provided to EU-13 countries. This skewed allocation phenomenon is also highly visible in the low number of newcomers – in 2014 and 2015, Excellent Science’s share of newcomers was 5.5% and 5.8% respectively, compared with 19.6% and 21.7% in Horizon 2020 overall.\(^70\)

The uneven allocation of Excellent Science funding is widely debated. There is a clear consensus on the need to provide support for newcomers. Although it is extremely clear that research actors want to see Excellent Science driven by an excellence criterion (and are wholly against e.g. the idea of introducing quotas for low-capacity countries/institutions), it is equally recognised that the (at times ultra-) competitive success rates is spilling over to become a political issue. Interviewees have pointed to several factors which hamper newcomers:

**Factors relating to Horizon 2020 programme design:**

A possible disadvantage is that the Horizon 2020 programme, including Excellent Science, tends to call for and fund comparatively large projects. This does not necessarily favour low-capacity countries and smaller institutions that are yet to build up sufficient international experience and capacity.

Although at both EU and national level, the definition of innovation is slowly broadening, several of our interviewees thought that Horizon 2020 still (over-)emphasised technological innovation, including steering too close to the idea of the linear model of

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\(^69\) Newcomer countries are defined as Horizon 2020 Participants who was not involved in a FP7 Project (not a FP7 participant).

\(^70\) Horizon 2020 Monitoring Reports
innovation, which was considered to work more effectively for highly R&I intensive regions in Europe than for low-medium-capacity institutions and regions. It was felt that insisting that the linear model is the right approach for all European regions was counter-productive.

**Wider R&I political and structural challenges:**

A number of the low-capacity countries are hampered by a lack of university autonomy, which means these institutions are not able to act independently of the public administrations to, e.g. set sufficiently competitive salaries and invest sufficiently in infrastructure and equipment. They are also much less likely to succeed in attracting international and/or holding on to national high-quality researchers. One interviewee suggested that there are more Central and Eastern European researchers in UK institutions than there are in the whole of the EU-13. Two of the EU-13 countries are faring better, namely Cyprus and Estonia. Estonia has also undergone recent institutional changes including developing a self-governing university system, which was considered to have increased the country’s competitiveness.

There are a number of existing interventions in place to tackle intra-EU R&I inequalities, including the ‘Spreading Excellence and Widening Participation’ (SEWP) horizontal measure within Horizon 2020. According to our interviewees, there is only anecdotal evidence available on SEWP effectiveness to date. As also indicated in the report assessing Horizon 2020 implementation of the Societal Challenges Priority, the competitive success rates under SEWP indicate unmet demand. Interviews undertaken as part of this report also add that the challenge of braindrain is huge and although the current Horizon 2020 response is a step in the right direction, it may be insufficient.

<table>
<thead>
<tr>
<th>There are several ways in which Excellent Science works to encourage newcomers.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FET</strong> looks to encourage newcomers through a number of tools:</td>
</tr>
<tr>
<td>1. It has established networks with NCPs in low participation countries to build links with advanced institutions and to better communicate what FET is looking for in proposals.</td>
</tr>
<tr>
<td>2. FET also organise local events to communicate better its aims and priorities, and to encourage partner searches and matching.</td>
</tr>
<tr>
<td>3. The FET Flagship ERA-NET (FLAG-ERA) works with national and regional funding organisation to develop the FET Flagship concept. The project also fosters international cooperation with funding organisations outside Europe.</td>
</tr>
</tbody>
</table>

The **ERC** uses its applicant and grant holder data to understand how it can better support newcomers. Currently approximately 50% of ERC funding is awarded to 50 research institutions in Europe, while around 650 research institutions share the other budget half. However, the ERC believes that the concentration in funding has plateaued. Recent analysis on the success rates per host institution show that lower-performing countries such as Turkey and the Czech Republic have improved their performance by +7% and +5.8% respectively. Romania, Malta, Luxembourg and Serbia (an Associated Country) have also won their first grants as host institutions. While most other countries have maintained their performance levels, Greece, Croatia, Estonia and Cyprus have decreased theirs somewhat.

National-level success rates are not only the result of the number of applications submitted. The ERC can also observe a certain interplay between national and EU level in funding performance. For example, national reforms in the Netherlands, which have put an increased focus on competitive research grant funding, has resulted in increased applications from Dutch researchers and institutions. Vice versa, in Poland, the Polish Academy of Science grants programme tends to be the preferred funding source over the ERC alternative.
III – Research & Industry Involvement in the Excellent Science Priority

Although industry involvement is clearly encouraged and required for some types of grant, Excellence Science is fundamentally a bottom-up research programme. The four objectives account for different kinds of research and industry involvement:

Table 3: Research and industry involvement

<table>
<thead>
<tr>
<th>Excellent Science</th>
<th>Research and industry involvement description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERC</td>
<td>The ERC welcomes applications from Principal Investigators hosted by private for-profit research centres, including industrial laboratories. However in practice, total participation from the private sector and SMEs totals 1.9% and 1.5% respectively, which is substantially below Horizon 2020 averages: 32.6% and 21.9%.</td>
</tr>
<tr>
<td>FET</td>
<td>FET projects are collaborative projects that include both public and private partners. In FET OPEN, 55% of participants are HES, 27% research organisations, and 13% SMEs.</td>
</tr>
<tr>
<td>MCSA</td>
<td>MSCA provide grants for researchers who may be based in public and private institutions. Secondary and HE establishments (HES) account for 53% of participants, receiving more than 60% of the total EU contribution provided under MSCA. HES is followed by Private-for-profit entities (PRC) and Research organisations (excluding education) – REC. The first accounted for approximately one-forth of the total number of participants involved in the MSCA and received nearly 20% of the total funding. The latter involved 17% of participants and 17% of the total spending committed under the MSCA. A less relevant role was played by Public entities (excluding research and education): only 2% of participants and 1% of the funding were committed under this type of activity.</td>
</tr>
<tr>
<td>RI</td>
<td>RI projects involve especially research organisations and secondary and higher education establishments. They represent respectively around 45% and 35% of total participants. Research organisations more often act as project coordinators. Private sector participation has been 9.9% in 2015, higher than in the previous year, when only 7.3% of the total participants were classified as private for profit companies. The share of SMEs has increased too, from 5.2% in 2014 to 7.0% in 2015. Private participation for RI calls is among the lowest observed in the programme (Horizon 2020 averages are 32.6% for private sector companies and 21.9% for SMEs). In the case of RI, the higher involvement of the public sector can be justified by the public good nature of knowledge and services delivered by the RI. More than for other parts of Horizon 2020, industry participation in RI actions, especially if focused on large-scale infrastructures, is still more likely to be intermediated by research organisations.</td>
</tr>
</tbody>
</table>

Looking at the Excellent Science Priority as a whole, the share of participation is clearly led by Secondary and higher education (HES) establishments, which represent just over half (52.6%) of total participations across the Priority.

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Table 4: Share of participations and EU funding per type of organisation

<table>
<thead>
<tr>
<th>Type of organisation</th>
<th>Share of participations</th>
<th>Share of EU funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>HES</td>
<td>52.6%</td>
<td>65%</td>
</tr>
<tr>
<td>OTH</td>
<td>3.6%</td>
<td>2%</td>
</tr>
<tr>
<td>PRC</td>
<td>16.3%</td>
<td>5%</td>
</tr>
<tr>
<td>PUB</td>
<td>1.9%</td>
<td>1%</td>
</tr>
<tr>
<td>REC</td>
<td>25.7%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Source: CORDIS

In terms of EU contributions, nearly two-third of the funds were committed to HES, of which 67% was committed under the ERC priority and 18% to foster new skills of young researchers under MSCA. The amount of EU contributions under the REC is ranked second, reaching slightly more than 25%, with more than half of the budget (nearly 60%) committed to the ERC. The EU contributions classified under the PRC, OTH and PUB represent less than 10% of the total EU contributions.

Further analysis on the Research and Industry perspective is provided in Chapter 3 (section IV – Research and industry and their interaction), including evidence on effectiveness and efficiency of collaboration.
Chapter 3. Effectiveness & Efficiency of implementation

Key findings

- Oversubscription of calls for proposals is a challenge for ERC, FET and MSCA alike. The EC and implementation agencies responsible for these areas have all implemented or discussed implementing measures to improve success rates.
- The view of the EC-Agency relationship and effectiveness of implementation is rather split.
- The simplification measures introduced by the Horizon 2020 Programme have largely been welcomed, although some improvements are still sought, e.g. in auditing and monitoring procedures.
- The Excellent Science Priority funds bottom-up research, with less articulated focus on industrial impact. Consequently, industry-research collaboration partly takes different forms than under other parts of Horizon 2020. The introduction of Technology Readiness Levels appears to have split participants’ views.
- Chapter 3 also provides an analysis of Excellent Science vis-à-vis other EU and national funding programmes. As this Priority is focused on excellent research, there are generally no overlaps. EU-national initiatives, notably the Seal of Excellence, need to be redesigned if they are to benefit Excellent Science research.
- Internationalisation within Excellent Science takes many forms. It is an important driver of research quality.

Chapter 3 focuses on effectiveness and efficiency of Excellence Science implementation. It will first look at efficiency of implementation, discussing in particular success rates under the Priority (section I) then look at programme management and implementation (II), and grant procedures and rules (III). This chapter then moves on to discuss interaction between research and industry (IV), synergy and complementarity with EU and national programmes (V), and the participation of Third countries (VI).

I – Efficiency of implementation of H2020 – Excellence Science

As also described in Chapter 2, within the Excellent Science Priority, a major aspect in assessing the efficiency of implementation is the comparatively low success rates. Interviewees raised this issue repeatedly and discussions on success rates can also be found documented in the advisory group reports.

Table 5: Success rates per specific programme part provides an overview of the success rates for proposals and for the funding for Excellent Science.
In 2015, the lowest success rate in terms of both proposals and funding for all Horizon 2020 was under FET calls, where only about 1.8% of the proposals were retained for funding. Within the Excellent Science Priority, the ERC achieved the highest success rate in terms of proposals (13.2%). The highest success rate in terms of funding was found in Research Infrastructures with 25.1%.

Interviews with relevant experts and reports from the ERC, FET, and MSCA all express concern about the low success rates and oversubscription of calls for proposals. Clearly it is a widely recognised issue. The ERC, FET and the MSCA programme managers have all implemented or have discussed implementing restrictions on applications as a result of the high volume of proposals received compared to the funding available.

The MSCA advisory group has expressed particular concern about low success rates under ITN calls (7% in the 2015 call). One of the group’s proposed solutions was to restrict resubmissions for proposals rated below the quality threshold. Another was given that MSCA ITN are consortia-based – to include additional rules to define a resubmission, although this was feared to constitute a barrier for less experienced applicants who value feedback to previously submitted proposals.72

Potential impacts of the low success rates were described by the ERC President in a speech in November 2016: “[R]esearch and education, particularly postgraduate education, are intimately linked. For example, some 60% of the funding provided by the ERC for research goes on staff costs, predominantly to support PhD candidates and postdoctoral researchers working in the teams of ERC funded Principal Investigators. A majority of these highly trained individuals will go on to work outside academia, using their acquired skills to impact the economy. The ERC is funding only about 1% of researchers working in Europe with a budget representing roughly 1% of the available budget for research. With a success rate of applicants that fluctuates slightly above 10%, the ERC is missing to fund a significant number of excellent projects year after year purely due to budgetary constraints. More top researchers could be funded. Achieving a 15% success rate could be a good target. It would even encourage evaluators to support bolder ideas of applicants and to take more risks.”73

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The ERC’s Scientific Council has applied restrictions on applications since 2009 (i.e. under the Seventh Framework Programme). Compared to FP7 the eligibility restrictions applied under Horizon 2020 are becoming more severe; although the ERC have eased restrictions in the last year. The 2016-17 WPs for ERC all describe calls under the Council as “extremely competitive” and that “only exceptional proposals are likely to be funded and the number of applications has generally risen faster than the available budget”. The restrictions appear to have had an effect insofar as proposal numbers were noted to have decreased in 2016.74

An important caveat is that the ERC’s budget for the years 2014-16 has in real terms been lower than for the latter part of FP7. As the ERC’s budget is set to rise for the latter half of Horizon 2020, the Council some of the pressures will ease.

Consequently, a main concern from the ERC’s point of view is instead the significant number of successful proposals (given an ‘A’ rating by the peer review panel) that remain unfunded due to a lack of budget. Although there are no exact figures, the ERC estimates this number to reach 1,000-1,500, which it considers troubling. The ERC will indeed make a case for an increased budget for the 9th Framework Programme.

The FET objective of Excellent Science also struggles with extremely competitive success rates (ranging from 1.8% to 7.5%). DG CONNECT, the Directorate-General responsible for FET, is currently aiming to reach a success rate of 8%-10%, which may be achievable considering that FET’s budget – like that of the ERC – is set to increase in the latter half of Horizon 2020. One specific challenge faced by FET is the large proportion (60%) of resubmitted proposals the programme receives. This could be addressed in the future through the introduction of submission restrictions.

Ultimately, DG CONNECT considers the overall FET budget to be insufficient and that a budget increase for FP9 is highly desirable.

More generally, consortia applying for Horizon 2020 funding appear to increasingly make use of proposal-writing consultancies, which are beneficial partners for winning funding but that are not R&I specialists.Awarding R&I funding to such organisations is risks not making effective use of public funds to promote innovation. Similarly, this study has received interview feedback from NCPs which indicate that some consortia submitting proposals under Horizon 2020 are taking to increasingly draconian measures as a response to low success rates. There is anecdotal evidence of consortia submitting multiple applications that contain “very similar” information in order to increase their chances of funding and in the hope of having one of the sets of applications approved. This practice not only distorts competition and but entails increased efforts by the peer reviewers.

Compared to the other Excellent Science objectives, RI actions exhibit a relatively high success rate, both in terms of funding and proposals. RI success rates are also among the highest in the overall Programme, which can be explained by the relatively more focused target of RI actions. The prioritisation process coordinated by ESFRI serves as a sort of pre-selection phase, at least for proposals to the INFRADEV calls. At the same time, the e-infrastructure call focused on the integration and consolidation of e-infrastructure platforms (Theme 1 of EINFRA call 2016-17) already targets existing facilities, which are

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already known and limited in their number. By nature, the success rate for this call is close to 100%.

II – Efficiency of programme management and implementation – views of participants and implementation bodies

The objectives under Excellent Science are implemented by different bodies. While the Research Executive Agency is the implementation agency for FET and MSCA, RI calls are managed jointly by the European Commission DG RTD and DG CONNECT (e-infrastructure calls) and the ERC is implemented by the European Research Council Executive Agency.

Table 6 shows the time to grant for Excellent Science and average values across the Horizon 2020 programme.

Table 6: Share of selected projects signed within time-to-grant benchmark for calls in 2014-15

<table>
<thead>
<tr>
<th></th>
<th>Time-to-grant</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2014</td>
<td>2015</td>
<td>Total</td>
</tr>
<tr>
<td>Excellence Science(^{75}) (excluding ERC grants)</td>
<td>88.4%</td>
<td>94.2%</td>
<td>91.1%</td>
</tr>
<tr>
<td>ERC</td>
<td>8.6%</td>
<td>7.0%</td>
<td>7.8%</td>
</tr>
<tr>
<td>FET</td>
<td>96.8%</td>
<td>96.3%</td>
<td>96.6%</td>
</tr>
<tr>
<td>MSCA</td>
<td>89.1%</td>
<td>94.5%</td>
<td>91.7%</td>
</tr>
<tr>
<td>RI</td>
<td>59.0%</td>
<td>81.6%</td>
<td>67.7%</td>
</tr>
<tr>
<td>Average HORIZON 2020(^{76})</td>
<td>89.2%</td>
<td>92.4%</td>
<td>90.7%</td>
</tr>
<tr>
<td>Average number of time-to-grant in days(^{77})</td>
<td>216.6</td>
<td>184.9</td>
<td>201.7</td>
</tr>
</tbody>
</table>

Source: EC Monitoring Report 2015

Excluding ERC project, the average the time to grant (TTG) for Horizon 2020 is 92.4%. Both the FET and MSCA TTG are slightly above the Horizon 2020 average. In contrast the ERC TTG is very low, averaging 7.8% for 2014-15, indicating that a significant number of projects have not been signed within the TTG benchmark (although the ERC is not bound by this).\(^{78}\) The ERC website suggests that the timeframe for receiving the result of an application should be around nine months.

Time to grant for RI is also below the average of Horizon 2020, and lower than for RI-related FP7 calls. The already mentioned prioritisation process carried out by ESFRI and well-defined target of e-infrastructure actions have contributed to reduce the time elapsing between the closure of a call and the signature of the Grant Agreement, in addition to increasing the success rate.

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\(^{75}\) Excluding ERC Grants

\(^{76}\) Excluding ERC Grants

\(^{77}\) Excluding ERC Grants

Assessing implementation more generally, stakeholder views were somewhat split, with one interviewee describing the implementation process as “mechanical”, considering that the EC’s outsourcing of management including contract negotiations have turned implementation into a ‘box ticking process’, which has also meant that the EC now has less influence and ability to steer implementation. A few also considered the EU-Agency relationship to be “generally weak” and lacking in transparency. Both national stakeholders and Horizon 2020 participants would welcome more transparency, including published Q&As to clarify grey areas.

The majority of comments collected for this Excellent Science report corresponded with the findings of the Societal Challenges Horizon 2020 assessment report, which indicated that the efficiency of programme management and implementation very much depends on having staff with the appropriate knowledge and experience in place. In a few instances, alternative management approaches were put forward, including that of the US Defence Research Agency (DARPA). In some contrast to the EU programme, DARPA programmes are driven by highly specialised project officers who proactively seek out potential applicants based on the specific R&I needs perceived under the remit of the programme in question. Although one could take the view that this approach is contradictory to the ‘bottom-up’ approach of the Excellent Science Priority, the DARPA approach is clearly effective in establishing and maintaining a high-quality portfolio of research, which prioritises not only R&I production but equally the effective and strong management of R&I portfolios. It may be that Horizon 2020 as a whole can learn lessons from this approach.

III – Effects of changes in grant procedures and rules

The simplification measures introduced by the Horizon 2020 Programme have largely been welcomed by participants and by organisations representing participants. LERU – the league for research universities – for example, is especially positive about the new measures related to the funding model, the use of electronic tools and the participant portal, and the wider use of a two-stage submission process (leading to increased success rates). The latter point is also echoed by EARTO although the RTO umbrella group would also like to see improved/clearer feedback as part of the two-stage procedures.79, 80

Although recognising the improvements, LERU and EARTO suggests that there are still measures that require “urgent action” relating to internal invoicing and equipment costs (as regulated through the Annotated Model Grant Agreement). LERU and EARTO would also like to see improvement in the EC’s audit and control approach relating to Horizon 2020 participants, arguing that participants need an easier audit burden than is currently in place. 81, 82 This view is also supported by inter alia the Research Council of Norway in their interim evaluation statement.83

79 LERU’s Interim Evaluation of Horizon 2020 Advice Paper no. 21, October 2016
81 LERU’s Interim Evaluation of Horizon 2020 Advice Paper no. 21, October 2016
83 The Research Council of Norway’s feedback for the interim evaluation of Horizon 2020
We can also make a number of objective-specific observations with regards to changes in procedures and rules:

**European Research Council**

In terms of changes to rules – as mentioned in the preceding chapter – the ERC has tightened eligibility restrictions as a result of the high volume of funding applications received.

**Future and Emerging Technologies**

A FET advisory group report has stated that multiple stages of funding are needed for high-risk projects and to consolidate proof-of-concept projects. The group is subsequently calling for an additional bottom-up FET instruments to support FET-Open projects that are in in-between early stage funding and market exploitation, as this is a funding stage currently overlooked in the Horizon 2020 programme. According to the group, the “distinction between consolidation research projects and projects near-to-application is crucial, as the latter falls within the remit of other Horizon 2020 schemes”.84 The advisory group also suggest that in order to match the flexible nature of technological innovation, greater diversity is needed in terms of project duration.85

Feedback received more widely has suggested that industry participation needs to be better targeted in calls and WPs, as there is a lack of common definitions on broad R&I concepts, such as ‘ICT’. A more effective use of keywords and Calls written by Commission experts in the field(s) in questions were seen as the most important improvements that could be made. It was further felt that Horizon 2020 overall needed to increase it awareness of industry sectors that ‘move faster than the programme’ and offer more flexibility to these sectoral areas in order to encourage their participation.

**Marie Skłodowska-Curie actions**

Under Horizon 2020 MCSA has introduced a simplification measure by extending the use of simplified forms of grants (unit costs), streamlining the funding schemes (from 11 to 4) and unified the rules and framework conditions for mobility.

The MSCA has also launched a Pilot on Open Research Data which aims to improve and maximize access to and re-use of research data generated by projects. MSCA applicants participate in the Open Research Data Pilot on a voluntary basis, however an agreement to participate is not taken into account.

A third new MSCA element in Horizon 2020 is the use of Data Management Plans (DMPs), which is required for projects participating in the Open Research Data Pilot. DMPs detail what data the project will generate, whether and how it will be exploited or made accessible for verification and re-use, and how it will be curated and preserved.

**Research Infrastructures**

RI project management has benefitted from higher simplification, thanks to new rules and streamlined administrative procedures. Interviewees have mentioned that the 25% flat rate


to cover indirect cost of a project (overhead) has greatly simplified the budget preparation and grant management. Higher simplification during the implementation phase has been observed as well. The new rule according to which staff members working 100% on a single Horizon 2020 project are not required to complete timesheets was positively welcomed by research and education organisations.

There is some scope and need to further simplify the administrative procedures and reduce the burden on beneficiaries. The calculation of personnel cost is still regarded as too complex. EARTO, the European Association of Research and Technology Organisations, has encouraged the Commission to simplify the methodology for declaring the direct cost of large RI.\textsuperscript{86} In particular, the different structure of balance sheets makes it difficult for project participants to ascertain certain cost categories. A more extended use of lump sum and flat rate approaches would cut the administrative time and costs of fund management, reporting and control, thus allowing project participants to concentrate efforts to achieve the project results. Moreover, simpler rules might increase interest by SMEs in being engaged in RI projects.

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IV – Research and industry and their interaction

Collaboration between research and industry is considered to be of fundamental importance to achieve the objectives set out in Horizon 2020. Although Excellent Science is the ‘least industry-oriented’ of the three Framework Programme Priorities, collaboration between industry and academia – and the facilitation of collaboration through e.g. mobility support – is nevertheless a key consideration. Our interviews with the Horizon 2020 advisory groups and the various opinion papers published in response to the EC’s interim evaluation and accompanying open public consultation of Horizon 2020 both confirm this.

As the Excellent Science Priority is a vehicle for funding bottom-up research, and the key criterion for funding is scientific excellence with less articulated focus on industrial impact, industry-research collaboration partly takes different forms than under the Societal Challenges or LEIT Priorities. As described in Chapter 2 (section III – Research & Industry Involvement in the Excellent Science Priority), universities and research organisations dominate the Excellent Science Priority, however industry does participate in Excellent Science.

As the Cordis participation data shows, industry participation in ERC and the MSCA is very limited in practice. According to our interviews, the limited participation from industry is related to that fact that, if compared to other regions internationally, Europe has a relatively low proportion of researchers in Europe as a percentage of the overall population. In particular, Europe has a deficit of researchers in the business sector: 46% of the total number of researchers in the EU against 79% in the USA. This is in turn a symptom

\textsuperscript{86} EARTO Paper on the Horizon 2020 Funding Model. Input for the Mid-Term Review. 22 September 2016.
of the lower rates of private sector R&D investment in Europe, compared to those in the USA or China.\textsuperscript{87}

In this regard, the FET projects may be more immediately accessible for fostering industry-research collaboration. FET projects also tend to include on average more partners than other types of Excellent Science project. FET funding can be awarded to projects exploring new technological possibilities, new science, new types of collaborations, or new research and innovation practices. Although the ultimate aim is to foster innovation and socioeconomic prosperity – the immediate objective is to support new R&I themes, develop a critical mass of European researchers in exploratory interdisciplinary research topics, and encourage areas that are not yet mature enough to include in industry R&I strategies.

Within FET, the composition and balance of research versus industry varies according to the field of the research. Taking the two Flagships as an example the Graphene Flagship includes 25-30\% industry. This is in line with the content of the research agenda and the comparatively high level of the TRL of the research. For the Brain project, industry participation is much lower, but is expected to develop in tandem with the development of the research activities. In particular it is expected that the Brain Flagship will involve industry (e.g. Pharma) for the supply and use of RI. As part of RI activities, the Flagship is also expected to open up opportunities for industry within E-infrastructure in the next funding round.

The FET funds research at Technology Readiness Levels 2-3 (TRL 2 – technology concept formulated; TRL 3 – experimental proof of concept). Industry-oriented associations, including EARTO and Business Europe, have welcomed the introduction of the TRL-scale – which has not been used in previous Framework Programmes – as it helps industry to better position their Horizon 2020 applications and to conceptually fit their activities into the right areas of Horizon 2020.

But the TRL scale is not applicable to all technologies, and thus has limitations.\textsuperscript{88} Similarly, the TRL scale implies the use of the linear model of innovation, which is generally considered to be too simplistic by R&I actors, although still fairly widely applied in R&I policymaking. Indeed, interviewees with links to universities and higher education have tended to deem research-industry collaboration is hampered by TRL\textsuperscript{89} indicators introduced as part of Horizon 2020, as it has created/emphasised a strict separation between industry-led projects and HES-led projects, and also because it relies on the linear model of innovation. According to some actors, the TRL system risks becoming a barrier to innovation. In contrast, interviewees with closer links to industry and later stage R&I


\textsuperscript{88}Business Europe Informal survey on Horizon 2020 implementation and possible recommendations for next Framework Programme Overview of the preliminary outcomes. October 2016

\textsuperscript{89}TRL 1 – basic principles observed. TRL 2 – technology concept formulated. TRL 3 – experimental proof of concept. TRL 4 – technology validated in lab. TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies). TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies). TRL 7 – system prototype demonstration in operational environment. TRL 8 – system complete and qualified. TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)
expressed strong support for the TRL system (see for example Universities of Applied Sciences in Europe’s Statement on the mid-term review Horizon 2020).90

A few interviewees also expressed the opinion that HES participants tend to have closer links to SMEs and to European regions than large enterprises and that HES participants produce spin offs, thus it follows that Horizon 2020 should encourage them to get closer to the market and to play a central role in stimulating regional innovation.

There does not seem to be a unanimous conclusion on the effectiveness of research and industry interaction or indeed how to organise it. The European Commission’s 2015 monitoring report, which surveyed the Horizon 2020 NCPs, found that science and business cooperation was one of the strongest positive developments in Horizon 2020 – 83% of NCPs responding to the survey ‘agreed’ or ‘strongly agreed’ that Horizon 2020 provides sufficient opportunities for cooperation between science and business. Only 4% ‘disagreed’ or ‘strongly disagreed’ with this statement. A small number (1%) stated that no further effort was needed in this field, since it is so well addressed.91

In contrast to the views of the NCPs, our interviews have been more critical about research and industry cooperation, as well as the level of cooperation more generally, in particular between large capacity and low capacity countries and regions.

One concern is that of supporting effective and ‘true’ cooperation. For example, the MSCA advisory group have had discussions on the need for dedicated measures to improve SME participation, which brought up some reservations. One of the advisory group reports raised concerns over the fact that some of the industry newcomers (in Horizon 2020 generally, not specifically MSCA) were consultancies that were chiefly involved in the proposal writing.92 The increased involvement of such consultancies, and increased dependency of researchers on professional proposal writers, was a concern also raised by this study’s interviewees.

Our assessment of the MSCA is that quality of research and industry collaboration can vary considerably, ranging from excellent or very good, to challenging and ‘artificial. The MSCA Advisory Group, which has discussed the need for a specific SME call under the MSCA, however concluded that it risks being ineffective if it attracts proposals which are merely collaborations on paper. The risk of funding less effective, artificial collaborations is clearly not unique to MSCA, but equally affects other areas and Priorities of Horizon 2020, as described below concerning RI.

**Research Infrastructures**

Interviewees have noticed that the significant budget increase for world-class frontier research under the ERC calls has not been matched by a similar increase for collaborative

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91 Horizon 2020 Monitoring Report

92 Summary Record of the 6th Meeting of the Horizon 2020 Marie Skłodowska-Curie actions’ Advisory Group, Brussels, 20 October 2015
RI projects. In its contribution to the Horizon 2020 Interim Evaluation, Science Europe, the association of European Research Funding Organisations and Research Performing Organisations, highlighted that “the overall budget for RIs under Horizon 2020 is very limited and does not reflect the extensive demand for RI funds, the ecosystems of RIs and the necessity for long-term sustainability”. Increasing demand originates from the need to ensure high-quality operation, management, and services to a wide range of RI users and stakeholders. The SWOT analysis realised by the H2020 panels for Research Infrastructures and CNECT in July 2016 highlights the need to increase financing of e-infrastructure investments, based on the fact that Europe currently purchases one third of high-performance computing resources worldwide, while it supplies only 5% of them.

There is wide agreement in the literature and among professionals on the difficulties in creating links between RI and industry. Limited participation by industry prevents the system from capitalising on the potential of RI to drive innovation. The scientific and technological breakthroughs being made using the RI could create more value for users and underpin innovation, but only if research facilities and industry collaborate and learn to pursue common goals. Interaction with enterprises may respond to the objective to gain revenues from the transfer of knowledge, by means of licensing and sale of patents. For many RI, however, priority is put on considerations such as contributing back to society and promoting the RI’s image as a centre of excellence for technology.

Collaborative RI projects can provide industry with the opportunity to participate in frontier science. A recent paper on knowledge transfer at CERN, one of the top research organisations in terms of Horizon 2020 funding, acknowledges that European research programmes have been important instruments for connecting CERN to external actors. The knowledge transferred from public research organisations to industry through collaborative research and consultancy contributes to suggesting new research and innovation projects, developing new technologies, products and services, opening up new markets. RI could also favour the creation of spin-offs, aimed at commercialising the facility's research breakthroughs.

Procurement is the main mechanism for establishing RI-industry collaboration. When a procurement contract for high-tech and highly customised products needed in the RI is signed, an intense collaboration process between the suppliers and the RI staff gets started, aimed at co-designing, testing and manufacturing the required technology or product. However, not all enterprises collaborating with RI prove to be capable of using/adapting the new knowledge/technology developed in other markets. But also, not all frontier technologies produced for RI could easily find interest in the market. As an example, Maglev, the technology for magnetic levitation vehicles, in spite of the initial enthusiasm,


94 During the 2007-2013 period CERN was part of 87 FP7 projects, coordinating 36 of them, and collaborating in total with 526 partners. Of these many were universities and other research organisations, but also 73 SMEs and 53 larger companies, indicating that EU projects serve as a useful contact surface between CERN and the private sector. Nielsen, V. and Anelli G. (2016). "Knowledge transfer at CERN", Technological Forecasting and Social Change, 112: 113-120. http://dx.doi.org/10.1016/j.techfore.2016.02.014
failed to disrupt the global rail industry, “because no one wants to buy it” (Carlos Härtel, chief technology and innovation officer at the GE Global Research Center–Europe).95

Under Horizon 2020, the Commission has extended its support for groups of public procurers who work together on PCP to create innovation opportunities for companies. PCP aims to foster competition between different suppliers by awarding contracts at the same time to several competitors to develop the required products or services. R&D services are split into different phases with the number of competing R&D providers being usually reduced after each evaluation phase in order to allow for progressive selection of companies with the best competing solutions (SEC(2007)1668). In the context of RIs, although some big infrastructures are still reluctant to change their usual procurement practices, several others across Europe have started using PCP and are reporting positive feedback. PCP seems effective in stimulating innovation activity and cooperation among companies and between research centres and companies, including SMEs.

The Advisory Group on European Research Infrastructures has highlighted the need to enhance the engagement of the industry (including SMEs) in RI activities and has advocated a change of culture within RI. Cooperation with industry is still not the focus of many RI researchers. There is a need to increase opportunities to attract industry both as supplier and as RI users. Examples of initiatives coming from RI include Industrial Liaison Officers, outreach programmes, knowledge transfer and co-development with industries of new products for new markets, the establishment of techno/science parks and incubator centres linked to RI, licensing, access to RI and technical assistance to conduct analysis and R&D activities within the RI.

V – Synergy and complementarity with EU and national programmes

EU programmes

The development of EU policy over the last programming periods clearly shows a commitment to R&I as part of regional development. Whilst, between 2000-2006, approximately EUR 13 billion – around 6% of the EU Structural Funds – was spent on research infrastructures and networks, innovative business start-ups and the modernisation of SMEs, in the current 2014-2020 programming period, regions and Member States must target EU investments on four key areas for economic growth and job creation, of which one is Research and Innovation. EU efforts to create synergies and complementarities between the ESI Funds and Horizon 2020 are largely seen as positive, although the umbrella organisations EARTO and ERRIN have equally emphasized the need for ESI Fund-Horizon 2020 synergies not to “drive future research and innovation policies, but rather support such policies.”96

Although the use of the Structural Funds (ESI Funds) in Europe to encourage R&I is growing in importance, research and innovation activities are still highly concentrated in the core regions of the EU. “Approximately half of total research expenditure goes to 30


EU regions out of 254. Disparities between regions in business research expenditure are even wider.97

Especially in the EU-13, ESI Funds are a more significant source of funding than Horizon 2020 and significant amounts of EU regional funding has been invested in improving the quality of research infrastructure through modernisation and upgrading. These investments are generally considered to be an important starting point prior to being able to compete for FP funding, especially in a coordinator capacity. The Expert Advisory Group (EAG) on European Research Infrastructures98 has also stressed the importance of enabling and leveraging a blend of multiple funding sources (Horizon 2020, regional, national, Cohesion, PPP, other) in order to address the diversified long-term investment needs for research infrastructures.

Examples of synergies between the ESIF and Horizon 2020 funding could be the development and equipment of innovation infrastructures or the fostering of innovation skills through ESIF that enable the participation in a Horizon 2020 project. ESIF can also be used to expand the support and advisory services for potential Horizon 2020 participants. Moreover, research, development and innovation is one of the priority sectors targeted by the European Fund for Strategic Investments (EFSI). As of September 2016, 134 projects have been approved under the infrastructure and innovation window, out of which 9 projects were fully dedicated to RDI. Indeed, although there is evidence of RI-related impacts of ESI Funds, there is no clear link between other Excellent Science Priority areas and ESI Funding. For example, the 2015 monitoring data shows that the EU-13 has not had any great success in accessing competitive research funding, such as FET and the ERC funding.99

However, ESIF, ESFI and Horizon 2020 funds have different objectives and address different types of beneficiary. This means it is not always easy to find synergies between them. A tension arises between the efficiency and excellence goals chased by Horizon 2020, on the one hand, and the EU Cohesion Policy aims to equity purposes on the other one. While research and innovation policies generally tend to concentrate funds in core and well-endowed areas, in order to reach economies of scale and scope, the intervention logic of Cohesion Policy favours less endowed, peripheral and economically weaker regions, which could be less prepared to achieve excellence in innovation and research. In its recent feedback document for Horizon 2020’s mid-term review,100 EARTO pointed out that organisations from more advanced regions, who are often strong actors in Horizon 2020, have much smaller ESIF budget available in their regions, which hampers their capacity to combine funding.

One way to address the trade-off between innovation/excellence and cohesion/redistribution objectives has been proposed by the smart specialisation approach, which admits the possibility for any region to generate innovation, by leveraging its own strengths and competitive advantages and selectively targeting its place-based research...

97 Structural funds (archived website). See http://ec.europa.eu/invest-in-research/funding/funding04_en.htm


99 Horizon 2020 Monitoring Report

and innovation strategy on those economic activities in which the region can hope to excel. Yet, the strategic and priority setting defined by Member States/regions according to a bottom-up and place-based approach may not be fully aligned with the EU research strategy. As to the ESFI, this is an instrument targeting the private sector, not public institutions. Unless there are private actors involved in RI projects, the instrument is not suitable to support RI as such.

Even if the Commission can facilitate the exploitation of synergies where it sees the scope for it, interviewees have highlighted that synergy between different funding sources should be engineered in the funding instruments from their early design stage. Having the same target beneficiaries and main objectives are preconditions for creating easier and more effective synergy and complementarity.

National programmes

There has been an emphasis on R&I strategies since the signing of the Lisbon Treaty and the subsequent creation of the ERA. The national policy mix in Europe is, to various degrees, aligned with the ERA pillars. National policy developments are partly driven by EU/ERA level activity.

A recent JRC report points out that, in principle, ERA impacts on national R&I systems may in practice have either adverse or beneficial impacts from both national and EU level perspectives. Examples given to this observation are that “an adverse ERA impact could drive national policies to focus on ineffective instruments, for example, national knowledge transfer policies supported by structural funds within the context of systemic failure in the economy. Similarly, policy changes observed may occur due to other dominant national policy rationales, coinciding with the ones supporting ERA goals.”

In terms of the strategic thinking behind R&I strategies, although the academic world is increasingly turning away a linear model of innovation and despite the increasingly complexities R&I policies are expected to perform, the linear model of innovation still tend to dominate in policymaking in Europe. This may be starting to change as in recent years there has been an increasing interest in 'broad-based innovation policies', 'systemic innovation policies, 'a demand-pull view', and 'demand-oriented policy instruments'.

At a general level, our interviews with NCPs have suggested that the Member States would welcome more involvement in the Horizon 2020; both representation from national as well as regional level. This also related to the coherence of EU level policies and national Programmes and with issues related to intellectual property.

One example of an area of increasing EU-national coordination is the Seal of Excellence certificate introduced by the European Commission to facilitate national/regional or ESI Fund support for unfunded Horizon 2020 proposals that were above the quality threshold.

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but could not be funded under the EU Framework Programme because of budget restraints.\textsuperscript{103}

However, with a few exceptions (notably France and the EEA countries) the Seal of Excellence is not implemented widely under the Excellent Science Priority. To date, the certificate has benefited proposals submitted under the SME instrument. Although the Seal of Excellence is a welcomed initiative, it has also been criticized for being difficult to use in practice (see box below). However, interviewees agree that the potential of the certificate makes it an initiative that could – and should be – extended to other Horizon 2020 funding schemes.\textsuperscript{104}

\textit{Source: interview}

The Seal of Excellence initiative has been taken up by a number of countries. Although the SoE largely supports SME instrument proposals, there are some countries that are applying the SoE principle more broadly.

France for example sees a clear complementarity between Horizon 2020 and national programmes. French national policy has the same objectives with Horizon 2020 (although notably these are oriented more towards Societal Challenges than Excellent Science). However, France also carries out programmes aiming to support participation in Horizon 2020. For instance, there is a national programme that funds projects that fulfilled the eligibility criteria for Horizon 2020 but that were unfunded by the Framework Programme.

The Research Council of Norway also funds proposals rated as high quality but which could not receive Horizon 2020 funding due to a lack of budget.

Although generally national R&I funders considers the SoE as a good principle and part of the solution to see high-quality European proposals go unfunded, there are also some reservations with regards to its design (in Finland, this issue also extends to the SME Instrument as Tekes, the Innovation Agency, has a maximum allowance of national funding applicable to individual SMEs. Once this is exhausted, innovative SMEs are encouraged to apply for European funds; hence only 4-5 projects have been funded under the SoE in Finland).

More generally, some national funders also find the SoE certificate somewhat contradictory as Horizon 2020 proposals have been developed with European Added Value in mind. If projects are then supported at national level, it has been argued that EU-level objectives risk being lost. On a practical level, SoE cannot easily be used for projects submitted by consortia, which is a particular problem for FET under Excellent Science.

Looking at the Excellent Science Priority specifically, clearly a strong science-base and mobility of researchers are important. There are no overlaps in terms of programming content, as the Excellent Science Priority is not a thematic one.

\textsuperscript{103} https://ec.europa.eu/research/regions/index.cfm?pg=soe

\textsuperscript{104} Business Europe Informal survey on Horizon 2020 implementation and possible recommendations for next Framework Programme Overview of the preliminary outcomes. October 2016
The FP7 MSCA interim evaluation demonstrated that the Actions are “unique in terms of the overall mix of instruments (linking research mobility with training, career development and inter-sectorial cooperation) applied” and stated that no other nationally or internationally funded programme covered a similar array of activities (although some similarities exist with other EU instruments, such as Erasmus Mundus and Erasmus).\(^{105}\) The MSCA programme was also considered to be a good model that influenced the design of similar programmes at the national level, as well as influencing current practices in terms of research training and development of careers.\(^{106}\)

The ERC is a very attractive instrument from the national perspective. ERC grants are considered a ‘badge of honour’ and quality-mark, and which is an advantage when applying for national funding. In other words, securing an ERC grant can open door for further national funds. Universities in the EU are therefore keen to attract and retain ERC grantees. In the UK, there are examples of the research-intensive Russell Group universities developing strategies for supporting and mentoring researchers who are seen as potential ERC grant holder to apply.

Although the FET programme is explicitly aimed at building research themes at European level, FET is also making use of the ERA-NET funding model, and the 2016-17 WP has published two calls for proposals under FET ERANET Cofund. The first call (2016) had a budget of EUR 10 million with another EUR 5 million allocated to the second (2017) call. Although it is too early to locate the funding allocated, both have as the overarching goal to enhance the construction of the [ERA] in the FET domain, however the proposals submitted are equally required to “coordinate national and regional programmes for research in the FET domain by implementing a joint transnational call for proposals (resulting in grants to third parties) with EU cofunding”.\(^ {107}\) Proposals are also encouraged to implement other joint activities, in particular sharing information on existing national and regional research programmes, strategic research agendas and technological roadmaps, among research funding organisations and with the other relevant stakeholders. The ERA-NET should ideally also identify emerging topics where transnational cooperation and support to community structuring is most needed and develop strategic agendas for these topics and accompany the structuring of the related communities through workshops and support to transversal activities.\(^ {108}\)

The high-level political agreement on the priority research infrastructures of EU-wide interest (projects listed in the ESFRI roadmap) favours coordination with national funding sources. National programmes provide complementary support for RI projects, in synergy with Excellence Science calls. By contrast, the lack of agreement between the European Commission and Member States on funding needs of other small or large scale RI, for instance e-infrastructures, could limit the scope for exploiting synergies and complementarities between EU and national funding. In particular, the fragmentation of


\(^{107}\) Horizon 2020 - Work Programme 2016 – 2017 Future and Emerging Technologies

\(^{108}\) Horizon 2020 - Work Programme 2016 – 2017 Future and Emerging Technologies
e-infrastructures endowment across countries from a technological, geographic and thematic perspective determines weak collaboration among e-infrastructure projects and possible competing interests between regional, national and European authorities. Lack of coordination of Member States’ e-RI policies and the European strategy is considered a serious weaknesses constraining Europe’s global race to world-class computing infrastructures. In order to foster coordination and pooling of resources and investments in this field, the EAG advocates that European, national and regional funding agencies are involved as far as possible in joint programmes and actions.

VI – Main achievements in the cooperation with third countries

Cooperation with third countries is relevant in several ways, including in the context of cross-border or international collaboration between researchers and research institutions, but equally through cooperation activities undertaken at a policy level to facilitate internationalisation of research.

With regards to the former, globally, internationalisation of research is growing and the added value of international cooperation is increasingly debated. Numerous studies are showing that research outputs that represent collaborations – particularly international collaboration – have a higher citation impact than those that do not. International collaboration can also foster the development of technological capabilities and innovations.109

Figure 5: Excellent Science - share of EU contribution to non-Member States

The figure above shows the share of non-EU Member States in the Excellent Science Priority. Third country participation is still limited and dominated by Horizon 2020

Associated Countries – Switzerland (CH), Israel (IL), Norway (NO), and to a lesser extent Turkey (TR), Iceland (IS) and Serbia (RS). Cooperation with third countries that are not Associated to Horizon 2020 is limited to less than 0.1% (ZA - South Africa, US - USA, UA - Ukraine and BR - Brazil).

However we understand that the “level of participation of third countries in Horizon 2020 is lower than in FP7”. This decline is partly due to the fact that Brazil, Russia, India and China (the BRIC countries) no longer being automatically qualified for EU funding.

Internationalisation takes different forms within the Excellent Science Priority. For example, both international researchers (i.e. non-EU, non-Associated Country citizens) are eligible for grants (as Principle Investigators, PIs) under both MSCA and ERC.

Internationalisation is rather low in ERC grants – 8-9% for young researchers (Starting Grants) and 5-6% for more senior researchers. ERC encourages international researchers to seek grants and international applicants can also seek funding for an additional EUR 0.5 million to be spent on equipment in the host institution. This is support particularly attractive for international researchers relocating to Europe, which will also benefit the European host institution. Typically international ERC Principle Investigators settle in large-capacity countries, notably Switzerland, UK and France.

However, international researchers are also indirectly supported by the ERC as many ERC Principle Investigators teams include international scientists. According to ERC grant (survey-based self-reporting) data 18% of PI teams are international. The BRIC countries (Brazil, Russia, China and India) typically make up 3% each of these 18%. ERC hopes these will eventually apply for ERC grants of their own.

Thirdly, ERC encourages international mobility with successful grantees of sister organisations in the US (National Science Foundation) Japan (Japan Society for the Promotion of Science), China, Brazil, Mexico, South Africa and South Korea. Because these sister organisations have already vetted applicants for exchange, this is a good way of encouraging high quality researchers to come to Europe.

In contrast to the ERC approach, internationalisation in FET takes different forms. Mostly, there is interaction with the USA in particular – the National Science Foundation is involved in the Brain Flagship project, and the Flagships are very international. Within FET there is also interaction with Mexico and Japan. Due to the higher TRL levels, the Graphene Flagship is less international as the EU is competition with international colleagues, thus collaboration has become more selective and sensitive.

Source: interviews

The Horizon 2020 Advisory Group on International Cooperation advocates that international cooperation should be “high on the agenda of the EU in order to be able to address global societal challenges and for increasing Europe’s international competitiveness in research”. In its 2014 activity report, the Advisory Group also makes
a number of comments and recommendations with regards to the Excellent Science objectives:

- Europe needs researchers with hands-on experience and in-depth knowledge of third countries, these countries, especially emerging economies. MSCA-RISE should devote special effort towards increasing the mobility of European researchers to these countries.

- The ERC could develop an ERC internationalisation strategy to attract excellent international researchers to Europe. The Advisory Group also recommends that the ERC encourages suitable incoming MSCA fellows to apply for ERC Starting Grants keeping them in the EU for longer periods of their professional career before returning home.

- The Advisory Group recommends that COST aligns the rules for participation with Horizon 2020 rule. COST actions may be used as gateways for international researchers and institutions and launching platforms for the development of new research consortia and initiatives.\textsuperscript{112}

With regards to \textbf{Research Infrastructure}, the EU contribution to Third Countries has been higher for RI calls than for other Excellence Science calls. Third Countries involved in RI projects have received so far EUR 9.4 million. The share of Third Country participations in collaborative projects has been 3.8\% on average in 2014-2015 years, higher than the Horizon 2020 average (2.4\%). The research community using large-scale RI is global by nature, which favours the participation of Third Countries.

It is the specific aim of RI actions to facilitate the development of global research infrastructures (including e-infrastructures) and the cooperation of European infrastructures with their non-European counterparts, ensuring their global interoperability and access. The work programme 2016-17 contains six topics encouraging International Cooperation. Among these, in the call H2020 INFRAIA-2016-2017 - Integrating and Opening Research Infrastructures of European Interest (covering 2 topics) legal entities established in Australia, Brazil, Canada, China, India, Japan, Russia, Mexico and the USA, which provide access to their research infrastructures to researchers from Members States and Associated countries, are eligible for funding from the Union.

Although the EU interest in the international cooperation has grown in Horizon 2020, some interviewees have noted that not all third countries are eligible for EU funding. Indeed participants from the BRIC and Mexico, even if they can participate as partners in the project, generally are no longer automatically eligible for funds. This requirement necessarily limits the degree of involvement of Third Countries in collaborative RI projects.

Chapter 4. The Design of Horizon 2020 – Excellent Science

Key findings

- The Excellent Science Priority is overall well regarded and often considered to be the most well functioning part of Horizon 2020.

- Although the Excellent Science budget is comparatively generous vis-à-vis Horizon 2020 overall, the Priority is experiencing significant oversubscription issues overall.

- With the exception of RI, Excellent Science funding is skewed in favour of a smaller number of very high-quality R&I actors. Although high quality is in line with the excellence criterion underpinning the Priority, there is a clear consensus that current barriers to participation need to be addressed.

I – Excellence science in relation to the overall Horizon 2020 programme

The Excellent Science Priority is regarded as well designed. The recent opinion paper by LERU – the League of European Research Universities – describes Pillar I as “well organized” and that “resources [are] well spent”. Interviewees have largely considered Excellent Science to be the most well functioning of the three Priorities. Priority carries particular importance towards the overall Horizon 2020 goals through its emphasis on excellence and curiosity-driven research and innovation. Positive assessments of Pillar I can also be found at national level. The Norwegian Research Council considers that “the funding of bottom-up excellent research and enabling technologies is one of the great successes of Horizon 2020.114

Although it is recognized that Excellent Science receives a fair share of the budget when compared to the overall Horizon 2020 funding, there are nevertheless multiple calls for more “bottom-up, collaborative research”115 in Horizon 2020 and concerns that there is not adequate funding allocated to the Excellent Science priority to meet the demand of the scientific community. Science Europe recommends strengthening the ERC, MSCA as well as the FET-Open instruments, and also advocates for RI funding to be increased during the remainder of Horizon 2020.116

Although our research shows that generally the three priorities structure of Horizon 2020 is a welcome development, there are calls for improving coordination between the three.

113 LERU’s Interim Evaluation of Horizon 2020 Advice Paper no. 21, October 2016
114 The Research Council of Norway’s feedback for the interim evaluation of Horizon 2020
II – Main achievements and main challenges

The high-level key achievement to date has been to contribute to competitiveness and excellence of European R&I. Over time, the drive towards high-quality European research has influenced – and is expected to continue to influence R&I at national and regional level.\(^{117}\)

For the Excellent Science Priority as a whole, we can point to a number of overarching challenges:

- The uneven ability of the EU-28 and Associated Countries to compete and absorb funding available through Excellent Science due to differences in R&I capabilities. If not adjusted, these inequalities risk leading to a concentration of R&I excellence in a smaller number of European institutions/regions.

- The prominent position of the linear model of innovation concept in Horizon 2020 design, which risks favouring stronger institutions/regions over lower-capacity ones.\(^{118}\) This approach does not sufficiently allow for R&I actors that are catching up to build capacity.

To reiterate, there is a clear consensus among interviewees and the existing literature that the Excellent Science Priority should focus on funding the best science, but that barriers to participation need to be taken into account.

Looking beyond the Excellent Science Priority design, Europe also faces a challenge of finding 1 million new researchers to reach the objective of 3% of GDP invested in R&D. This will require a net increase by two-thirds by 2020. As Europe’s population is also ageing, a large number of the existing R&I work force will retire by 2020.\(^{119}\) Horizon 2020, and perhaps in particular Excellent Science, plays a key role in addressing this challenge.

The remaining part of Chapter 4 will look at the main achievements and main challenges of each of the four parts of Excellent Science – ERC, FET, MSCA and RI. Chapter 5 will offer conclusions and recommendations.

European Research Council

The ERC has very strong support and is considered to have become a real success story since its establishment in 2007. It is well respected by the international R&I community and performs on par with its US counterpart, the National Science Foundation (NSF). For some Key Performance Indicators (KPIs), it even surpasses the NSF (number of publications accepted and published in top science journals). The ERC plays an important role in strengthening competition at European level while also helping to improve research excellence.

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\(^{117}\) LERU’s Interim Evaluation of Horizon 2020 Advice Paper no. 21, October 2016

\(^{118}\) Interviews. See also Science Europe Position Statement The Framework Programme that Europe Needs, October 2016 Contribution to the Horizon 2020 Interim Evaluation: Lessons Learnt and the Way Forward

\(^{119}\) European Commission (2011), Innovation Union Competitiveness report
The ERC is currently working to increase and improve coordination with the other programme managers within the Excellent Science Priority, in particular with FET and MSCA, but also with RI. The ERC and responsible Commission DGs exchange data and is working to better understand how linkages between the various parts can be strengthened.

ERC’s key challenges are to tackle the pressures on its budgets (and subsequent low success rates), and address the issues of ‘Unfunded A’ proposals, i.e. project proposals that have been awarded a top mark by their peer review panels, but which cannot be funded due to insufficient budgets. If not addressed, both challenges risk having an adverse effect on the Council’s reputation in the longer-term. More long-term, the ERC is aiming to address the current political climate which it believes tend to favour top-down and/or policy-driven research, and champion the need to sufficiently budget for and fund investigator-driven projects.

**Future and Emerging Technologies**

According to the FET advisory group, FET research has already significantly contributed to Europe’s leadership in areas such as quantum communications, nanoelectronics, neuro- and bio-inspired information science, advanced robotics and complex systems.

The advisory group believes that FET is fulfilling the excellence criteria set out by the work programmes. FET fills an important gap in the funding market as it supports new ideas for radically different technologies, at an early stage when there are few researchers working on the topic.

A recent SWOT\(^\text{121}\) analysis by DG CONNECT also highlights the following strengths and opportunities:

- FET has wide political support. According to DG CONNECT, FET is the only programme that can support Europe-wide collaboration between groups that are traditionally funded through their national science agencies.

- FET is important for the advancement of R&I into ICT, which in turn is “a key enabler of convergence between disciplines as well as for transformation of sectors (e.g., digitalisation of European industry)”\(^\text{122}\). It is considered that FET can develop long-term thought-leadership in this area.

- FET could also develop better links with regional and national incentives and develop collaborations around local smart specialisation priorities.

As for the ERC, a significant challenge for FET is the problem of dramatic oversubscription. Although this is an issue that the FET management is trying to address, it is felt that in contrast to the ERC, which has established a strong reputation, FET is less well known and lacks ‘ambassadors’ who can promote its cause (whereas the ERC has access to high-profile grant holders and its Scientific Council to raise its profile).

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\(^{121}\) Strengths, Weaknesses, Opportunities, Threats
Another challenge relates to the brain drain issue and Europe’s inadequate absorption of research talent in industry/academia. As FET partly operates close to the market, it risks losing important research results which are developed within its project but exploited elsewhere as a result of a less favourable entrepreneurial and investment climate in Europe.

**Marie Skłodowska-Curie actions**

A key strength of the MSCA is that the programme attracts international talent to Europe and thereby strengthens the competitiveness of European science. The MSCA mobility structure is also advantageous as it has the potential to bridge research, education and innovation.

According to the MSCA advisory group, up to 65,000 researchers across the EU are expected to benefit from MSCA funding under Horizon 2020 to enhance their careers. Much of the research addressed through MSCA funding is also highly relevant to Horizon 2020 overall, and especially the Societal Challenges Priority, as MSCA research includes health- and societal-related projects on cancer, Alzheimer’s and Multiple Sclerosis, providing safer food, developing solutions for improved road safety, reducing noise pollution, preserving cultural heritage and shaping the development of key policies such as migration, climate change and energy.

Like other areas of Excellent Science, MSCA also faces challenges with regards to competitive success rates and in ensuring that research-industry collaboration projects funded indeed develop into constructive collaborations.

Other challenges, specific to MSCA relate to ensuring a balanced demographic of award holders, including encouraging young researchers as well as older ones (+55 years of age) to participate in actions. Other demographic imbalances include a lack of women and researchers from low-capacity countries.

**Research Infrastructures**

For RI actions specifically, one of the main achievements of Horizon 2020 relates to the higher visibility and priority given to the development and integration of e-infrastructures. E-infrastructures can have huge impact across different scientific communities. The GÉANT Project and associated programme of activities are prominent examples of success stories.

A still existing challenge however has to do with limited coordination of investment for e-infrastructures between the Commission and Member States. The e-Infrastructure Reflection Group (e-IRG)\(^{122}\) cooperates with ESFRI strategy working groups, but there are no strong mechanisms of coordination with national authorities. Already during the 10th e-Infrastructure Concertation Meeting which took place in 2013, Steven Newhouse, director of the European Grid infrastructure (EGI.eu), proposed the creation of a body to coordinate e-infrastructures in Horizon 2020: “If the European Commission is serious about coordinating e-Infrastructures, they need to think about how to put a body in place to do this, supported by the Member States, and that can do things like collation of metrics; long-

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\(^{122}\) E-IRG is the strategic body to facilitate integration in the area of European e-Infrastructures and connected services, within and between member states, at the European level and globally.
term development of policy, in a manner similar to what e-IRG has been doing; and provide the long-term coordination of the e-infrastructures.”

Another challenge mentioned by interviewees with reference to Excellence Science RI actions relates to the lack of tools to support technology infrastructures. EARTO\textsuperscript{124} and some interviewees emphasised the need to establish a dedicated instrument for technology infrastructures at EU level. The main expected benefit would be greater capacity to translate applied research into technological innovation. Furthermore, the introduction of horizontal technology programmes could help develop technologies which could find application in a number of RI at the same time (e.g. technologies needed by particle detectors and accelerators are not used at CERN only, but also in other fundamental research infrastructure, as well as in the medical field).

\begin{footnotesize}
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\begin{enumerate}
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\end{footnotesize}
Chapter 5. Conclusions & Recommendations

I – Conclusions

The Excellent Science Priority is regarded as well designed. The quality of the research and innovation activities undertaken by the Priority appears overall to be extremely high.

The administrative simplifications introduced under Horizon 2020 have been welcomed, although further reforms are needed, in particular relating to auditing. Moreover, the implementation of Excellent Science and the relationship between the EC and its agencies is considered to be uneven and largely relying on the quality and expertise of individual officers.

The Excellent Science Priority is successful in funding high-quality projects but is at the same time risking concentrating excellence on a smaller number of European institutions/regions. A major concern relates to the low success rates, in particular concerning the ERC, FET and to an extent MSCA, and to what extent these risk damaging the reputation of the Excellent Science objectives in the longer-term. Related to this is the equally substantial concern about the low number of newcomers in Excellent Science.

Horizon 2020 is also proving to be a valuable instrument to support collaborative research in the specific field of e-infrastructures. However, greater efforts are needed to increase coordination and networking across Europe in this field. There are notable concerns about the lack of collaboration within Excellent Science – as well as within Horizon 2020 overall – and the need to improve this. In spite of changes introduced in grant procedures and rules with the purpose of simplifying the application and grant management process, so as to attract enterprises, there is wide scope for increasing the involvement of the industry in Excellent Science, in particular MSCA and RI.

The lack of a governance structure to coordinate investment of world-class e-infrastructures and still limited coordination of Member State and European strategies reduce the effectiveness and efficiency of Horizon 2020 actions. Specifically, on the one hand, poor coordination slows down the development of e-infrastructure resources which are needed to meet the high demand coming from both the research and industrial community; on the other hand, it necessarily implies some cost duplication, multiplication of systems and redundancy, and fragmentation of infrastructures and services.

With specific reference to RI actions, the combination of a bottom-up approach and top-down investment priorities defined at a European political level for European Strategy Research Infrastructures favours coordination between stakeholders and a concentration of resources around well-specified target infrastructures. This is reflected in the relatively higher success rates of RI calls. It also creates the opportunity for exploiting synergies between different national and European sources of financing. Pre-Commercial Procurement is still underutilised, due to lack of interest or hesitation of research organisations to change their established purchasing strategy.

Finally it was felt that the clear change in gear in terms of budget allocation (compared to FP7) and the merging of R&I under the Horizon 2020 umbrella has not paid off as expected. It is felt that Horizon 2020, including Excellent Science, has an overreliance on the linear model of innovation, and an overly technological perspective of innovation.
II – Recommendations

We now present our recommendations for Excellent Science. These have been developed to provide ideas and suggestions for improvements applicable to the latter half of Horizon 2020 (2017-20) as well as to future Framework Programmes.

Excellent Science overarching recommendations

- The EC Directorate-Generals and Agencies responsible for implementing the Excellent Science Priority are already engaging in different kinds of coordination activities. This is a positive trend, which should be encouraged to continue and be further strengthened. In particular, based on the evidence collected, we recommend that the EC is encouraged to specifically consider to:

  o Support and promote collaborations that discourage further national disparities. The Priority should be driven by excellence, and lower-capacity regions and institutions should be encouraged to participate and build capacity, including through but not limited to supporting mobility, career development, and recruitment of researchers in industry. Braindrain has become a serious challenge in a number of EU-13 and Associated Countries, which ought to be tackled.

  o Tackle the challenge of oversubscription through for example, providing more flexible budgets to fulfil Excellent Science and Horizon 2020 objectives, developing clearer priorities in the call texts (including improved text on the impacts expected), considering limiting the possibilities for resubmissions and/or making further use of two-stage proposal processes if appropriate.

  o Further fine-tune the newer objectives within Excellent Science, notably FET, including developing funding and evaluation models that are less reliant on the linear model of innovation (e.g. take into account new public and private R&I actors and further broaden the scope of innovation to specifically include non-technological innovation).

- The EC Directorates-General and Agencies together with the Member States could be further encouraged to design and implement programmes and tools through which unfunded high-quality proposals to the Excellent Science Priority could be supported.

European Research Council

- The ERC has established itself as an internationally highly respected funding agency since its start in 2007. It is recognised by the scientific community worldwide and its grants are considered to be a badge of scientific quality. It is important it is maintained in its current form.

- Around half of the ERC grants budget is currently concentrated in around 50 R&I institutions in Europe, thus a significant amount of its funding supports (already) leading R&I actors. Although the excellence criterion should not be questioned, the high concentration of funding risks becoming a political issue. The ERC would benefit from engaging in (more) activities with the aim of boosting collaboration across Europe and supporting low-capacity regions and institutions. This would be an important step in ensuring that EU R&I policy works for the continent as a whole and that excellence
does not become a barrier obstructing the participation of low-capacity institutions but contributes to developing internationally competitive capacity.

- Reflecting the above recommendation, the ERC should also continue its internationalisation activities, since these are likely to have a long-term positive impact on the presence of international research talent in EU R&I.

**Future and Emerging Technologies**

- FET is a new and unusual funding programme. It has a relatively small budget within the Excellence Science Priority, but has begun to develop a respectable profile. FET is considered to have great potential. It will require further support and time to establish itself, improve, and refine programme objectives.

- FET constitutes a good opportunity for spreading excellence and innovation at European national and regional levels. FET could be encouraged to continue its engagement with regional and national incentives (including through the FET ERA-Net) and could play a role in the implementation of smart specialisation priorities.

- As one of the Horizon 2020 objectives providing funding to large consortia, FET should be vigilant about the increasing use of proposal-writing consultancies and ‘ungentlemanlike’ behaviour by consortia to win funding in the extremely competitive environment.

- There is also a role for FET to play in addressing the braindrain challenges faced by lower-capacity regions and countries in Europe. FET should also be vigilant of the emergence and advancement of international competition within its remit. As FET partly operates close to market, it risks losing important research results developed within its projects but exploited elsewhere as a result of a less favourable entrepreneurial and investment climate in Europe.

**Marie Skłodowska-Curie actions**

- MSCA was first established under FP6 (then known as Marie Curie actions). Overall, it is a well-functioning programme, although it suffers from challenges also present elsewhere in Excellent Science and Horizon 2020, e.g. low success rates, instances of unsustainable collaboration and braindrain, which require action.

- MSCA would also benefit from further improving its intersectoral mobility between academia and industry. This would be important in helping R&I actors build up trust, develop sustainable working relationships, and encourage real collaborations.

- MSCA plays an important role vis-à-vis the Societal Challenges Priority as it supports many researchers working in areas relating to health, climate change and energy etc. The EC may benefit from building on existing synergies at project level to help these develop further and with institutional support.
Research Infrastructures

- The process of simplification of administrative procedures should continue in order to attract the interest of enterprises, particularly SMEs, and ease their participation in research projects.

- Considering the potentially important role played by enterprises as suppliers or users of RI, ways to increase the participation of industry in RI Actions should be sought. Increasing the volume of resources devoted to INFRAINNOV calls may be considered, focused on supporting technological infrastructures and fostering the innovation potential of RI, which have so far absorbed a relatively small share of the budget.

- RI should continue to support (and perhaps even increase the focus on) networking of e-infrastructures and collaborative research projects on e-infrastructures, in order to counteract the existing fragmentation of resources and political interest. This might help EU and single countries coordinate their investment priorities.
## Annex A List of Interviewees

<table>
<thead>
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<th>Affiliation</th>
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</tbody>
</table>
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ANNEX II

THE IMPLEMENTATION OF HORIZON 2020
- EXCELLENT SCIENCE -

Economic and financial perspective

Briefing paper
by Europe Economics

Abstract

This report is an evaluation of H2020 funding, from an economic and financial perspective, of the Excellent Science pillar. The pillar is designed to strengthen the Union’s world-class scientific excellence and make the Union’s research and innovation system more competitive. In this report we focus on three specific sub-areas: European Research Council (ERC); Marie Skłodowska-Curie Actions; and Research infrastructure (including e-infrastructures).

Horizon 2020 is received positively by different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions from our interviewees. However, stakeholders are of the opinion that it is difficult to measure the success of this pillar using conventional economic impact metrics (employment and growth). In this area, additional indirect economic impacts are mentioned as important.

Our main conclusions show some concerning issues around the problem definition, envisaged impacts of the interventions, ex-post monitoring and evaluation of the projects, budgets and the problem of oversubscription, and evaluation of proposals. We also show our conclusions in relation to cross-country cooperation, the synergies with other programmes and the simplification of the regulations. Recommendations are provided to correct for such problems.
AUTHOR
This study has been written by Dr Pau Salsas, Kareen El Beyrouty, Summayah Leghari, Nadia Chernenko (Europe Aconomics) and Jacqueline Snijders (Panteia) at the request of the Impact Assessment Unit of the Directorate for Impact Assessment and European Added Value, within the Directorate General for Parliamentary Research Services (DG EPRS) of the General Secretariat of the European Parliament.

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Manuscript completed in January 2017
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Executive summary

This report is an evaluation of H2020 funding, from an economic and financial perspective, of the Excellent Science pillar. The pillar is designed to strengthen the Union’s world-class scientific excellence and make the Union’s research and innovation system more competitive. In this report we focus on three specific sub-areas: European Research Council (ERC); Marie Skłodowska-Curie Actions; and Research infrastructure (including e-infrastructures).

Methodology

We have used the following tools of analysis throughout the study: Data analysis using financial and programmatic data from CORDIS; Information and budgetary data from H2020 Work Programmes; Stakeholder interviews; Case studies; and Desk research.

The current study has been undertaken with limited time and resources and does not aim at a comprehensive evaluation. Our findings have been based on the judgement to inform a high level opinion of the implementation of the programme.

Main Findings and Conclusions

Horizon 2020 is received positively by different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions from our interviewees.

Stakeholders are of the opinion that it is difficult to measure the success of this pillar using conventional economic impact metrics (employment and growth). Stakeholders mentioned the importance of additional indirect economic impacts.

The rational for intervention with the programme Horizon 2020 is laid in the appropriate impact assessments and the corresponding annexes. The Work Programmes issues and challenges to be addressed, as well as the scope and the expected impact of the intervention. However, in some cases it is difficult to relate the programmes’ objectives to the market failures identified. Clarifications would be welcome.

The measurement of the impacts of research using economic outcomes is very challenging (in particular to relate them to social benefits). This makes it difficult to assess how funding should be distributed across different research areas (basic or applied research). It could be helpful to establish some high-level points on the impacts research can create (in terms of externalities and “spill-over” effects).

The simplifications introduced by the regulations are viewed as positive, but in some cases this has resulted in concerns of favouring established researchers and giving rise to specialised grant-writing agencies. The level of specialisation, the advantages and complementarities offered by existing researchers could be seen as positive (efficiency from “agglomeration” effects). There is some risk that new market players may feel excluded but the selection criteria encouraging participation would mitigate such effect.

The proliferation of “writing-agencies” may not be a negative solution in all cases (if they develop proposal-writing skills and bring specialisation efficiencies). Their main disadvantage however, would be in cases where the objectives have been over-promised. Therefore, there is a need for monitoring the outcomes and impacts of the projects. To quantify the economic impact of research, there could be a methodological approach to assess the economic impacts for reporting purposes when these are finalised. These would need to be proportional to the sizes and efforts of every project.

Excellent Science is highly oversubscribed, but not in the same way across calls (in some cases the success rates are unusually high). Although oversubscription should be seen as a
reflection of the success in attracting top researchers, the existing pool of unfunded good projects provides a reason to think about increasing the budgets. However, this should be done following clear guidelines (or strategy) that establish the areas where such investments are likely to provide greater benefits to society.

There are some concerns about the evaluation of proposals (lack of transparency and expertise of evaluators). This is a potential weakness and should be corrected by providing more reassurance on the process and outcomes of the evaluation.

Some stakeholders expressed concern that a noticeable share of research funding goes to established institutions in old Member States. This may not be surprising if the research originates in those centres where it is undertaken more efficiently (making use of economies of agglomeration). But this shows that the principles of creating a single market for knowledge are difficult to achieve. The extent to which both objectives need to be achieved could be clarified (the importance of dissemination of the findings and discoveries could be investigated as to reduce the “knowledge gap” between countries).

There are some overlaps between Horizon 2020 and other EU programmes. The use of the Seal of Excellence is seen positively but should rely on a trusted evaluation process.

The simplifications are seen as an achievement of the programme. Because of the no-ground negotiation clause introduced there may be some value in providing warnings and clarifications on the most common errors done by some participants.

**Recommendations**

To correct for the identified problems we would recommend the following:

**Recommendation 1:** The strategy for each of the calls under the programme should be more developed. This should take into account issues such as the problem definition: market failure to be corrected for, social impact (knowledge transfer, “spill-overs” and research mobility), and expected ex-post metrics for measurement of outcomes.

**Recommendation 2:** Assess size and scope of the calls using the evidence provided in Recommendation 1. Given the assessment it may be possible to rank the different calls and prioritise the funding for those that yield higher return to society.

**Recommendation 3:** There should be a close monitoring of project outputs. Given that measuring the impacts is a difficult task, the Commission could develop a methodological approach to assess the economic impacts of the different projects.

**Recommendation 4:** Improve quality control mechanisms for the evaluation process of applications. Using researchers who have received funds as reviewers could be an option. Another option could be to develop further a two-stage approach to evaluation.

**Recommendation 5:** Clarify the policy objectives of H2020 such that it is focussed on excellence and leadership at the European level. There could be benefits in providing guidance on how should synergies between programmes be achieved.

**Recommendation 6:** The simplification process is working well but warnings and clarifications on the most common application errors done by some participants could be provided in advance.
Chapter 1 – Introduction

The objective of this briefing paper is to assess, from an economic and financial perspective, the implementation of the Horizon 2020 framework programme as regards the priority “Excellent Science”. The paper is part of three evaluation studies (the other two being the assessment of “Industrial Leadership” and “Societal Challenges” priorities) which have been undertaken in parallel to this research.

In this chapter, we present a brief introduction to Horizon 2020 (H2020) and describe the Excellent Science section of Horizon 2020, along with the methodological tools we have employed in our investigation on the progress of Horizon 2020 from a financial and economic perspective.

I – Introduction to the programme

The general purpose of Horizon 2020 is to “take great ideas from the lab to the market”. It is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe’s global competitiveness.125

- Horizon 2020 has broken down its focus into three main pillars:
- excellent science to strengthen the Union’s world-class scientific excellence and make the Union’s research and innovation system more competitive;
- fostering industrial leadership to speed up the development of technologies that will support businesses and innovation, including for small companies; and
- tackling societal challenges to respond to the priorities identified in the Europe 2020 strategy.

In addition, there are three horizontal programmes (“Spreading excellence and widening participation”, “Science with and for society”, and “Fast Track to Innovation Pilot”) and three smaller blocks (“EIT - European Institute of Innovation and Technology”, “Euratom”, and “Smart Cyber-Physical Systems”). There are also three separate cross-cutting calls: Industry 2020 in the Circular Economy, Internet of Things, and Smart and Sustainable Cities.

The objectives of Horizon 2020 can be summarised in the following high-level goals:

- More breakthroughs, discoveries and world-firsts: The programme aims to deliver radical technological change, not changes by small increments.
- Driving economic growth and creating jobs: Economic impacts of the project are expected to affect two areas — GDP growth and job creation.
- Smart, sustainable and inclusive growth and jobs: The programme is expected to produce a certain type of GDP growth and jobs.

125 FP7 was the European Union’s Research and Innovation funding programme for projects which started in the time period 2007-2013. Horizon 2020 is the sequel of this programme and covers projects initiated between 2014 and 2020. The focus and the budget of FP7 and Horizon 2020, however, differ. FP7 focused on research only, while Horizon 2020 focuses on both research and innovation. Moreover, FP7 had a budget of €55 billion compared to around €79 billion for Horizon 2020.
- Produce world-class science: Research produced should rank in the top internationally.
- Remove barriers to innovation: Projects funded should have positive externalities for other potential innovations.
- Facilitate public-private cooperation in delivering innovation: It should create partnerships or lead to innovations that are beneficial to both the public and private sectors.

In this briefing paper we focus specifically on the Excellent Science section of Horizon 2020. It seeks to strengthen and increase the excellence of the EU science base and to make the EU’s research and innovation system more competitive globally. The section contains five areas:

- European Research Council (ERC);
- Future and emerging technologies;
- Marie Skłodowska-Curie Actions;
- Research infrastructure (including e-infrastructures);

Following the terms of reference, this paper focuses on three areas of Excellent Science: European Research Council (ERC); Marie Skłodowska-Curie Actions; and Research infrastructure (including e-infrastructures).

II – Methodology

We have used the following tools of analysis throughout the study:

- Data analysis using financial and programmatic data from CORDIS;
- Information and budgetary data from H2020 Work Programmes;
- Stakeholder interviews;
- Case studies; and
- Desk research.

Details on the methodology are provided in the annex.

III – Structure of the document

The current study has been undertaken together with a parallel evaluation of two other priorities (“Societal Challenges” and “Industrial Leadership”), but this report represents a complete evaluation of the Excellent Science pillar, presenting the evidence from data, desk research, interviews and case studies, and our recommendations for potential improvements that could be made for the Excellent Science pillar.

The structure of the study is the following:

Chapter 2: Implementation of the programme (contains the progress made in the spending against the budgets and analysis of the partnerships and cross-border cooperation of the different projects);

Chapter 3: Evidence from Excellent Science covering desk research, interviews and case studies;
Chapter 4: Conclusions and recommendations based on a review of the evidence in previous chapters and our economic analysis and judgement of the different results.

IV – Limitations of the study

The extension and complexities of H2020 make its evaluation a challenging task. The current study has been undertaken with limited time and resources and does not aim at a comprehensive evaluation of all the aspects of the programme.

The scope of the study is to provide a briefing paper assessing, from an economic and financial perspective, the implementation of H2020. We have used evidence from desk research and in-depth interviews. Our findings have been based on the judgement of what we consider most relevant to inform a high level opinion of the implementation of the programme. Our conclusions exclude views and arguments which are hard to prove or contain minor details on its functions which would not allow a high-level critical review of the programme.
Chapter 2 – Implementation of the programme

In this chapter we analyse indicators which compare the indicative and realised budget (by Call, Topic and type of actions and type of funding). We also analyse the partnerships and cross-border cooperation of the different projects.

I – Comparison of indicative and realised budgets

To assess the progress in the implementation of the programme, we analyse the spending in comparison with the actual budgets allocated in the Work Programmes. This is shown using the metrics of total spending, total allocated budget, and the share of the budget spent. For description purposes we also report the number of projects and average size in the three different focus areas of “European Research Council” (ERC), “Marie-Skłodowska-Curie Actions” (MSCA) and “Research Infrastructures” (RI).

The initial budgets (as reported in the Work Programmes) were allocated unevenly across the three focus areas: ERC had an allocation of around €3.3bn in 2014-2015 whereas MSCA had an allocation of around half of that of ERC (€1.6bn in 2014-2015). RI had the lowest budget amongst the three focus areas of around €1.1bn in 2014-2015, see Table 1.126

The spending for ERC and MSCA is also rather proportionate to their budgets. ERC is almost within budget in 2014 (103%) but is underspent in 2015 (81%) and overall is being underspent (92% across both years). Spending in MSCA is very much in line with the total budget and hence the share is 100%. The only exception is spending on RI in 2014-2015 which is underspent with a 52% share of total budget.

More than 4,800 projects have been funded in 2014 and 2015 (see Table 1). Most of these projects were in MSCA reflecting the smaller size of projects in this area. The average size of the projects for ERC was around €1.6 million, for MSCA, around €0.6 million but significantly larger for RI, around €6 million.

Table 1: Details of projects granted under Excellent Science (2014-2015)

<table>
<thead>
<tr>
<th>Area</th>
<th>Spending, €m</th>
<th>Budget, €m</th>
<th>Share</th>
<th>Number of projects</th>
<th>Average size, €m</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERC</td>
<td>1,722</td>
<td>1,367</td>
<td>1,677</td>
<td>1,681</td>
<td>103</td>
</tr>
<tr>
<td>MSCA</td>
<td>1,592</td>
<td>1,591</td>
<td>100</td>
<td>1,656</td>
<td>1,186</td>
</tr>
<tr>
<td>RI</td>
<td>587</td>
<td>1,139</td>
<td>52</td>
<td>101</td>
<td>5.8</td>
</tr>
<tr>
<td>Total</td>
<td>5,268</td>
<td>6,088</td>
<td>87</td>
<td>4,880</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations based on CORDIS database and Work Programme 2014-2015: Excellent Science. CORDIS data refers to data added on 2015-07-29 and updated on 2016-09-01. Spending and budget data for MSCA and RI could not be separated by years (2014 and 2015) and hence we provide the combined statistics for the years 2014-2015.

126 These budgets differ from the ones reported in the Monitoring Report. The likely reason for this is that the Monitoring Report does not report budgets attributed to other actions such as public procurement, expert evaluation, subscription etc. in the exact form as detailed in the Work Programme.
In the next tables, we further breakdown the budgets and funding in these two focus areas by Call type and Topics.

- Calls refer to the different programmes being undertaken in the main focus areas.
- Topics describe the different projects (within Calls) being undertaken to achieve the main objectives of the focus areas.

The analysis of expenditure and budgets has been done using CORDIS data (aggregated at Call and Topic levels) and compared with the budgets provided in the Work Programmes. When doing so, we found that some of the Calls referred to in CORDIS did not match any of the Calls in the Work Programmes (for example, projects referred to as “Adhoc” in CORDIS). In some instances, we also found that some of the budgets contained in the Work Programme were not matched by projects from CORDIS (this refers to the “Other actions” in the Work Programmes). For the remaining Calls, it was possible to establish a link between the spending and the allocated budgets in the Work Programmes.

The results are presented in Table 2. For most of the Calls, there is a good balance between the spending and budget amounts (reaching a share of 100%). However, there are some exceptions:

- Some Calls are over-spent by more than 10% or close to 10%: INFRADEV (110% in 2014-2015) and INFRAIA (115% in 2014-2015).
- Some Calls are being under-spent by more than 10%: ERC (82% in 2015) and INFRASUPP (81% in 2014-2015).

It is also worth mentioning that the highest spending in 2014-2015 is in Call ERC (€3.1 billion or around 59% of total spending of €5.3bn in 2014-2015 respectively). This is followed by MSCA (30% of total spending in 2014-2015).
Table 2: Spending, budgets and shares by Call (2014-2015)

<table>
<thead>
<tr>
<th>Area</th>
<th>Call</th>
<th>Spending, €m</th>
<th>Budget, €m</th>
<th>Share,</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERC</td>
<td>Adhoc</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ERC</td>
<td>ERC</td>
<td>1,720</td>
<td>1,367</td>
<td>1,663</td>
</tr>
<tr>
<td>ERC</td>
<td>OA*</td>
<td>-</td>
<td>-</td>
<td>14</td>
</tr>
<tr>
<td>MSCA</td>
<td>Adhoc</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MSCA</td>
<td>MSCA</td>
<td>1,592</td>
<td>1,567</td>
<td>102</td>
</tr>
<tr>
<td>MSCA</td>
<td>OA</td>
<td>-</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>RI</td>
<td>Adhoc</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RI</td>
<td>EINFRA</td>
<td>179</td>
<td>176</td>
<td>102</td>
</tr>
<tr>
<td>RI</td>
<td>INFRADEV</td>
<td>218</td>
<td>198</td>
<td>110</td>
</tr>
<tr>
<td>RI</td>
<td>INFRAIA</td>
<td>161</td>
<td>140</td>
<td>115</td>
</tr>
<tr>
<td>RI</td>
<td>INFRASUPP</td>
<td>30</td>
<td>37</td>
<td>81</td>
</tr>
<tr>
<td>RI</td>
<td>OA*</td>
<td>-</td>
<td>589</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>5,268</td>
<td>6,088</td>
<td>87</td>
</tr>
</tbody>
</table>

Note: * OA (Other actions) include budgets in the Work Programme that could not be matched to the projects in the CORDIS database. These primarily consist of public procurement, expert evaluation, subscription etc. Data for MSCA and RI could not be separated by years (2014 and 2015) and hence we provide the combined statistics for the years 2014-2015.

Source: Europe Economics calculations based on CORDIS database and Work Programme 2014-2015: Excellent Science. CORDIS data refers to data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.

All the Calls under the three focus areas are funded by different funding schemes. In the table below, we breakdown the spending on projects in Excellent Science by different types of actions (funding schemes). Around 90% of the funding is provided under ERC and MSCA as can be seen from the shares of total spending. This is followed by RIA (Research and Innovation Action) which consists of 10% of total funding in 2014-2015.

Funding schemes categorised as others consist of Cofund-PCP and CSA.\(^{127}\)

- COFUND-PCP refers to pre-commercial procurement funded through programme COFUND grant.
- CSA refers to coordination and support actions.

As seen from the table, a very small percentage (only 1% in 2014 and 2015) of funds is coming from these two type of actions (funding schemes).

\(^{127}\) Cofund means an action funded through a grant whose main purpose is to supplement the funding of individual calls or programmes which are funded by entities managing research and innovation programmes, not including the Union funding bodies.
Table 3: Spending by type of action (2014-2015)

<table>
<thead>
<tr>
<th>Funding scheme</th>
<th>Spending 2014-2015, % of total spending</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERC</td>
<td>59%</td>
</tr>
<tr>
<td>MSCA</td>
<td>30%</td>
</tr>
<tr>
<td>RIA</td>
<td>10%</td>
</tr>
<tr>
<td>Other*</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

*Note: Other includes COFUND-PCP and CSA.

Source: Europe Economics calculations based on CORDIS database and Work Programme 2014-2015: Excellent Science. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.

II – Partnerships and Cross-border cooperation

Transnational co-operation between MS and/or between MS and non-European countries is a condition for participating in some of the calls, and this is reflected in the analysis for country participation.

In the table below, we show the spending on different focus areas between different groups of participating institutions. We constructed the groups based on the number of participating institutions in each project such that projects consisting of between 1 and 4 participating institutions were grouped together under one group. Similarly, projects between 5 and 9 participating institutions were grouped together under group 5-9 and so on.

We then summed the total spending on projects within these groups and calculated the share of total spending as shown in Table 4 below. For instance, projects consisting of between 1 and 4 participating institutions in ERC have a total spending of €3.1 billion which is 59% of total spending in Excellent Science in 2014 and 2015.

The highest amount of money is spent on projects which have between 1 to 4 participating institutions (74%). This is because one of the objectives of Excellent Science grants is to empower individual researchers and provide best settings to foster their creativity. This is followed by projects with 5 to 9 participating institutions (24%).

Table 4: Spending by groups of institutions, €m, and % of total spending (2014-2015)

<table>
<thead>
<tr>
<th>Focus area</th>
<th>1-4</th>
<th>5-9</th>
<th>&gt;=10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERC</td>
<td>3,083 (59%)</td>
<td>6 (%)</td>
<td>125 (2%)</td>
<td>3,089 (59%)</td>
</tr>
<tr>
<td>MSCA</td>
<td>705 (13%)</td>
<td>762 (14%)</td>
<td>15 (2%)</td>
<td>1,592 (30%)</td>
</tr>
<tr>
<td>RI</td>
<td>84 (2%)</td>
<td>488 (9%)</td>
<td>15 (%)</td>
<td>587 (11%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,873 (74%)</td>
<td>1,256 (24%)</td>
<td>140 (3%)</td>
<td>5,268 (100%)</td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations based on CORDIS database and Work Programme 2014-2015: Excellent Science. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.
In Table 5, we show the spending by number of participating countries. For each project, we calculated the number of different countries participating in the project. The projects are then divided into groups consisting of 1-4, 5-9 and 10 or more EU participating countries (a separate group is used to contain projects with any partner from outside the EU).

The total spending on projects in these groups is calculated, together with the share of the total Excellent Science spending in 2014-2015. For instance, projects in ERC which consist of 1-4 EU participating States had a spending of €2.7bn in 2014 and 2015, which was 52% of total spending in Excellent Science (Table 5).

The data does not show high cross-country cooperation in projects as only 23% of total spending is on projects with more than 5 EU Member States and 70% of the spending is on projects with 1-4 participating EU Member countries (reflecting the objective of empowering individual researchers). The share of non-EU participating countries is also relatively low: non-EU participate in €0.4 billion worth of projects (8% of total Excellent Science amount spent).

**Table 5: Spending by Non EU and different group of EU countries, €m, and % of total spending (2014-2015)**

<table>
<thead>
<tr>
<th>Focus area</th>
<th>Non EU</th>
<th>EU 1-4</th>
<th>EU 5-9</th>
<th>EU &gt;=10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>411 (8%)</td>
<td>3,676 (70%)</td>
<td>889 (17%)</td>
<td>292 (6%)</td>
<td>5,268 (100%)</td>
</tr>
<tr>
<td>ERC</td>
<td>374 (7%)</td>
<td>2,713 (52%)</td>
<td>1 (0%)</td>
<td></td>
<td>3,089 (59%)</td>
</tr>
<tr>
<td>MSCA</td>
<td>36 (1%)</td>
<td>883 (17%)</td>
<td>673 (13%)</td>
<td></td>
<td>1,592 (30%)</td>
</tr>
<tr>
<td>RI</td>
<td>0 (0%)</td>
<td>80 (2%)</td>
<td>215 (4%)</td>
<td>292 (6%)</td>
<td>587 (11%)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5,268 (100%)</td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations based on CORDIS database and Work Programme 2014-2015: Excellent Science. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.
Chapter 3 – Evidence from Excellent Science: interviews and case study

This chapter discusses the specific evidence gathered on the Excellent Science pillar of Horizon 2020 via interviews, case studies, and reviews of stakeholder documents. Stakeholders and advisory groups in the Excellent Science area agreed on most of the issues raised for Horizon 2020 in general. These include positive elements such as simplification improvements and good synergies across different programmes as well as elements perceived as negative such as oversubscription and scarcity of funds.

In this chapter, we describe some of the distinctive features of Excellence Science and how these relate to findings on objectives, impacts, programme structure, synergies with other programmes, cross-country cooperation and, finally, the regulation/simplification.

I – Objectives

The objectives of the Excellent Science pillar are:

- Supporting top-class research.
- Investing in skills and competences of the researchers.
- Investing in research facilities and resources.

Each of the objectives is expected to contribute to the overall economic growth and development of Europe. Investing in research will also promote innovation, increase competitiveness and contribute to the social welfare.

The respondents recognise that the key objective of H2020 Excellent Science pillar is supporting research and researchers. They generally agreed that the MSCA and ERC are well-designed and successful research programmes. One of respondents noted that the programmes are successful because they are open to any researcher.

However, some of respondents see H2020 as less focused on fundamental research than FP7 and previous programmes. They stressed that it is important to keep or increase the focus of funding on basic (or fundamental) research. They emphasized that short-term economic impact assessments are not appropriate for this type of research, which is why they like the selection criteria used by MSCA and ERC.

II – Impacts

The interviews demonstrated the need to distinguish the direct and indirect impact of H2020 on the economy.

- The direct impact is growth in the number of jobs (number of people hired to conduct research) and growth in productivity (improvement in economic output because researchers do their work more skilfully and efficiently or by using better research equipment).

- The indirect impact helps address the market failures, for example related to production factor immobility. Training the researchers with additional professional skills improves their mobility between the academic and non-academic sectors, hence, reducing the overall lack of labour factor mobility between these sectors and hence increasing the efficiency of labour markets.
Many respondents stressed that supporting the research is one of primary ways to boost GDP and increase competitiveness. However, to assess the economic impact of research, one needs a very long horizon at least 30 years, not even 5-10 years. Hence, short-term economic impact cannot be used as an assessment criterion.

For the MSCA in particular, respondents and the MSCA Advisory group highlighted that there is an indirect impact of H2020 on jobs that is not as often advertised as direct job creation, which is that researchers get training and exposure to private partners, which makes them more suited to the professional world.

III – Structure

In some instances, the organisation and structure of the programme have been received very positively. Respondents have often expressed positive views on the progress of ERC and MSCA because they can help a wide range of researchers (in particular those with different levels of experience).

However, there is a variety of issues that respondents mentioned or discussed with respect to the structure of H2020:

- Oversubscription and low success rates.
- Lack of transparency in the application review process.
- The risk of failure among the selected projects.
- Support of interdisciplinary projects.
- Cooperation with industry.

**Oversubscription and low success rates**

The respondents generally agree that there is high oversubscription in many topics and calls. As a result, the success rate is often low. One respondent noted that a very low success rate, e.g. below 10 per cent, suggests that the evaluation system might not be working well.

The same respondent noted that very high rates, e.g. above 50 per cent, can also be observed for new topics or calls. Once the topic becomes well-known, the success rate drops to a more reasonable level. Very high rates at the start of the call indicate low information awareness and suggest that more action might be need to advertise new topic and calls in the research community.

Multiple stakeholders report that FET Open is amongst the most dramatic examples of oversubscription in Horizon 2020. In this respect, CESAER recommends the EC to take measures to further inform the scientific community about the crucially important novelty elements of an FET-Open project. It also recommends that more funding should be allocated to the European Research Council (ERC).

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128 FET Open funds projects on new ideas for radically new future technologies, at an early stage when there are few researchers working on a project topic. This can involve a wide range of new technological possibilities, inspired by cutting-edge science, unconventional collaborations or new research and innovation practices.
Lack of transparency in the application review process

National Contact Points received many complaints about the lack of transparency amongst the applicant community about the evaluation procedures. One reason for this is the nature of the feedback provided to applicants, where in some cases details given in the explanations seem to be in contradiction with the score. Another criticism, also mentioned by the respondents, is the quality of evaluators. Sometimes evaluators are evaluating proposals outside their area of expertise and may not be able to appropriately judge the good quality of research proposals.

The risk of failure among the selected projects

At the same time the respondents noted the advantages of having some failing projects, because of the learning experiences that can be derived. This is also consistent with the aim to achieve new and risky innovations. Sometimes, projects that aim at a quick return of investment are a signal that the “funding selection is not taking enough risks”, and this prevents discovering true break-through ideas. In this sense, the programme should be less risk-averse and adopt the strategy of some venture capital funds (who carefully monitor the returns in investments and in some cases may re-think their portfolio allocation of their funds if the return is too constant and secure).

Support of interdisciplinary projects

Another positive element recognised by some stakeholders is interdisciplinarity. In particular, the evidence seen by the Advisory Group for MSCA does suggest that research currently combines expertise from both STEM (science, technology, engineering and mathematics) and AHSS (arts, humanities and social science) disciplines. However, the Group does suggest that actions can be taken to further enhance the benefits of interdisciplinarity within the programme by monitoring application rates for these proposals, ensuring fair and appropriate evaluation of interdisciplinary proposals, and profiling successful interdisciplinary proposals in order to highlight the impact that can be delivered through interdisciplinarity.

Cooperation with industry

Both the respondents and the reports by European Research Infrastructure Advisory group highlighted the need to improve cooperation with industry where industry is understood in broad terms as any private organisation offering not only advanced products but also services, software and technologies. For example, the industry can co-finance the construction of Research Infrastructure and obtain an ownership share in the joint project, or pay for access to Research Infrastructure as test facilities. Industries offering services, software and technologies would be especially welcomed in the development of e-infrastructure.


130 The NCP Academy recommends better quality control mechanisms for the evaluation process. As far as possible, they recommend the use of consensus meetings in all the programmes and the reinforcement of evaluation teams in more ‘crowded’ calls (NCP Academy, 2016: “NCP input paper for the Interim evaluation of Horizon 2020”).
IV – Synergies with other programmes

Achieving synergies and complementarities between different EU funds and programmes is one of the requirements for designing the programmes, in particular H2020. To this end, the European Commission provides guidelines to support and encourage synergies, especially between H2020, the European Structural and Investment Funds (ESIF) and other EU-funded programmes.

In contrast to the goal of achieving synergies, some respondents expressed concern that research funding in the EU is dispersed across several programmes (H2020, ERDF and Structural funds). While the total amount of funding for research across different programmes appears to be substantial, the dispersion of funds might prevent the EC from becoming the leader in specific topics or strands of research.

The MSCA Advisory Group on skills, training and career development, gave support in its report to the leveraging of MSCA funding through synergies with other parts of H2020 and with European Structural and Investment Funds (ESIF). They envisioned that this would include synergies between the different MSCA funding schemes, for example by supporting common training across schemes. The group also recognised and supported synergies with ESIF via the MSCA COFUND scheme, a scheme designed to provide inter-sectoral, international and interdisciplinary research training and support.

Another potential for synergies between programmes is offered by the Seal of Excellence that is currently implemented for SMEs. The MSCA Advisory Group urged that consideration be given to the introduction of Seal of Excellence for proposals on the reserve list in Excellent Science (notably for Individual Fellowships), in order to facilitate the funding of these proposals through ESIF, national or other funds.

There appears to be no particular concerns within the ERC and the European Research Infrastructure areas.

V – Cross-country cooperation

With respect to cross-border aspects of the programme, the responses varied according to the area and the type of cross-border cooperation.

The MSCA area requires the project to involve participants from different MS or non-EU countries, for example, three MS and one non-EU partner. This rule stimulates cross-border cooperation, and according to some interviewees, the minimum requirement is often exceeded, e.g. up to 5 partners from MS and typically more than one partner from non-EU countries.

The MSCA area also has cross-border mobility of researchers as one of its objectives (other aspects are mobility between academic and non-academic professions, and knowledge and skills transfer). The report by the MSCA Advisory Group believes that the current support for mobility is not enough and so supports further enhancement of flexibility and mobility for academics, by encouraging travel to conferences and networking among researchers, entrepreneurial activity or additional formal training to widen career prospects (e.g. a degree in law or management).

One of respondents noted that the professional training of researchers is a successful element of the MSCA work programme. However, another respondent expressed a wish that the funding could be re-distributed to research itself rather than to travel and networking that do not lead to research output per se.
The ERC programme, by contrast, does not have specific requirements for cross-country participation. Still, as one of respondents pointed out, the ERC grants are well known in the global research community and therefore act as a guarantee and a sign of prestige, which allows attracting high-quality post-doctoral researchers and research partners from non-EU countries.

While cross-border mobility and research consortia appear to be widespread in the ERC and MSCA programmes, the situation with the Research Infrastructure Development is different. A report by the European Research Infrastructure Advisory group highlighted that the Research Infrastructure varies widely across MS due to difference in national funding schemes, as well as political, cultural and legal barriers. Therefore, support to initiate partnerships might be needed to promote or create Research Infrastructure in countries with less sophisticated infrastructures.

The same report by the European Research Infrastructure Advisory group also highlighted the regional discrepancy and uneven distribution of pan-European Research Infrastructure. Therefore, the report recommended setting Regional Partner Facilities and use “location-based” policies (in addition to current “location-blind” criteria) to overcome the regional discrepancy.

VI – Regulation/simplification

H2020 simplified considerably the application rules and monitoring criteria within the programme and individual pillars. The simplification aimed at making the programme structure clearer to the applicants as well as attracting more participants, especially top academic researchers. Overall, the respondents were pleased with the new simplified framework and noted that the changes were equally welcomed by the participants.

However, some interviews highlighted some negative impacts of the simplification and the related no-ground negotiation clause. Along with the simplification process, H2020 also introduced a no-ground for negotiation clause, which means that if applications are missing a requirement, the bidder cannot provide additional material later. This may have a perverse impact to favour applications from large and established players (e.g. large pharmaceuticals) as opposed to smaller entities. It may also make it harder for new entrants to join the programme, which might, in the long-run, hinder the competitiveness of the allocation process.

One respondent commented that the no-negotiation clause risks favouring professionalism in administrative details over scientific content of the project in the application pack. Because the quality of the application becomes so important, it has given rise to the proliferation of specialised “grant-writing agencies” which offer to write the proposal for third parties in exchange of a management fee (a percentage of the funding). In one of the case studies the delayed responses from the helpdesk was mentioned as a problem. The calculation of personnel and indirect costs were also perceived as complex.

VII – Evidence from case studies

The case studies are helpful to visualise the range of projects funded and the views of respondents on different aspects of the programme.
Flow Visualization Based Pressure (FLOVISP)

FLOVISP is an ERC-funded proof of concept project that measures pressure on an athlete’s body or the bodywork of a car by tracing the airflow around it. It is a spin-off of a much larger project called FLOVIST, which was also funded via an ERC grant. Unlike FLOVIST, FLOVISP is more industry-oriented with three industrial areas targeted: aeronautics, automotive, and energy systems (turbo machinery and wind energy).

With regards to expected impacts, while the FLOVIST impacts were measured using metrics related to academic success, the expected outcome of FLOVISP is the industrialisation of the approach, measured by the number of firms and sectors that would begin using the technology. At the present time, the project has succeeded in getting a car manufacturer interested in the technology.

The project coordinator found the application process to be simple and lean, however he noted the significant amount of time required to put together a good proposal. On the other side of the process, he finds the low funding success rates discouraging. For example, Future and Emerging Technologies (FET) Open calls have success rates of 2-3%, and it gives participants the sense of funding awards as a lottery. In addition, he believes the large volume of applications received can compromise the quality of the evaluation of proposals.

While the grant gave the project coordinator international exposure and links with researchers from many other countries, he believes the individual funding structure of ERC grants limits the development of synergies and collaborations with organisations in other countries. It promotes individualism while it should encourage collaboration.
Accelerating photo redox catalysis in continuous-flow systems (Photo4Future)

The Photo4Future Innovative Training Network aims to tackle the challenges associated with photochemistry in a coherent and comprehensive fashion by establishing a training network with beneficiaries from academia and industry. In total 10 Early Stage Researchers were recruited within the Photo4Future network and the network will provide them with opportunities to undertake research with the aim to overcome the current limitations towards the applicability and scalability of photochemical transformations.

The project coordinator has benefitted from individual MarieCurie fellowships before, but is a newcomer to large consortiums. The consortium consists of many young researchers. They had to approach companies and ask them to participate in the research, which went relatively smoothly.

There are two main concerns. First, the success rate in many H2020 projects is dramatically low, which might be very frustrating for many people. For ETN, the success rate is about 5 or 6 percent, though, more than 50% of the proposals do not stand a chance as they did not start in time working on the proposals and therefore the proposal is not on a competitive level.

Secondly, it seems that some H2020 projects are so complicated, that an external specialised agency is hired to write the proposal. This is very expensive. For researchers it is very difficult to compete with the supersonic proposal with amazing graphics created by the specialized agencies. Moreover, a research proposal should be written by a researcher, as it is a part of a scientific career, and not by an agency. It does create employment in the EU, however, the agencies have to be paid upfront, and they get a certain percentage after the budget is allocated. Those upfront costs are high and although this may not cause problems in richer EU countries, not all universities in the EU can pay these amounts upfront. This will create a Europe divided by class, a class society.

The administrative part of the application process for ETN was manageable. It is a lot of work as there are many questions in the proposal, but they feel that it is manageable. The ETN budget is good and it is nice that researchers get the freedom to conduct their own research. They are not pushed towards a certain direction. The required interim reports are written by the project officer they hired, which saves a lot of time. It is very helpful to have a project officer, as they keep track of the deadlines and makes sure these are met. This allows the researchers to focus on the research and training part. They are also very positive about the EU officer assigned to them, as she is very understanding.
Support to Reinforce the European Strategy Forum for Research Infrastructure (STR-ESFRI)

STR-ESFRI is a four-year Coordination and Support Action project of which the goal is to provide support to reinforce the European Strategy Forum for Research Infrastructures (ESFRI) under the guidance of its Chair. This is achieved by providing support to the ESFRI Chair in all ESFRI related activities, to support the process for delivery of the new ESFRI Roadmap, to disseminate and exploit ESFRI related outputs to the European and Global Research Infrastructure Area, liaise with key stakeholders including the e-Infrastructure Reflection Group (e-IRG), to identify best practices and facilitate the exchange of experiences among ESFRI projects and other European and Global Research Infrastructures and finally to monitor projects on the ESFRI roadmap.

The coordinator is involved in many Horizon 2020 projects and also has experience with FP6 and FP7 projects. Generally, they feel that the application process is good in Horizon 2020 compared to previous framework programs. The streamlining of the processes has reduced the time between results and signing the grant agreements, allowing projects to be initiated sooner. Generally, the level of financial budgetary monitoring is appropriate, although they can imagine that for a newcomer it could be difficult, e.g. auditing requirements. Although it can seem a bit excessive, they understand it needs to be transparent due to it being public money.

In general the coordinator was dismayed when the overall Horizon 2020 budget was cut, especially in the Research Infrastructure Program. They would welcome seeing funding levels rise in the latter years of Horizon 2020 and in Framework Program 9 and would not want to see the research infrastructure budget cut any further relative to other parts of the programme.

In terms of the structure of the budget allocations within the Research Infrastructure Program, there are a number of activities that essentially have gone beyond the project stage, but the only available instrument for funding them is as a project. So, whilst the Commission and the reviewers identify that these activities are strategically important and should continue, the consortium must develop a new version of a project with a start, middle and end, even though it is an evolution. This becomes an artificial process forcing ongoing e-infrastructure and research infrastructures activities into projects. A recommendation would be to investigate non-project grant mechanisms for long-term strategic areas within the research infrastructure area. This would not apply across the board but could be focussed on long-term strategic activities as identified by the Commission.

One of the really positive parts of the Research Infrastructure Program is transnational access. This funds the best research infrastructures in Europe to open their doors to the best researchers in Europe irrespective of where they are based. There are a lot of research infrastructures that are too costly for every country to have their own, so in terms of cross-border cooperation, the transnational access part of the program is extremely valuable. Not only does this enable sharing and better use of investments, but it also brings together researchers who share ideas, develop new collaborations and advance research and innovation.

There are complementarities with other EU, such as structural funds, and national funding opportunities, in research infrastructures. In terms of this project, STR-ESFRI supports the ESFRI Forum’s activities and the ESFRI Roadmap process. The ESFRI Roadmap process identifies key new research infrastructures for Europe and this enables Horizon 2020 funding to be targeted to help those get established. The European funding is really important in enabling the strategic consideration of research infrastructures and in supporting their early stages. But once they are established, national funding covers their operational costs. Therefore, there is a really strong linkage between European and national funding. There is always an opportunity for even greater alignment with national funding programmes although some of the barriers to this are beyond the control of funding agencies, such as the timing of member state budgets.
Efficient harvesting of wind energy

The primary research aim of this project is to develop sustainable Wind Energy Solutions (WES) for variety of EU needs. In the development of such a system there are a number of detailed scientific and technical issues that will be addressed by the project starting from identifying the wind energy potential (off-shore and on-shore, including the built environment) to the design of a sustainable and highly efficient WES.

The project coordinator informed us that their organisation is not a newcomer to Horizon2020, having previously conducted 76 projects in FP7 and currently 30 under the present scheme. In regards to the application, they feel that questions about the impacts and how to monitor them should be included in the application process for H2020. They feel that it comes a step too late, one should already know what type of information is needed to determine and monitor the impact.

The Marie Curie program in which they operate is simple in its application in terms of research months and unit costs. In other Horizon 2020 projects, costs are not calculated on the basis of the actual personnel costs as was done in FP7. Costs are instead based on the level of personnel costs of the previous year. Projects tend to cover longer periods of time and personnel costs can change year upon year depending on circumstances, such as increases in wages or the flexibility of staff. This means that they are losing EU contributions. This deviation from the actual cost principle is not a simplification for the beneficiaries.

In reality EU funding in MSCA-projects only accounts for around 50% of the projects’ actual costs, which is a difference between Marie Curie projects and other Horizon 2020 based schemes where the total contribution level is closer to 80-85%. PhD student’s salaries in Sweden are higher than the EU contribution, so the costs to be financed by the organisation are quite high. Another problem is the salary inequality between countries. This means that certain people get angry when they discover that they do not receive equal salary compared to their peers from other EU Member States although they are doing similar work in the same project but in different EU countries. This means that participants quit the project and move to other positions where they can earn more. This leads to a loss in contribution as the organisation gets nothing back for the money that has been paid to them so far.

In regards to the Marie Curie actions, they do not think that indirect costs and management costs should be put together as the management costs are the result of a negotiation between the coordinator and other beneficiaries. It would be much simpler to have the indirect costs as they were in FP7, separate from the management costs. Under Marie Curie actions in FP 7, the indirect costs were 10%, but they feel costs should be increased to 25% as in other Horizon-projects under the program.

In terms of documentation, they suggest that the forms that should be completed should also be made available online in advance as it is hard to prepare otherwise, considering deadlines are rather short. Also, communication should be improved. For example, questions to the helpdesk sometimes provided answers up to two weeks later, and even longer in other cases. Getting information on how to deal with a replacement of the coordinator was very hard and the whole process took almost a year. This is a different standard to what the European Commission expects, as they expect them to stick to strict deadlines.
The most important issue in terms of threats to the implementation of Horizon 2020 is the low success rate. This does not encourage researchers to apply, therefore running the risk of losing good potential projects. The success rate is around 10%, and it is a lot of work for the researchers writing up an application with little chance of success. As a solution, the simplest way would be to increase the funding. Another solution is to narrow the focus of the calls (Pillar 2 and 3), as at present they are too wide. A more focussed system combined with a much higher success rate would encourage applications. Another way would be two stage applications with the first stage asking for a very short input. Another recommendation in general is that the various EU funded programs, for example Horizon 2020, RFCS, EIT, Structural and territorial funds, all use different rules, regulations and portals. Today’s multitude of rules, regulations and portals does not result in effective administration and is wasting resources at all levels. The cost of the work needed to understand and manage the various rules, regulations and systems are unjustifiably high and both national funds and EU-funds should instead be used for project activities.
Chapter 4 – Conclusions and Recommendations

This chapter presents our main findings of the evaluation undertaken and recommendations for its improvement. We first summarise the findings based on the desk-based research, interviews and case studies described in the previous chapter. We then present the conclusions and recommendations based on the list of findings and our economic analysis and judgement of the different results.

I – Findings

The findings cover the following topics: the take up (evolution of expenditures), the cross-border objectives, outcomes, impacts, the synergies with other programmes and the regulation/simplification process.

1. Take up (evolution of expenditures)

Programmes are progressing satisfactorily in relation to their planned budgets. However, there are some disparities when viewed at the Section or Call level:

- In the Excellent Science pillar, most calls and topics have a reasonable balance between the budget and the spending. The share of spending in the budget is between 100% and 110% for most calls in 2014 and in 2015.
- While the majority of calls is properly funded, three calls have a discrepancy between the budget and the spending. The INFRAIA call overspent the budget by 15% in 2014-2015. The ERC call appears to have spent about 82% of the budget in 2015. Similarly, the INFRASUPP call spent only 81% of the budget in 2014-2015.
- All the calls under the Excellent Science pillar are funded by five funding schemes but the MSCA and ERC predominate (over 90% of funding goes through these two schemes).

2. Cross-border objectives

The cross-border cooperation is a funding condition for many topics in the Excellent Science pillar. Some topics require, in addition to cross-border EU cooperation, a presence of at least one non-EU partner in the project.

The data does not show high cross-country cooperation in projects as only 23% of total spending is on projects with more than 5 EU Member States and 70% of the spending is on projects with 1-4 participating EU Member countries (reflecting the objective of empowering individual researchers). The share of non-EU participating countries is also relatively low: non-EU participate in €0.4 billion worth of projects (8% of total Excellent Science amount spent).

3. Outcomes

The general perception among stakeholders is that the ERC and MSCA are well designed research programmes.

Stakeholders expressed concerns about the funding and oversubscription of some of the calls. High oversubscription and low success rates might demotivate excellent researchers who might decide not to apply for funding in the first instance.

Some stakeholders are also concerned that the funding dedicated to research-related activities such as travel to conferences or networking could be spent on research itself.
4. Impacts
The impacts of the different projects can be difficult to measure because the programme is at the early stage of the evaluation.

Stakeholders are of the opinion that conventional economic impact, e.g. GDP growth, cannot not be amongst the monitoring criteria of the Excellent Science pillar, or would be very difficult to measure. Due the nature of academic research, many economic impacts (boost EU economy, create jobs and improve lives) of the programme will materialise with time and, hence, could only be measured over a long-term horizon, of at least 30 years.

Some stakeholders pointed out to the additional indirect economic impacts on the economy and jobs creation stemming through supporting research-related activities such as training of and networking between academic researchers. While indirect impacts can be difficult to measure, stakeholders agree on the positive impact of such activities on the academic labour force (researchers can continue to cooperate when the project is finished when not support is provided using new ICT options such as email and skype).

5. Synergies with other programmes
There is some support that H2020 generates synergies with national programmes. The stakeholders identified one issue and one potential instrument with respect to synergies.

First, stakeholders observe that research is supported not only through H2020 but also through other European funds. This leads to the dispersion of research funding and efforts which might adversely affect leadership of EU in particular research areas. In some cases (the MSCA Advisory Group) suggested leveraging of MSCA funding through synergies with other parts of H2020 and with European Structural and Investment Funds (ESIF).

Second, the Seal of Excellence currently used for Innovation in SMEs could also be used for research proposals on the reserve list in the Excellent Science, to help these proposals seek funding elsewhere, e.g. other European funds or national research programmes.

6. Regulation/simplification
There is a general agreement that the simplifications of the application process and monitoring criteria was successful. The simplification made the programme particularly attractive for top academic researchers.

However, some stakeholders expressed dissatisfactions with the no-ground negotiation clause introduced as part of the simplification. The absence of negotiation means that the application pack has to be ex ante of high quality which gives advantage to more experienced participants and gives rise to grant-writing agencies.

II – Conclusions
Horizon 2020 is received very positively by the different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions by some of our interviewees.

Our main conclusions show some concerning issues around the problem definition, envisaged impacts of the interventions, ex-post monitoring and evaluation of the projects, budgets and the problem of oversubscription, and evaluation of proposals. We also show our conclusions in relation to cross-country cooperation, the synergies with other programmes and the simplification of the regulations.
Problem definition

The rational for intervention with the programme Horizon 2020 is laid in the appropriate impact assessments and the corresponding annexes (SEC(2011) 1427 and SEC(2011) 1428). These documents also explain market failures to be addressed through Horizon 2020. Furthermore, the Work Programmes contain a description of different topics and calls and outline the issues and challenges to be addressed, as well as the scope and the expected impact of the intervention.

The Impact assessments list a range of market failures that have to be addressed in Horizon 2020. Two market imperfections from this range appear to be particularly relevant for the Excellent Science pillar, namely knowledge transfer (or “spill-overs”) and researcher’s mobility. The knowledge transfer may refer to exchange of information, ideas and skills. The researcher’s mobility may refer to mobility between different countries, or sectors of the economy (academic versus non-academic), or research disciplines. Both knowledge transfer and mobility of European researchers appear to be constrained by legal, institutional and cultural barriers that exist between different Member States.

The Excellent Science Work Programmes has the support of research and research-related activities as its key objectives. Specifically, the ERC Work programme aims at supporting world-class research. The MSCA Work programme seeks to support researchers’ mobility, networking and exchange of knowledge. Finally, the European Research Infrastructure Work Programme seeks to develop and promote access to first-class research infrastructure.

The two market imperfections mentioned above, knowledge transfer and researcher’s mobility, are directly addressed within the MSCA calls and topics. Two other programmes, ERC and European Research Infrastructure, also appear to address some form of market imperfections. However, in some cases it is difficult to relate the programmes’ objectives to the market failures identified in the Impact assessment. While supporting research and research infrastructures with public funds is unlikely to be disputed, the reasoning for policy support could be better articulated, especially to gain support for the public funding of research outside the scientific community or to reassure researchers from other areas. For example, it could be mentioned that knowledge derived from research and access to research infrastructure is a public good and, hence, needs to be financed with public funds.

The lack of precise articulation leads to a situation where stakeholders may interpret programmes objectives in a different way and advocate for some type of research more than others, or for some specific type of actions or grants. For example, in the Excellent Science some stakeholders argued that more funding should be allocated to fundamental research as opposed to near-the-market innovative research, or to ASHH (arts, humanities and social sciences) projects, or to projects that improve co-operation with the industry. Therefore, a clearer definition of the market imperfections, the problems to be addressed and the objectives to be achieved for each of the financial instruments would be welcome.

Envisaged (ex-ante) impacts of the interventions

The Excellent Science pillar uses different KPI for different work programmes that reflect the output of research and research-related activities under each programme. More specifically, the following KPIs are employed:

- ERC: Share of publications from ERC funded projects which are among the top 1% highly cited.
- MSCA: Number of researchers undertaking international mobility under MSCA.
- MSCA: Number of researchers undertaking mobility between academic and non-academic sectors. (Private sector participation/SME participation).
- RI: Number of researchers who have access to research infrastructures through Union support.

The indicators reflect well a concept to be achieved, however, the KPI listed above are provided for reporting the benefits of the research industry (number of publications, number of participating researchers, …). It is difficult from these indicators to gauge the real impacts in terms of social benefits which are not accrued privately. Our understanding is that the ultimate objective of H2020 is to drive economic growth and create jobs but it is difficult to estimate these impacts from the KPIs.

The measurement of the impacts of research on economic outcomes is a very difficult matter. The impact assessment shows a list of studies that have calculated the effects of R&D using different economic metrics. In general, we have found that there is acceptance around the scientific community of the value added research provides to the EU.

However, some stakeholders from the Excellence Science pillar (but also from the other pillars) have expressed a view on how funding should be distributed. In some cases it has been argued that more funding should be directed to basic research (as opposed to more applied research). Because the comparison of the returns between the different areas will always be difficult, it could be helpful to establish at list some high-level points on the impacts research in Excellence Science can create. These should relate to the impacts that externalities and “spill-over” effects can create to other members of society, and additionality (impacts on society that could have not occurred in the absence of the intervention).

Some of these impacts are described in the impact assessment and annexes but we believe that there could be better communication of the expected social value of such impacts and rationale for intervention to the scientific community. This could be done in the Work Programmes by providing more clarity on the reasons for intervention and the specific expected impacts (quantified to the extent possible). This would be helpful to compare budgets and funding across other areas and would also remind the participants of the ultimate objectives of the programme.

**Participation and the need for ex-post monitoring and evaluation of the projects**

We have found that one of the consequences of the simplifications introduced by the regulations is that the proposal has to be of a sufficiently high quality to be evaluated (this is addressed further below). This risks favouring administrative details of the proposal over its research content, according to some stakeholders. Stakeholders also pointed out that this situation favours established researchers, disadvantages newcomers and gives rise to grant-writing agencies that offer services for writing proposals.

It is not surprising that excellent research goes along (or even requires) the development of specialised research centres and conglomerates. Network and conglomeration effects would make some research centres more efficient than others (and hence, more capable of delivering high-quality research). Therefore, the level of specialisation, the advantages and complementarities offered by existing researchers could be seen as a sign of good functioning of the programme. But in such cases, it is true that there is some risk that new market players may feel excluded from these big consortia. However, the existing selection criteria encouraging participation from more centres and countries (in this and other pillars) would mitigate such effect (researchers may be able to learn the application process by applying in other areas too).
Some opinions mention that the knowledge required to submit a bid may be too large and this may lead to a situation where newcomers may find it hard to enter the market. This view is supported by some stakeholders by mentioning the need of some participants to use “writing-agencies” (agencies which write the proposal in exchange of a management fee).

“Writing-agencies” may not be a negative solution in all cases and in some situations they may help overcoming entry barriers for new participants. Through recurrent bids it may be that the agencies develop proposal-writing skills. This may bring efficiency allocation as it would leave researchers to do more of the tasks they are good at (research) and less of those that are less good at (administration of the bid). It may also be that through specialisation, such agencies are able to spot opportunities (linking different partners in a consortium) or putting together cross-disciplinary and cross-sectoral expertise. Such cases could benefit new market players and help in lowering the barriers to entry.131

But agencies could also pose problems. Their main disadvantage would be in cases where the agency has provided a proposal which is “good” to be approved in the evaluation process but cannot be delivered by the partners it has involved. This would be a situation of dis-alignment between proposal and outcomes and highlights the problem of monitoring the outcomes and impacts of the projects.

The difficulties in measuring the actual impacts are especially important in case of the Excellent Science pillar, due to the nature of fundamental research and research activities. It might be difficult to translate the impact of every research project into direct measures of GDP growth or the number of jobs. If such measured could be developed, these would have to be assessed over a long period of time, e.g. 30 years, because of the delayed impact of fundamental research on the economy. The impact of increased research mobility and better research infrastructure might be also difficult to quantify as these usually are present through an indirect impact on the economy.

To quantify the economic impact of research, the Commission could develop a methodological approach to assess the economic impacts of the different research projects (for reporting purposes when these are finalised). This analysis should go beyond the assessment currently being done by the Commission132 and would help in establishing the outcomes of the programmes to be disseminated across relevant stakeholders. This would need to be proportional to the sizes and efforts of every project but should be able to provide reassurance to the research community that the outcomes of the project have been achieved (and this would detect any situations of too-optimistic or unrealistic objectives provided by “writing-agencies”).133

**Budgets and the problem of oversubscription**

Similar to other pillars of Horizon 2020, the Excellent Science is highly oversubscribed. Stakeholders have mentioned that low success rates signal that a lot of time and efforts is

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131 Of course, the agencies are charging a management fee, but as long as they are efficient in doing their job (and as long as there are many agencies operating in the market) this would make the management fee an attractive price to pay for participating in the projects. Furthermore, by using agencies, applicants may learn how to make the submissions alone in future calls and may decide to operate without the agencies.


133 These should be agreed upon from the start of the project, so that participants know which information to collect and keep track of.
wasted in preparing good quality applications. Furthermore, low success rates might discourage some applications as the researchers weight their chances of receiving the funding against the time and efforts of writing a winning proposal. Stakeholders expressed the view that the programme funding could be increased as there are many good quality applications that do not receive grants. The opinions suggest that this is evidence that the programme budgets could be increased and achieve efficient outcomes.

At the same time we have also found that the oversubscription problem is not homogeneous across calls. One stakeholder mentioned that in some cases the success rates are unusually high (50%). This is due to poor awareness and publicity when announcing new project calls (rates drop back to typical levels once the call becomes well known in the research community). This finding shows an important information problem in this pillar. It provides inefficiencies because in some situations the projects may be allocated not to the most research-efficient participants but to those participants that had better information or had more luck in finding the call.

We do not believe that the high subscription rate alone could be a sufficient reason for increasing the budgets in this pillar. The high demand for funding reflects, to a certain extent, the success of the programme in attracting the top researchers. In this regard, it is a consequence of the objective of achieving excellent research (along the lines of: discoveries and world-firsts, world-class science in all fields of research).

The oversubscription problem however does show that there is a potential pool of good projects that could also receive funding (and do not because of budget restrictions). To the extent that un-awarded projects are capable of providing social value to the EU this could represent a lost opportunity. This provides a good reason to think about increasing the budgets, but when doing so there should be some clear guidelines (or strategy) that establish the areas where such investments are likely to provide greater benefits to society. This should be properly analysed (along the lines of market failures and additionality) and properly transmitted to the scientific community so that the sense of “unfair” allocation of budgets (between basic and applied research or between different areas) is avoided.

We have been told that the oversubscription could demotivate some researchers from applying. This is because some researchers may look at the success rates of calls before applying. There have been some suggestions (from stakeholders in this pillar and also others) for thinking about ways to reduce the resources spent on preparing proposals. This could include a two-stage evaluation process or other ways for pre-filtering the number of candidates into a shortlist. If this approach is used this should fulfil two objectives: (1) that the new process really filters out some proposals and that (2) this is done in a way that is perceived objective and fair. This would save time and costs of the researchers applying for funds but to the extent that filters the number of applications to be reviewed in a second stage it can also save time and efforts of the evaluators (which may be able to reallocate their work more efficiently).

**Evaluation of proposals**

There are some concerns about the evaluation of proposals (in relation to problems of oversubscription) and this constitutes an important point.

One concern relates to the transparency and credibility of the selection process. The applicants should receive consistent feedback and scoring throughout the selection process, otherwise, inconsistencies in the evaluation at the different stages of the selection would undermine the confidence of applicants. The lack of confidence in the evaluation
process is a potential weakness and should be corrected by providing more reassurance on the process and outcomes of the evaluation.\textsuperscript{134}

Stakeholders also raised concerns about the quality of experts invited to evaluate proposals, or more precisely the mismatch between the expertise of evaluators and the research field of applicants. The mismatch means that the evaluator, being an expert in his or her area of research, is not fitted to judge the quality of application in another area.

**Cross-country cooperation**

There appears to be some discrepancy between formal requirement of cross-border cooperation and the actual funding awarded to multi-national research consortia. The ERC call does not have the formal requirement while the MSCA call does.

Some stakeholders expressed concern that a noticeable share of research funding goes to established institutions in old Member States (as opposed to new Member States). However, if H2020 is to follow the principles of excellent research it has envisaged (discoveries and world-firsts and world-class science) it is not surprising that the research originates in those centres where it is undertaken more efficiently. This is likely to continue in this way in the next years or it may even tend to a higher concentration if economies of agglomeration are exploited (research tends to be focused around some “clusters” or “networks”). This may be seen as a positive development in terms of allocation efficiency.

However, the principles of H2020 are also to break down barriers to create a genuine single market for knowledge, research and innovation. The extent to which both objectives need to be achieved could be clarified. Alternatively, this second objective could be achieved by intensifying the dissemination of the findings and discoveries which have been granted with public funds. This would imply “sharing” and “collaborative” approaches which will promote knowledge in geographical areas where there is less active research. If effective and sustained on time this would help reduce the “knowledge gap” between countries at the forefront of research and those catching up.

**Synergies with other programmes**

Stakeholders observed that there are some overlaps between Horizon 2020 and other EU-funded programmes as well as scope for synergies to be created and exploited. Therefore, more clarification on the potential for synergies and the objectives to be achieved under the different funds would clarify the situation and avoid potential overlaps. When doing so, it should be clearly stated the objectives which are part of H2020 and those that belong to other funds.

The Seal of Excellence could be used as a way to signal good research proposals in Excellent Science. In order for this to be a successful device, this should rely on a credible and trusted evaluation process (in relation to the pillar of Industrial Leadership the Expert Advisory Group for Innovation in SMEs criticised the “quality stamp” of the Seal of Excellence due to situations where there may be doubts on the quality of the evaluation process). A reliable seal would need to rely on high-quality independent evaluators but, more importantly, should be able to filter out overly optimistic proposals which may not reflect a feasible realisation of outcomes.

\textsuperscript{134} NCP Academy, 2016: “NCP input paper for the Interim evaluation of Horizon 2020”.
Simplification of the regulations

The simplifications are seen as an achievement of the programme. As always, there are views that express that simplifications can be further improved.

The responses also mentioned the no-ground negotiation clause introduced as part of the simplification measures. The clause means that the applicants cannot provide additional materials once the proposal is submitted. The net impact of the clause would seem clearly positive if one takes into account the benefits obtained from the simplification (time saved in the application and award process) against the costs for participants (lost proposals because of errors that could not have been amended). However, there may be interest in calculating how much of these errors did take place and among which type of market players did this happen (with a special focus on SME or newcomers). There may be some value in providing warnings and clarifications on the most common errors done by some participants, so as to avoid the sense of being treated unfairly by the no-ground negotiation clause.

III - Recommendations

To correct for the identified problems we would recommend the following.

Recommendation 1: The strategy for each of the calls under the programme should be more developed. This should take into account issues such as the problem definition: market failure to be corrected for and social impact (knowledge transfer, “spill-overs” and research mobility, as identified in the impact assessment). It would also be helpful to establish an assessment of the envisaged impacts of the calls and expected ex-post metrics for measurement of outcomes. This would help when comparing the priorities of budgets and funding across areas and would reassure the scientific community of the social impact envisaged in the different calls.

Given that data may be scarce or unavailable a methodology or consensus approach could be developed to assess the relevance or expected value added in the different topics. The findings from the impact assessment and data from previous research framework programmes could be used to inform this analysis. Stakeholders or external experts could be involved at this stage to reach a consensual view.

In some situations the pursuit of an “excellence” objective may be difficult to achieve in conjunction to the objective to create a genuine single market for knowledge, research and innovation. The extent to which both objectives need to be achieved could be clarified. One possible way to make the programme inclusive could be to encourage further the inclusion of additional partners in the projects or to require a greater activity in the dissemination of results to less research-intensive Member States (in the mid-term, this would help reduce the disparities in knowledge across countries).

Recommendation 2: Assess size and scope of the calls using the evidence provided in Recommendation 1. It may be possible to rank the priorities of the calls and prioritise the funding for those that yield a higher return to society. The ultimate objective would be to provide arguments and reassurance on how are the funds allocated across areas (hence clarifying the balance between fundamental and applied research).

Recommendation 3: There should be a close monitoring of project outputs and impacts. Given that measuring the impacts is a difficult task, the Commission could develop a methodological approach to assess the economic impacts of the different research projects.
These would need to be proportional to the sizes and efforts of every project but should be able to provide reassurance to the research community that the outcomes of the project have been achieved. With time, close monitoring should help deter situations of too-optimistic or unrealistic objectives provided by specialised “writing-agencies”.

**Recommendation 4:** Improve quality control mechanisms for the evaluation process of applications. Because of the complexity of projects, it may be difficult to find capable evaluators, so selection criteria for evaluators (and their rewards) may need to be considered.

Using researchers who have received funds as reviewers could be an option, but if so, this should be done in a way that it keeps a “double-blind” process (so that evaluators cannot identify the partners in the calls, so that only strict and objective evaluation criteria are used).

Another option could be to develop a two-stage evaluation process or other ways for pre-filtering the number of candidates into a shortlist. If this approach is used this should fulfil two objectives: (1) that the new process really filters out some proposals and that (2) this is done in a way that is perceived objective and fair.

**Recommendation 5:** Clarify the policy objectives of H2020 such that it is focussed on excellence and leadership at the European level. Although not a major issue, in some cases it may help to delimit the scope of the programme such that it is easy to link to other programmes without overlapping in the objectives. There could be benefits in providing guidance on how should synergies between programmes be achieved.

**Recommendation 6:** The Commission may think about improving further the process in relation to reporting of costs and reducing further the administrative burden.

In relation to the no-ground negotiation clause, there may be some value in calculating the prevalence of errors in the applications and among which type of market players did this happen (with a special focus on newcomers). Warnings and clarifications on the most common errors done by some participants could be provided, so as to avoid the feeling of some applicants of being treated unfairly by this clause.
Annex – Methodological approach

We have used the following tools of analysis throughout the study:

1. Data from CORDIS

The Community Research and Development Information Service (CORDIS) database contains information on all EU-funded research projects and their results. In addition to data on H2020 projects funded, it also has data on FP7, FP6, FP5 and earlier research programmes since 1990.

We have used the latest available CORDIS data (data added on 2015-07-29 and updated on 2016-09-01). Our data analysis concentrates on the Programme, Topic, Call Id, Funding Scheme, Coordinator Country and Participant Country fields to assess the financial progress of the programmes.

2. H2020 Work Programmes

All funding available under Horizon 2020 is set out in multi-annual work programmes formulated by the European Commission in accordance with the Horizon 2020 legislation and EU policy objectives. In the period of our evaluation, there have been two rounds of Work Programmes formulated, 2014-2015 and 2016-17.

The Work Programme describes the various funding opportunities available in each section of H2020 via calls for proposals that have various topics specified within each call for proposals. In addition, there are some additional funding opportunities via other mechanisms such as public procurements, opportunities where demand for innovative products is first created by governments to bring solutions earlier to the market. Every topic in the Work Programme sets out the challenge the topic intends to address, the range of activities the Commission intends to be carried out under each topic, and the impacts expected from projects. The Work Programme is formulated in consultation with stakeholders, including the Horizon 2020 Advisory Groups for each area.

We have used the Work Programmes to provide background and budgetary information on the range of activities planned. This is in order to compare the expected activity under H2020 as set out in the Work Programme and make a comparison with the actual activity funded as recorded in CORDIS.

3. Stakeholder interviews

We have supplemented our data analysis with stakeholder interviews to qualitatively understand the reasons behind our programme implementation findings and to explore other qualitative questions on the programme’s implementation. These questions cover measures of success of H2020 (boost the economy, provide jobs, cross-border cooperation, and synergies/complementation with national and EU programmes and policies). They also explore the financial envelope of the programme, the financial incentives provided and monitoring mechanisms, along with the strengths, weaknesses, opportunities and threats of the programme. Persons interviewed broadly fall under four categories:

- DG RTD
- Organisations responsible for H2020 implementation.
- Horizon 2020 Advisory Groups
- National Contact Points
For this briefing paper, we have interviewed seven stakeholders. Two have responsibilities in different advisory groups. Another four are from RTD (combined into two interviews). One was a National Contact Point. Their details are in the table below:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon 2020 Advisory Group for the Marie Skłodowska-Curie actions on skills, training and career development</td>
<td>Orla Feely</td>
<td>Chair</td>
</tr>
<tr>
<td>Future &amp; Emerging Technologies Advisory Group</td>
<td>Prof Jerzy Langer</td>
<td>Chair, and Professor</td>
</tr>
<tr>
<td>[Anonymised interviewee]</td>
<td>[NA]</td>
<td>[NA]</td>
</tr>
<tr>
<td>DG RTD. Directorate A - Policy Development and Coordination</td>
<td>Kurt Vandenberghe</td>
<td>Director</td>
</tr>
<tr>
<td>DG RTD. Directorate A, Unit A5 - Evaluation</td>
<td>Nelly Bruno</td>
<td>Policy Analyst</td>
</tr>
<tr>
<td>DG RTD. Directorate B - Open innovation and science</td>
<td>Doris Schroecker</td>
<td>Head of Strategy Unit</td>
</tr>
<tr>
<td>DG RTD. Directorate B - Open innovation and science</td>
<td>Nicholas Deliyanakis</td>
<td>Deputy Head of Unit</td>
</tr>
</tbody>
</table>

We thank interviewees for their time and for the contributions made for the study. All contributions have been anonymised.

4. Case studies

The paper provides three case studies to illustrate some of our findings. The initial selection of the projects studied here have been made after obtaining initial results from our data analysis showing which topics have achieved higher or lower funding rates from that planned in the Work Programmes. Within each of the areas of Excellent Science we focus our evaluation on, we selected a topic and a particular project funded within the topic. Our selection was guided by the following principals:

- The project has already started;
- Multiple countries are involved in the project;
- The identity of the coordinator and partners of the project and their experience;
- The project funded is substantial (based on the EU contribution); and
- Sufficient information about the project is available on the website.

Due to time limitations for conducting the study, we complemented our planned selection process with a random selection of some projects. We interviewed project coordinators on the objectives of the projects and H2020, regulations and simplifications introduced in the programme, financial mechanisms and monitoring, strengths and weaknesses of the programme, and recommendations for future programmes and/or future work programmes.

5. Desk research

Finally, we undertook a review of materials available on the background and implementation of H2020 to inform our analysis. The three main types of documents reviewed include previous reports on H2020 and FP7, its predecessor, reports from Horizon 2020 Expert Advisory Groups, reports from stakeholders who have publically
responded to the Commission’s ongoing interim H2020 evaluation online questionnaire, and project specific documentation stored on CORDIS. These sources include the Commission’s Horizon 2020 Monitoring Reports for 2014 and 2015.

135 The questionnaire closes in January 2017, but some of the respondents have made public their general response to the questions. The link to the questionnaire can be accessed at http://ec.europa.eu/research/consultations/interim_h2020_2016/consultation_en.htm
ANNEX III

THE IMPLEMENTATION OF HORIZON 2020

- INDUSTRIAL LEADERSHIP -

Research and industry perspective

Briefing paper
by CSIL and CSES

Abstract

The ITRE Committee of the European Parliament has launched its own initiative to assess progress in implementing H2020 from different perspectives. This briefing paper investigates the different perceptions of participants from industry and research organizations in the Industrial Leadership pillar. In particular, the paper looks at how changes introduced in H2020 have affected participation by different groups of beneficiaries and identifies achievements and implementation challenges in the thematic areas of ICT, ICT for health and SMEs.
AUTHOR
This study has been written by Laura Delponte (CSIL, IT) and Jan Smit (CSES, UK), at the request of the Impact Assessment Unit of the Directorate for Impact Assessment and European Added Value, within the Directorate General for Parliamentary Research Services (DG EPRS) of the General Secretariat of the European Parliament.

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LINGUISTIC VERSIONS
Original: EN

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Manuscript completed in January 2017
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## Abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CIP</td>
<td>Competitiveness and Innovation Framework Programme</td>
</tr>
<tr>
<td>DG</td>
<td>Directorate General</td>
</tr>
<tr>
<td>EASME</td>
<td>Executive Agency for SMEs</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
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<tr>
<td>ECSEL</td>
<td>Electronic Components and Systems for European Leadership</td>
</tr>
<tr>
<td>EIT</td>
<td>European Institute of Innovation Technologies</td>
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<td>ETPs</td>
<td>European Technology Platforms</td>
</tr>
<tr>
<td>FP7</td>
<td>Seventh Framework Research Programme</td>
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<tr>
<td>FTI</td>
<td>Fast Track to Innovation</td>
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<td>HES</td>
<td>Secondary and higher education establishments</td>
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<td>H2020</td>
<td>Horizon 2020</td>
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<td>ICTs</td>
<td>Information and Communication Technologies</td>
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<tr>
<td>JTI</td>
<td>Joint Technology Initiatives</td>
</tr>
<tr>
<td>KETs</td>
<td>Key Enabling Technologies</td>
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<tr>
<td>LEIT</td>
<td>Leadership in Enabling and Industrial Technologies</td>
</tr>
<tr>
<td>IPRs</td>
<td>Intellectual Property Rights</td>
</tr>
<tr>
<td>NCP</td>
<td>National Contact Point</td>
</tr>
<tr>
<td>NMBP</td>
<td>Nanotechnologies, Advanced Materials, Biotechnology, and Advanced Manufacturing and Processing</td>
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<tr>
<td>OTH</td>
<td>Other Entities</td>
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<tr>
<td>PCP</td>
<td>Pre-commercial public procurement</td>
</tr>
<tr>
<td>PPI</td>
<td>Public Procurement for innovation</td>
</tr>
<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
</tr>
<tr>
<td>PRC</td>
<td>Private for profit companies</td>
</tr>
<tr>
<td>PUB</td>
<td>Public bodies (excluding research and education)</td>
</tr>
<tr>
<td>RDI</td>
<td>Research Development and Innovation</td>
</tr>
<tr>
<td>REC</td>
<td>Research organisations (excluding education)</td>
</tr>
<tr>
<td>RIA</td>
<td>Research and Innovation</td>
</tr>
<tr>
<td>RIS3</td>
<td>Research and Innovation Strategies for Smart Specialisation</td>
</tr>
<tr>
<td>RTOs</td>
<td>Research and Technology Organisations</td>
</tr>
<tr>
<td>R&amp;I</td>
<td>Research and Innovation</td>
</tr>
<tr>
<td>SC</td>
<td>Societal Challenge</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium Enterprises</td>
</tr>
<tr>
<td>SMEI</td>
<td>SME Instrument</td>
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<tr>
<td>TRL</td>
<td>Technology Readiness Level</td>
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</table>
Executive summary

Horizon 2020 has been implemented since December 2014. Preliminary findings from these three years are key to inform a debate about the future direction of the Programme. In this respect, the perspective of participants from industry and research, along with the experience of implementing agencies, is of paramount importance to identify the main achievements, failings and bottlenecks in the implementation of the Programme. This report presents the perspectives of industry and research participants with respect to the implementation of the Industrial Leadership pillar.

H2020 departed from the heavily research centered approach of past Framework Research Programmes. The Industrial Leadership pillar, with its focus on industry relevant technologies and strong linkages with the EU Industrial Policy, has been a novelty in H2020. The Industrial Leadership Work Programme addresses key enabling technologies for the EU industry, such as ICT, nanotechnologies, robotics, biotechnologies, advanced materials and space, along with tailored support to SMEs.

Changes in the programme approaches have had different implications for industry and research participants. While the former has seen its participation enhanced, by the increased financing for innovative and close-to market technologies and the use of more business-friendly instruments, such as the SME Instrument and the Fast Track to Innovation, participants from academia face a reduction of funding for fundamental research activities.

Reflecting the pervasiveness of digitalization, ICT is well integrated in H2020 through targeted financing in a specific Work Programme and horizontal integration in other parts of H2020. The LEIT ICT programme design is well-rated by participants, which consider it to be adequate for striking a good balance between technologies where EU industry has a strong comparative advantage (e.g. electronics) with technologies that are led by other countries (e.g. Big Data). The ICT sector receives the lion’s share of the budget.

ICT for health is not included in the LEIT ICT Work Programme, but is rather a priority of the “Health, Demographic Change and Wellbeing” Work Programme in the Societal Challenge Pillar and prioritizes active ageing. Recognizing that SMEs are very active providers of e-health services and applications, the SME Instruments have also been used to support new e-health projects. In addition to this, the ICT-LEIT Work Programme also promotes the use of ICT in vertical industries, as in the case of the Big Data and 5G Public-Private Partnerships.

The use of new business-friendly instruments, simplification of access and the increased adoption of calls having broader objectives, have succeeded in widening participation, even to groups that were not reached by previous Programmes. Nevertheless, widening participation has resulted in oversubscription and low success rates that can discourage participation in the future both from industry and academia. The existing instruments used for filtering applications, such as the use of two-stage calls, have not been well received by participants in Industrial Leadership calls.

Participation of SMEs has been greatly enhanced by the use of a tailored SME instrument. However, it is important to note that participation of SMEs is also encouraged in LEIT thematic calls that can also have a specific focus on SMEs (e.g. LEIT-ICT call for SMEs operating in creative industries). While it is too early to assess the effective participation of
SMEs in collaborative consortia, preliminary results show that the SMEI has quickly become very popular and saw unexpectedly high participation rates from all over the EU. Nevertheless, the instrument has the lowest success rate in H2020 and is further undermined by increasing dissatisfaction with the evaluation process.

In the ICT-LEIT Work Programme collaboration between scientists and business rests on medium TRLs, where more synergies can be leveraged. Joint collaborative projects represent the largest majority of projects both for Research and Innovation and Innovation Actions in LEIT calls. As in FP7, the management of large international consortia proves to be burdensome and the involvement of research technical organizations is often seen as necessary in industrial leadership projects to mediate between the approach of industry and academia to R&D projects.

Preliminary data on project outputs reveal that publications in peer reviewed journals are still much more prevalent than patents. Although the programme has put more emphasis on market and commercialization outcomes, it still remains rather technocentric, because of the lack of a clear framework for assessing market readiness from a business perspective. The composition of evaluation panels is also ill-suited for evaluating market readiness and commercialization strategies. However, it is too early to draw general conclusions about the capacity of the programme to develop technologies that will be up-scaled into markets. Finally, two areas that have progressed less than expected are the exploitation of complementarities with national or regional (European Regional Development Fund) programmes and international collaboration. The importance of increasing synergies with national and regional funds has become more critical following results of the first three years of implementation. First, national or regional funding could be directed to address weaknesses in countries that have lower participation and success rates. Secondly, it could be used, as some country examples show, to support high quality projects that could not be financed through H2020. Thus far, national initiatives have been limited to targeting SME projects, because the use of national/regional funding for large international consortia is less justifiable. In contrast to FP7, international cooperation is not a target area, but it is rather integrated in different Work Programmes following specific sector priorities. However, in Industrial Leadership this approach has resulted in lower participation from third countries.
Chapter 1. Introduction

I – Background and study objectives

The ITRE Committee of the European Parliament has launched its own initiative to assess progress in implementing H2020 from different perspectives. This briefing paper is one of the six reports commissioned by the European Parliament and its objective is to provide an assessment of the current state of implementation of the Industrial Leadership priority from the perspective of industry and research, to inform a debate about the future FP9. Within the Industrial Leadership pillar, the paper focuses on the thematic areas of ICT and SME Innovation. An overview of progress in the area of e-health is also provided. In the sectoral focus, the study looks in depth at strengths, weaknesses, opportunities and threats of implementation as compared to past FPs and identifies which changes have positively or negatively affected particular groups of beneficiaries.

II – The research questions

The research questions consider the effectiveness of implementation of the Industrial Leadership work programme. This requires investigating how participants get involved in the entire H2020 programme cycle, including design of WPs and calls, implementing arrangements, effectiveness of evaluation processes and impact on beneficiaries.

Questions related to design quality discuss the overall approach of the pillar and the early perceptions of participants with respect to the modifications introduced with H2020. They also assess if calls have been designed to meet the initial objectives and targets and if these are aligned with larger EU policy objectives. On implementation arrangements, the research questions investigate changes compared to past regulations, improvements in the efficiency of processes (e.g. evaluation, time-to-grant) and effectiveness of measures undertaken to redress critical aspects of implementation of the work programme (e.g. oversubscription and low success rates). The last group of research questions seeks to provide an early assessment of the effectiveness of the programme in terms of impact on potential beneficiaries with respect to the planned objectives.

III – Methodology of the research

This briefing paper is based on desk research and semi-structured interviews with different stakeholders. The desk research reviews H2020 policy, strategy and regulatory documents, as well as on a number of position papers, articles and expert reports that illustrate the perspectives of industry and research organizations and Member States. It also includes an analysis of data on project implemented up to November 2016 which relies on the Cordis dataset. Semi-structured interviews were designed to provide insights into specific implementation issues and to gather an early assessment of the achievements of the programme. A total of 15 interviews were conducted (Annex B), ensuring an appropriate balance of different opinions from participants and beneficiaries and an adequate geographical coverage.
Chapter 2. The main features of Horizon 2020 approach in supporting Industrial Leadership

Key findings

- H2020 marked a significant departure from the heavily research-oriented approach of FP7 and the industrial leadership work programme is a novelty in this respect.
- Reflecting the new approach pursued by H2020, the Industrial Leadership work programme includes two new instruments, the SMEI and the FTI, targeted at supporting close-to-market innovations.
- Changes introduced led to higher attention to impact and industrial outcomes, increased financing for projects with higher Technology Readiness Levels (i.e. closer to the market), enhanced use of industry-led instruments (PPPs) and broader thematic calls to increase participation.
- Industry participants appreciate that more funding is earmarked for innovative actions. Conversely, reduced funding for fundamental research has negative implications for research organizations.
- On ICT, the overall approach is generally rated as satisfactory in terms of addressing modern challenges, such as Big Data, computing power, cloud and the Internet of Things.
- The ICT for health work programme is set to address “ageing R&I” challenges with a focus on personalized healthcare.

I – The Industrial Leadership Work Programme

The Industrial Leadership work programme was set up to build a strong and globally competitive European industry by enhancing leadership in breakthrough and enabling technologies. It was conceived to support industrial deployment of KETs (Key Enabling Technologies) and involvement of industrial participants. The pillar therefore contributes to achieving EU Industrial Policy goals136, which recognize that industry is the backbone of the EU economy and put forward a strategy for the industrial renaissance of European manufacturing. It is also a relevant component of the EU Strategy for Key Enabling Technologies137.

To this end, the Industrial Leadership work programme138 is structured in three thematic areas.

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European Implementation Assessment

- "Leadership in enabling and industrial technologies" (LEIT) supports groundbreaking technologies and includes the parts of Horizon 2020 focusing on areas of R&D and innovation with a strong industrial dimension. In particular, it provides support for:
  - Information and communication technologies (LEIT-ICT)
  - Nanotechnologies
  - Advanced materials
  - Biotechnology
  - Advanced manufacturing and processing
  - Space (LEIT-Space)

This programme part is implemented by different Commission services: DG RTD for the NMBP part, DG CNET for the LEIT-ICT part and DG GROW for the LEIT-Space part. The implementation of the LEIT-Space calls has been delegated to two agencies - the Research Executive Agency and the European GNSS Agency.

- "Access to risk finance": is delivered through financial instruments (equity and loans) and aims to overcome deficits in the availability of debt and equity finance for R&D and innovation-driven companies. ‘Access to risk finance’ has been conceived to continue the experience of schemes that supported R&D in 2007-2013 during the FP7, such as the Risk-Sharing Finance Facility and the Risk-Sharing Instrument for SMEs, and the early-stage part of the High-Growth & Innovative SMEs Facility provided under the CIP (Competitiveness and Innovation Framework Programme). The financial instruments are implemented by the European Investment Bank (EIB) and the European Investment Fund (EIF).

- "Innovation in SMEs" aims at creating a bridge between the core of the framework programme support to R&I projects and the creation of a favorable ecosystem for SME innovation and growth. It includes a number of actions geared towards developing and providing better innovation support services to SMEs and the EUREKA/Eurostars initiative, which provides funding for transnational collaborative projects of research-intensive SMEs. The Eurostars programme applies a decentralised funding procedure, where funds are administered by national funding bodies.

The Industrial Leadership work programme also includes the use of two new instruments targeted at supporting close-to-market innovations. These instruments apply to both Industrial Leadership and Societal Challenge eligible projects.

- The SME Instruments (SMEI) is a key novelty in the EU FP and is the key H2020 instrument to reach the objective of allocating at least 20% of funding for LEIT and Societal Challenges to SMEs. It provides direct support to SMEs with a high growth potential within and outside the single market. Support is provided along the entire innovation cycle, namely concept and feasibility assessment; R&D, demonstration, and market replication; and commercialization. It is implemented under a single centralized management system by the Executive Agency for Small and Medium-sized Enterprises (EASME) through multiple calls that keep participation as open as possible. Based on the budget available up to 2020, and considering an average amount
for grants in phase I (50,000€) and II (1,7M€), the EC expects a total portfolio of approximately 7,600 beneficiaries, with nearly 1,500 SMEs supported in Phase II.

- **Fast Track to Innovation (FTI)** is a new element of Horizon 2020 and was launched as a pilot action in 2015. Like the SMEI, it cuts across the two pillars of LEIT and Societal Challenges. It supports innovation actions carried out by any entity, but consortia must include participants from industry, in any technology field through a continuously open call. The instrument was designed to support close-to-market innovation and to keep the time-to-grant within six months. Under the pilot action of 2015, it was foreseen that up to 100 proposals would be funded. The FTI is also centrally managed by EASME.

II – ICT in Horizon 2020

Digital technologies are pervasive and are transforming business and society alike. As a generic and enabling technology, **ICT support is distributed across the three priorities cutting across the entire ICT innovation chain, namely:**

- **Excellent Science** supports advanced research to explore radically new technological possibilities and ICT contributions to upstream research and innovation,
- **Industrial Leadership** addresses research and innovation activities on generic ICT technologies, and
- **Societal Challenges** supports multi-disciplinary application-driven research and innovation, which leverage ICT to tackle different societal challenges, including society (approximately 26% of budget), security (25%) and health (15%).

This feature distinguishes Horizon 2020 from FP7, where ICT was one of the ten key thematic areas supported under the Cooperation block. In line with its prominent role, EU investments in ICT increased substantially under Horizon 2020 compared to the FP7.

The current and past LEIT Work Program for ICT is based upon six priority areas: i) a new generation of components and systems, ii) advanced computing, iii) future internet, iv) content technologies and information management, v) robotics, and vi) micro- and nanoelectronic technologies, photonics. The WP also includes several cross-cutting topics (cyber-security, Internet of Things and research on a Human-centric Digital Age) and is complemented with activities supporting international cooperation, dedicated actions for SMEs and dedicated support for innovation take up. Linkages with other KETs are ensured in the call for the Factories of the Future. On international collaboration, Japan and Brazil were the main target countries in the 2014-2015 period, while South Korea was added later.

To support key European ICT industries through industrial road map approaches, several Public-Private Partnerships have been established in the LEIT ICT work programme. These include: Joint Technology Initiatives, ECSEL (Electronic Components and Systems for European Leadership) with a budget of EUR 1,215 billion from EU and EUR 3,6 billion from industry partners and other sources, and several contractual PPPs (5G - EUR 700m, Photonics - EUR 700m, Robotics - EUR 700m, High Performance Computing - EUR 700m, Factories of the Future - ICT part EUR 450m, Green Vehicles- ICT part- EUR 80m, Big Data- EUR 500m and the newly established Cybersecurity – EUR 450 million).

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**ICT for health is a priority in the European Digital Agenda.** E-Health is addressed in the first thematic area of the Societal Challenges pillar, Health, Demographic Change and Wellbeing. The part of the work programme that targets e-health, contributes to achieve the objectives of the eHealth Action Plan 2012-2020 by addressing the growing global demand for healthcare, especially from elderly people, within the perspective of declining public budgets. The big priority under this theme is “ageing R&I” with a focus on personalized healthcare. The focus of ICT for health is on developing health information systems for managing huge amounts of data and to monitor changes in public health, along with giving patients more options for monitoring their conditions and managing their treatment. On international collaboration, the United States is identified as a priority partner for e-health programmes.

**III – A comparative overview of the Industrial Leadership Work Programme**

The Industrial Leadership pillar, with its strong emphasis on research and innovation with high potential industrial impacts, is a novelty with respect to the previous FP7. Overall, H2020 marked a significant departure from the heavily research-oriented approach of FP7. H2020 is designed to address the full research and innovation ecosystem and introduced the concept of technology readiness level (TRL) to support close-to-market innovative projects and integrate instruments that support commercialization of innovative products and services. The new approach pursued by H2020 was built upon a number of crucially relevant considerations. Compared to its competitors, Europe has developed a structural innovation gap that is due to a weak interaction between science and innovative ecosystems. The links between frontier research, commercialization of innovations and societal challenges remain weak and European enterprises have shown insufficient technological leadership and innovation capability. Furthermore, data from past evaluations of FP showed that private sector participation in EU research framework programmes had been falling for many years (from FP4 to FP7, it has declined from 43% to nearly 25%) and that projects funded in the past were not successful enough in bridging the gap between basic research and innovation.

In particular, the development of the Industrial Leadership pillar originates from the conclusions of the High-Level Expert Group on Key Enabling Technologies that advocated for rebalancing funds allocated to basic research projects with resources dedicated to applied and development research for product development. To achieve this purpose, the Industrial Leadership work programme was developed by combining past and new instruments. The pillar integrates measures from past research framework programmes with instruments used in the CIP (CIP) and introduces a new set of instruments, such as

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142 TRL are used to assess technology maturity of projects on a scale from 1 (basic principles observed) to 9 (proven in an operational environment).

143 Reinhilde Veugelers, Michele Cincera (2015).

144 BusinessEurope (2014).

145 European Commission (2012b).
the SME instrument (SMEI) and the Fast-Track Innovation (FTI) scheme that support close-to-the-market innovations. Changes in H2020 that are particularly relevant for participation in the Industrial Leadership pillar include:

- stronger emphasis on impact (e.g. for Innovation Actions impact criteria is considered first when scores are equal);
- less prescription in the design of calls and a bottom up approach that is pursued by using calls with broader thematic objectives and by allowing participants to have considerable freedom to come up with innovative solutions (e.g. call Open Innovation in the SMEI);
- enhanced use of industrial roadmaps developed within European Technological Platforms (ETPs)\(^{146}\);
- focus on higher Technology Readiness Levels (TRLs), while lower levels are addressed in other part of H2020 (Future and Emerging Technologies);
- increased openness towards industrial participants, including SMEs;
- implementation of part of the work programme in public private partnership (PPPs) to better address issues that are relevant to industry and ensure a stronger private sector commitment; and
- enhanced use of “market pull” instruments, such as pre-commercial procurement and public innovative procurement.

As compared to FP7, the approach towards the SME sector has also radically changed. In FP7 there were two elements that encouraged SME participation, namely a commitment to spend at least 15% of the Cooperation Programme budget for SMEs, and a commitment to SME-specific schemes (i.e. Research for SMEs and Research for SME associations). An interim evaluation of SME participation in FP7 shows that, despite targets were quantitatively achieved, the role of participating SMEs was less clear. In particular, participating SMEs were rarely in the driver’s seat and their participation was often organized and structured by Research and Technology Organizations (RTOs). While data shows that 10% of Cooperation projects and 66% of projects in Research for the benefit of SMEs was coordinated by an SME, qualitative research unveiled that the role of SMEs was often marginal and that it was not even possible to determine precisely which share of funding actually reached SMEs\(^{147}\).

To respond to these concerns, Horizon 2020 introduced a number of novelties to increase direct funding to SMEs and make SME participation and access to funds easier. In H2020, SMEs are targeted through a different mix of instruments including grant and financial instruments and a larger use of bottom-up approaches (Table 1). Industrial Leadership also includes a smaller budget for supporting actions favoring SME access to high quality business services that support innovation processes. These extend over different types of actions and objectives, such as support for the IPR Helpdesk, support for National Contact Points (NCPs), funding for analytical research activities and technology services for SMEs.

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\(^{146}\) ETPs were initially developed in FP6. These are industry-driven initiatives although members are from industry, research and technology organizations, academia and in some cases member states. These platforms prepare strategic research agendas which define research priorities for the sector and provides inputs for the preparation of the work programme.

\(^{147}\) European Commission, 2014a.
## H2020 support to the SME sector

<table>
<thead>
<tr>
<th>Instruments</th>
<th>SME participation target</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2020 Collaborative projects (i.e. transnational consortia of a minimum of 3 partners)</td>
<td>SMEs to account for 20% of budget in Industrial Leadership and Societal Challenges. Approximately EUR 6 billion until 2020.</td>
</tr>
<tr>
<td>SMEI (TRL higher than 6)</td>
<td>7% of the combined budget for Industrial Leadership and Societal Challenges. Approximately EUR 3 billion.</td>
</tr>
<tr>
<td>Eurostars (transnational projects, co-financing of 50%)</td>
<td>EU contribution set at EUR 287 million and participating country contributions set at EUR 861 million. This budget is significantly larger than those of the first Eurostars Joint Programme.</td>
</tr>
<tr>
<td>Access to Finance (reserved for RDI–driven SMEs and midcaps)</td>
<td>Guarantees and equity up to EUR 900 million.</td>
</tr>
</tbody>
</table>

*Source: H2020 SME Advisory Group*

The new approach promoted by H2020, along with the introduction of new instruments and a revisited governance architecture, had diverse implications for different categories of participants and beneficiaries. *Industry participants appreciate that more funding is earmarked for innovative actions and more emphasis is attached to industrial and societal outcomes*\(^{(148)}\). Within industry, *SMEs see their participation in the European research framework programme as greatly enhanced*\(^{(149)}\). The use of new instruments such as the SMEI and the FTI have been highly appreciated. In particular, companies highly value the shorter evaluation process and time-to-grant, along with the possibility of funding market-ready products or services. The introduction of the TRL-scale has also been perceived as a major improvement in H2020. Early assessments of the Pilot Phase – Fast Track to Innovation and of the SMEI were very positive, although concerns were raised about appropriate funding of these instruments in the light of the existing funding gap for innovation in Europe.

Conversely, participants from academia deem that the original purposes of the programme (i.e. supporting research) have been undermined by the new approach that has resulted in a lower budget for research organizations. From scientists’ perspective, too little funding goes to low TRLs which are less attractive to industry, but could generate larger benefit for society in the long period\(^{(150)}\).

Early concerns were also expressed with regard to the complex and multipurpose structure of the programme that resulted in deploying too many different funding instruments (e.g. PPP, calls for projects, EIT, PPI, etc.) and in spreading the H2020 budget too thin over too many priorities and beneficiaries\(^{(151)}\).

*On ICT, the overall approach is generally rated as satisfactory in terms of addressing modern challenges,* such as Big Data, computing power, cloud and the Internet of Things,


and helping European industry keeps its comparative advantages. The LEIT ICT work programme is generally considered forward looking and focused on new and emerging technologies. It also combines areas where European companies have more established competences, such as telecommunications, mechatronics, industrial robotics and microelectronics, with areas where third countries have a more leading role, including Big Data and creative industries. Finally, the combination of a targeted approach to ICT with horizontal integration of ICT in different thematic areas is highly valued as it properly addresses progressive digitalisation of economies and societies\textsuperscript{152}.

\textsuperscript{152} DigitalEurope (2016b).
Chapter III. Overview of implementation of the Industrial Leadership work programme

Key findings

- The lion’s share of the industrial leadership budget goes to the ICT sector.
- As compared to FP7, H2020 succeeded in securing a higher participation from the private sector, including SMEs. However, while private sector participation increased in numbers (70%), its share of EU contribution remained more limited (26.7%).
- The geographical pattern of participation and success rate still shows marked differences between EU-13 and EU-15 countries.
- Success rates are generally lower than in FP7. The SMEI has the lowest success rate in H2020.
- Preliminary data on project outputs reveal that publications in peer/reviewed journals still predominate as compared to patents.

I – Topics and instruments

Between 2014 and 2015, 1,413 grants were signed in Industrial Leadership for a total of EUR 3,219 million of EU contribution. As a share of H2020 overall, these figures represent respectively 15.5% of grants and approximately 20% of the budget. LEIT ICT had the largest number of grants signed (704, more than half of the grant in the second pillar) and the largest share of budget (EUR 1,876 million). In the same period, the SMEI supported 1,434 grants for a total EU contribution of EUR 524.9 million.

The figure below shows the distribution of grants signed up to November 1st 2016 in the Industrial Leadership pillar.

153 All data from Horizon 2020 Monitoring report 2015.
Number of projects and total EU contribution per specific topic in Industrial Leadership

Source: author’s elaboration of Cordis database including grants signed by November 1st 2016.

Note: For Societal Challenge calls the following abbreviations apply: BG (blue growth), DRS (critical infrastructure protection), IT (transport), PHC (Clinical research for the validation of biomarkers and/or diagnostic medical devices) SFS (Resource-efficient eco-innovative food production and processing) SIE (low carbon).

In ICT, implementation was guided by the priorities outlined in the LEIT-ICT work programme (Table 2).

Implementation of the LEIT-ICT priority, 2014 and 2015

<table>
<thead>
<tr>
<th>Instruments</th>
<th>Call and budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic calls</td>
<td>Information and Communication Technology including 20 topics covering the entire ICT value chain (EUR 1,344.5 m). This amount also include budget allocated to activities of PPPs on Robotics, 5G and Photonics.</td>
</tr>
<tr>
<td>JTI-ECSEL</td>
<td>Electronic Components and Systems for European Leadership (EUR for 135mRIA and EUR 145m for IA). Priority actions include key applications (e.g. smart energy, smart health) and essential technologies.</td>
</tr>
<tr>
<td>SMEI</td>
<td>Open Disruptive Innovation Scheme (EUR 44.1m in 2015 and 45m in 2014).</td>
</tr>
</tbody>
</table>
| International collaboration | EU-Japan research and development cooperation in net futures (EUR 6m).  
EU-Brazil Research and Development Cooperation in Advanced Cyber Infrastructure (EUR 7m). |
| Inducement prize     | 2015-Collaborative sharing of spectrum (EUR 0.5m).  
2015-Breaking optical transmission barriers (EUR 0.5m).                                      |


In ICT for health, calls have been set to address key priorities concerning the processing of Big Data, the integration of data and information from different sources, and the real-time integration of several objects (Internet of Things). Active and healthy ageing has been the major societal challenge addressed by e-health projects (Table 3).
ICT for health in H2020

<table>
<thead>
<tr>
<th>Instruments</th>
<th>Call and budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic calls</td>
<td>Personalising Health and Care (call managed by DG CNET) including topics related to interoperability, active and healthy ageing and Big Data (EUR 130.05 million). Increasing digital security of health-related data on a systemic level* (EUR 11 million)</td>
</tr>
<tr>
<td>Procurement</td>
<td>PCP Self-management of health and disease and patient empowerment supported by ICT</td>
</tr>
<tr>
<td></td>
<td>PCP Public procurement of innovative eHealth services</td>
</tr>
<tr>
<td></td>
<td>PCP eHealth innovation in empowering the patient* (EUR 18 million)</td>
</tr>
<tr>
<td></td>
<td>PPI for uptake of standards for the exchange of digitalised healthcare records* (EUR 18.76 million)</td>
</tr>
<tr>
<td>SMEI</td>
<td>Accelerating market introduction of ICT solutions for Health, Well-Being and Ageing Well* (EUR 30.5 million)</td>
</tr>
<tr>
<td>International</td>
<td>EU-US interoperability roadmap* (EUR 1 million)</td>
</tr>
<tr>
<td>collaboration</td>
<td>EU-Japan cooperation on Novel ICT Robotics based solutions for active and healthy ageing at home or in care facilities, (EUR 5 million)</td>
</tr>
<tr>
<td>Inducement prize</td>
<td>eHealth Food Scanner* (EUR 1 Million).</td>
</tr>
</tbody>
</table>

Source: author’s elaboration from H2020 Participant Portal.

Note: This list is not comprehensive, as is based on different sources. It includes calls from the 2014-2015 and 2016-2017 work programmes *2016-2017 Work Programme.

II – Participation in Industrial Leadership

As compared to FP7, H2020 succeeded in securing a higher participation from the private sector (Table 4). Overall, the largest number of participants in signed grants comes from the private sector (60%). However, the largest EU contribution is still going to academia (39.6%), while non-research private sector organizations succeeded in receiving 26.7% of total contributions. This pattern is due to the impact of the SMEI, which targets a large number of private sector entities with a low budget. Nevertheless, this outcome does not compare well with the large number of applications submitted by the private sector (approximately 70% of total applications) and the private sector’s overall contribution to R&D expenditure in Europe.

Participation in industrial leadership from different types of beneficiaries

<table>
<thead>
<tr>
<th>Category of participant</th>
<th>LEIT</th>
<th>SMEI</th>
<th>H2020 average</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-13</td>
<td>5.9%</td>
<td>11.6%</td>
<td>7.8%</td>
</tr>
<tr>
<td>Associated countries</td>
<td>6.3%</td>
<td>5.8%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Third countries</td>
<td>1.6%</td>
<td>0.1%</td>
<td>2%</td>
</tr>
<tr>
<td>Private sector</td>
<td>51.7%</td>
<td>100%</td>
<td>32.6%</td>
</tr>
<tr>
<td>SMEs</td>
<td>31.1%</td>
<td>100%</td>
<td>21.9%</td>
</tr>
</tbody>
</table>

Source: EC, 2016a.
Private sector participation has been large in Industrial Leadership LEIT, achieving almost 52% of participants in signed grants between 2014 and 2015. Collaboration between research and industry has progressed well both in RIA (Research and Innovation) and IA (Innovative Actions) actions across all LEIT thematic priorities (Figure 2).

Collaboration between science and business in industrial leadership (as % of budget)

![Collaboration between science and business in industrial leadership](image)

Source: author's elaboration of Cordis data.

Note: HES (secondary and higher education establishments), PRC (private for profit companies).

A characteristic feature of industry participation in LEIT calls is that this is often associated with participation of a RTO (Research and Technology Organization). In this respect, it is important to notice that eight out of ten largest recipients of H2020 funding in Industrial Leadership are RTOs, while seven out of ten top project coordinators also belong to the RTO category. As in past FPs, the role of RTOs in facilitating and aggregating participation of industry, including SMEs, in large collaborative projects is still very relevant and it appears that RTOs have positioned themselves as broker between fundamental research and applied industrial research.

Enhancing participation of SMEs and newcomers in FP is an important objective of H2020. So far, the programme has achieved its target of allocating at least 20% of the budget for LEIT and Societal Challenges to SMEs. While about 23% of funding was allocated to SMEs, 5.9% of funding went to the SMEI against a target of 7%. H2020 has also enlarged the pool of potential beneficiaries, as showed by participation rates from newcomers, which attained 7.1% of signed grants in Industrial Leadership and 27.9% in Societal Challenges.

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154 RIA are collaborative projects involving at least 3 entities from 3 member states or associate countries. Typical project duration is 36-48 months, funding rate is 100%, and the average EC contribution is set between EUR 2 and EUR 5 million. IA are set to support closer-to-the-market activities, such as testing, piloting, prototyping, and require the participation of at least 3 entities from 3 member states or associate countries. Typical project duration is 30-36 months, funding rate is 70%, and the average EC contribution is set between EUR 2 and EUR 5 million.

155 EARTO (2016d).
Organizations based in Germany have received the largest share of funding (18.9%), followed by those in the UK (11.7%) and Spain (11.2%). Together with France (10.9%), Italy (9.1%) and the Netherlands (7.0%), these Member States have received almost 70% of the EU funding. The cumulative EU contribution to EU-13 Member States has been 4.38%. A similar pattern can be observed in the SMEI, where 92.9% of funding went to the EU-15, with Spain, UK and Italy as the largest recipients. However, it is relevant to notice that participation in the SMEI from EU-13 countries has been higher as compared to their overall performance in H2020.

As with FP7, H2020 is also open to participation from countries outside the EU. H2020 does not set a target for achieving a certain number of internationally open projects, but third country participation has thus far been lower than in FP7, when it reached 4.3% of all collaborative projects. In Industrial Leadership participation from non-EU countries has been higher in Innovation in SMEs, reflecting the fact that the work programme specifically supports technological partnerships with third countries. Switzerland, Norway and Israel recorded the highest participation rate, along with Brazil and the United States.

### III – The success rate in Industrial Leadership

In the Industrial Leadership pillar, the average success rate, in terms of proposals, is lower than the average in H2020. However, looking at the success rate in terms of funding, Industrial Leadership as a whole performed on average better than the other parts of the programme. Among the specific objectives of Industrial Leadership, the best performing areas are ‘Innovation in SMEs’ and the LEIT-Space, while the SMEI has the lowest rate of success. Within the SMEI, the lowest success rate in terms of proposal is observed in ICT calls (3.6%), while the highest is in Space thematic calls (17.4%). High success rates in innovation in SMEs are due to the fact that the activities undertaken under this thematic area target a smaller and well defined audience.

### Success rates in H2020 per specific pillar (2014-2015 average)

<table>
<thead>
<tr>
<th>Pillar</th>
<th>Success rate proposal (%)</th>
<th>Success rate funding (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Leadership</td>
<td>8.8</td>
<td>13</td>
</tr>
<tr>
<td>LEIT-ICT</td>
<td>7.9</td>
<td>13.1</td>
</tr>
<tr>
<td>LEIT - NMBP</td>
<td>8.6</td>
<td>12.3</td>
</tr>
<tr>
<td>LEIT-Space</td>
<td>16.1</td>
<td>16.6</td>
</tr>
<tr>
<td>Access to Risk Finance</td>
<td>5.9</td>
<td>7.4</td>
</tr>
<tr>
<td>Innovation in SME</td>
<td>27.2</td>
<td>13.2</td>
</tr>
<tr>
<td>SMEI</td>
<td>7.6</td>
<td>5.9</td>
</tr>
<tr>
<td>Excellence in Science</td>
<td>13.4</td>
<td>11.6</td>
</tr>
<tr>
<td>Societal Challenge</td>
<td>10.7</td>
<td>13</td>
</tr>
</tbody>
</table>

Source: EC, 2016a

Note: Success rate proposal is calculated as the ratio between the number of eligible applications received and the number or retained proposals. Success rate funding is calculated as the ratio between the funding going to the retained proposals and the overall funding requested by eligible proposals.

156 Author’s elaboration from Cordis data.

157 Elaboration from Cordis database.
Overall in H2020, private sector entities and academic bodies have the lowest success rates in terms of proposals retained (12% and 11.9% respectively). For the private sector, this result is determined by the low success rate in the SMEI, whereas for academic bodies it is due to a combination of increased competition and lower available budgets for basic research.

As in FP7, participation and success rates amongst Member States varies greatly. In Industrial Leadership, in 2015, Belgium had the highest success rate (15.8%) and Bulgaria had the lowest (2.1%). Over 2014-2015, six countries achieved a success rate above 15%. These were: Austria, Belgium, France, Germany, Sweden and Netherlands. These countries also had good performances in the other pillars of H2020. In EU-13 Member States, Estonia and Czech Republic had the best average performance in Industrial Leadership during the period 2014-2015. A similar geographical distribution for the success rate applies in the SMEI. In particular, for phase I the countries with the highest success rates were Denmark (15.5%) and Sweden (15.0%), while Bulgaria (0.9%) and Romania (0.5%) had the lowest performances. In phase 2 the best performing countries were Ireland (10.9%), Czech Republic (8%) and Spain (8%).

**IV – Project outputs**

H2020 has just completed its third year of implementation and there is still little data about projects’ achievements. Preliminary data on information collected systematically from beneficiaries show that H2020 has thus far supported 1,760 publications in peer-reviewed journals, 109 patent applications and 29 patents awarded (Table 6). With regard to project outputs, publications in peer-reviewed journals still predominate, including in Industrial Leadership. However, what matters most in terms of industrial outcomes are patent applications and awards.

**Project outputs in Industrial Leadership**

<table>
<thead>
<tr>
<th>Thematic area</th>
<th>Publications in peer-reviewed journals</th>
<th>Patent applications</th>
<th>Awarded patents</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEIT</td>
<td>404</td>
<td>47</td>
<td>13</td>
</tr>
<tr>
<td>ICT</td>
<td>296</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>NMBP</td>
<td>47</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Space</td>
<td>60</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>


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158 Data on LEIT from H2020 Monitoring Report 2015, data on SMEI from EASME.
Chapter IV. Efficiency and effectiveness of implementation

Key findings

- Oversubscription and low success rates concern industry and research participants alike. Too many proposals that score above the required threshold do not access funding. This is discouraging participation in future calls because of the high effort required to prepare proposals.

- In response to low success rate, Member States are establishing linkages with national or regional R&I programmes to ensure that the best proposals get the necessary financial support.

- Evaluation of proposals is still technology-centred. There is no clear framework and inadequate expertise for evaluating business potential.

- Although improved in recent years, collaboration between industry and research has still to cope with fundamental differences between R&D approaches in business and academia.

- The LEIT work programme is well designed to deliver modern technologies, but, at this stage of the implementation of the programme it is too early to assess if the programme will succeed in upscaling a significant number of these technologies in new products and services in markets.

- The use of demand driven instruments and user-centric approaches has remained limited in the first three years of programme implementation.

- As compared to FP7, international cooperation is more selective and targeted, but has progressed less than expected.

I – Issues related to the implementation framework

Over its first three years of implementation H2020 has proved to be extremely popular. Changes in the FP approach and implementation framework have succeeded in widening participation, although a number of issues threaten current high participation levels both from industry and research (table 7).

Summary of major issues reported by industry and research with respect to accessing and using Industrial Leadership funds

<table>
<thead>
<tr>
<th>Industry</th>
<th>Research</th>
</tr>
</thead>
</table>
| - The heavy administrative burden in preparing proposals, especially for two-stage calls in the face of too low success rates | - Low success rates and too high transaction costs
|                                                                         | - Direct/indirect cost determination method and levels        |
|                                                                         | - Distrust with the current model of evaluation of collaborative research |
Industry

- Inadequate representation of industry experts in evaluator teams, especially for proposals with higher TRL
- Lower success rate as compared to FP7
- Difficulties in building international consortia
- The existing IPR regime, which favours a joint ownership regime, and supports a protectionist approach through the Affiliate Clause

Research

- Level of funding allocated to collaborative projects with low TRLs, which undermines university commitment
- Too much focus on short term economic impacts

Source: author’s summary from industry and research organization position papers

1. Oversubscription and success rate

Since the programme inception, oversubscription has been a key issue for both industry and research participants. For the calls of 2014-2015, the success rate, in terms of eligible proposals has been 11.8%, but it has been as low as 6% in the SMEI. By comparison, the success rate for the US National Science Foundation stands between 18% and 21%. The major implication of the low success rate is that research and industry might be discouraged from applying, especially in view of the extensive work that is needed to prepare a project proposal.

Oversubscription is due to a combination of factors. First, in the current macroeconomic scenario declining national budgets in most Member States have less resources for supporting R&I. Secondly, the new approach pursued by the programme has led to a considerable enlargement in the number of potential beneficiaries, especially in Industrial Leadership and Societal Challenges. As an example, the SMEI call “Open Innovation” had such a broad objective that it was difficult for participants, including for in-country support organizations, to understand whether the proposed projects would have met the selection criteria. This resulted in the submission of a large number of unsuccessful applications.

From the point of view of the EC, oversubscription is an indicator of the attractiveness of the programme and of its relevance for potential beneficiaries. However, industry points out that this also reflects the high unfunded innovative potential that exists in Europe. Different solutions have been put forward to address the low success rate in H2020. In FP7, DG CNET had a pre-application quality check procedure, which consisted in the appraisal of two-page project proposals. This preliminary assessment worked well and was appreciated by participants. However, the scheme was discontinued in H2020.

Generally, industry representatives are more in favor of narrowing the topics of calls to limit the number of potential applicants. However, this approach would inevitably limit the programme openness and would contradict the bottom up approach pursued in Industrial Leadership.

To tackle low success rates, the Commission decided to use two-stage calls more systematically in order to avoid too much time and effort being devoted to losing applications and to increase success rate for more mature projects. However, industry

159 Data from Horizon 2020 Monitoring Report 2015.
points out a number of weaknesses in this scheme: i) preparing a first-stage application also entails a lot of effort, especially for those that are new to the FP; ii) success in the first stage, which is less selective, leads to overly optimistic expectations for the second phase; iii) inconsistencies between stage one and stage two make preparation for the second stage more onerous; and iv) the use of two-stage calls is not appropriate in highly dynamic technologies such as ICT.

2. Evaluation criteria and process

Both industry and research participants have expressed their dissatisfaction with the evaluation process. First, participants have different views concerning the appropriate balance, or relative importance, to be attributed to the three dimensions of excellence, impact and implementation. From an industry perspective, more attention should be paid to the effective commercial exploitation and societal impact of projects. From a research perspective, too much emphasis has already been attached to impact to the detriment of basic research that has, by definition, less defined impacts. Secondly, in less prescriptive calls, participants find it hard to understand what impact evaluation criteria will be applied.

Applicants are also generally dissatisfied with the quality of the evaluation feedback. To reduce evaluation time, especially for close-to-market proposals, the evaluation process was standardized and decentralized as much as possible. This mechanism delivered too short and standardized evaluation reports that do not always provide sufficient elements to understand reasons for exclusion. As a matter of fact, this approach faces a trade-off between rapidity of response and quality of the evaluation feedback that has proved difficult to balance. In addition to this, two more weaknesses were highlighted. First, the overall perception of evaluators, which is admittedly rather subjective, weights too much in attributing the final score without pointing to any specific weakness in the application. Secondly, evaluation panels still lack adequate representativeness of experts from industry, including for evaluating close-to-market proposals, and most evaluators from academia still apply past FP approaches. Securing more and qualified experts from the private sector has been challenging, because of lack of incentives or for reasons related to the workload.

To improve the selection process in relation to the impact criteria, alternative approaches have been suggested. For more advanced and complex projects in phase II, which score above the evaluation threshold, the possibility of having more consensual evaluations based on discussing the intended project outcomes has been put forward by the SME Advisory Group and some industry organizations. For close-to-market innovations, meetings with potential beneficiaries would allow a better appreciation of the managerial qualities of applicants. In collaborative projects that involve SMEs, an interview approach is also suggested in order to better understand the real role of the SME in the consortium.

3. Simplification

Simplification has played a central role in the design of H2020. Access to funding was simplified by applying the same set of rules across the three pillars. The same funding rate

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162 ScienceBusiness (2015b) and DigitalEurope (2016b).
163 BusinessEurope (2016).
164 IDEA League (2016).
for direct and indirect costs applies (i.e. one funding rate per project and indirect costs covered by a single flat-rate to all participants), proposal submission has been fully digitalised and access has been provided through a single Participant Portal. Measures were also taken to reduce the time-to-grant that was a major barrier for industry participation in past FPs. These simplifications were well received by participants as these measures went in the direction of reducing the administrative burden for participants and making application for R&I funding less reliant on bureaucratic checks and more focused on impacts.

A survey undertaken by the EC in 2015 on the impact of simplification on H2020 participants shows that users are generally satisfied with the modifications introduced in H2020. However, a significant minority (20%) still reports that access to funding is easier under other national schemes and both industry and research have put forward suggestions for further simplification. In spite of progress made in streamlining access to H2020 funding, preparing an application still requires considerable efforts (approximately 500-700 hours165). This implies that companies need to have the necessary in-house expertise or hire external consultants. Companies also have to build their own network and find their entry points in Brussels to have a proper understanding of calls. All this disproportionately affects SME and small research center participation.

Cost accounting has also improved under H2020, but for invoicing of internal costs. As compared to FP7, internally invoiced costs have to be verifiable and measurable. Reporting requirements create a parallel system that deviates from standard accounting practices. Both research and industry organizations agree that this procedure represents a heavy additional administrative burden on beneficiaries and that it is also difficult to execute166. However, it is important to notice that this issue is particularly relevant for large companies or research centers that need to get reimbursed for the use of their internal core facilities.

Overall, time-to-grant has improved as compared to FP7. In H2020 the EC committed to keep the time elapsed from the submission deadline to the signature of the grant agreement to a general maximum of 8 months and of 6 months for the FTI. Industrial Leadership has the lowest time-to-grant average period with 93.6% of grants signed within 8 months. ICT is also the area where time-to-grant is closer to the planned targets (95.1%), which reflects the need to kick-start projects in technologies that have a short innovation cycle. By contrast, time to grant in “SME Innovation” (48.7%) is far below the H2020 average167. In multi-partner projects, participants point out that the time allocated to finalize a consortium agreement is sometimes insufficient to account for the complexity of projects’ governance structure and to design and agree on an appropriate IPR regime.

Finally, by bringing under a single umbrella different programmes, H2020 intended to streamline participation. However, the use of too many instruments and the implication of too many implementing bodies can be confusing to potential applicants, as it is not always clear how to identify the best entry point to the programme.

4. IPR regime

In H2020 the rules on intellectual property rights follow those established in the FP7, and also add provisions for open data access and open access to research publications. As a

166 Eurochambres (2016), EARMA (2016).
167 All data from H2020 Monitoring Report.
general principle, H2020 IP rules establish that the ownership of project results is with the beneficiary which generates them. However, in collaborative projects, the model grant agreement creates a default joint ownership regime. When IP rights are jointly owned, all parties have to agree contractually on how these rights are disposed, and this default clause is considered a barrier to entry in collaborative projects by industrial participants\textsuperscript{168}.

Another issue concerning the exploitation of IP rights is related to the affiliate clause, which might exclude access to IP by other entities. This clause is linked to the “in Europe first principle” advocated by the High-Level Group on Key Enabling Technologies in 2011. The principle states that participants in EU funded programmes should demonstrate that they have plans for exploiting the resulting IP within the EU. However, this provision has been opposed by industry, because it discourages participation of companies operating in global environments and integrated in global value chains, as in the ICT sector.

Finally, the existing IPR regime for pre-commercial procurement is also a barrier to private sector participation. Under the current regulation, the procurer has the right to grant access to third parties to exploit the R&D results. However, ownership of IP is critical for innovative enterprises and is a vital asset for start-ups. Participation from these groups in pre-commercial procurement is thus unlikely to improve under the existing regulatory framework\textsuperscript{169}.

5. Open data

Another novelty in H2020 has been the adoption of open research data with the purpose of accelerating innovation and collaboration, improving transparency and avoiding duplication of efforts. The scheme was initially pilot tested in some areas of the programme, including LEIT ICT, and, starting with the 2017 work programme, will be a default setting in all thematic areas with the possibility of opting out (e.g. in case of privacy or IPR concerns). In connection to the open research data approach, beneficiaries are also required to submit a Data Management Plan illustrating how data will be generated, used and stored. In the pilot period, approximately 65% of participants agreed to share their data\textsuperscript{170}. However, industry remains rather cautious on sharing data, especially for close to the market products/services, as this action might undermine competitive advantages. In this respect, participants are in favor of keeping the current regime which considers the possibility of opting out of the scheme, but are concerned that their decision to opt in or out could affect their chances of success\textsuperscript{171}.

II – Achievements and challenges ahead

1. Widening participation

As compared to FP7, H2020 performed better in attracting new entrants, especially from private sector and SMEs. This achievement stems from the new approach pursued by the FP and the use of industry-driven instruments such as the SMEI and the FTI. For instance,
in the SMEI, newcomers accounted to almost 80% of participants. While SME participation targets have been achieved, it is important to notice that the quality of SME participation has also improved, especially because of the use of a dedicated instrument. **SMEs appreciate being able to apply for funding outside large consortia and of having a direct relationship with the implementing agency**, which also allows SMEs to modify their projects if market conditions have substantially changed. Support received during project implementation, such as three-day coaching provided by the Enterprise Europe Network, is also deemed useful by participating SMEs.

### Box 1. Examples of successful innovations supported by the SMEI

In 2014, eVision (https://www.evision-software.com/about/), a Dutch company specialized in control of work software, received EUR 2.3 million from the SMEI (Phase II). The SMEI grant was deployed for developing the company’s flagship product, which consists of software used in high risk industries for reducing fatal accidents. Since receiving financing from H2020, the company experienced double digit growth and created 183 highly qualified jobs in Europe. The company is also active on the global scale with clients on all 5 continents, and recently established offices operating in UE, Qatar, UAE and North America.

Immunovia (http://immunovia.com) is a Swedish SME founded in 2007 to develop products that allow deciphering information in blood to diagnose complex diseases. In 2015, Immunovia was awarded a EUR 4.2 million grant from the SMEI (phase II) to develop a clinical validation of a serum protein biomarker signature for the early diagnosis of pancreatic cancer. Currently, this is the only blood-based test available for early detection of pancreatic cancer when the disease is still curable. H2020 financial support was decisive in building confidence for attracting further private investments. In December 2015 Immunovia was listed in the Nasdaq First North and it has recently announced its plan for applying for listing on Nasdaq Stockholm’s Main Market.

**Source:** EASME

Although SME participation has greatly improved in H2020, **the implementation of the Industrial Leadership pillar and SMEI have showed some weaknesses.**

- **The composition of the SMEI project portfolio raises some concerns.** Up till now, the programme has mostly included well established very small companies that already benefited from other funding, while the SMEI outreach to highly dynamic start-up companies has been less satisfactory. Nearly 80% of beneficiaries require additional efforts in the medium and long term to reach the market, and, under these circumstances, there is high risk of not seeing realised the expected market outcomes.

- **At this stage of the programme implementation it is difficult to fully assess the role of SMEs in collaborative projects.** As compared to large companies, SMEs have benefited less from other innovation support programmes, such as PPPs. In FP7, participation in these industry-led consortia varied. In H2020, PPPs, have gained more prominence, but the role of SMEs has remained unchanged, as there is no specific framework to channel and structure their participation in these fora where the interests of either academia or big companies remain dominant.

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172 Data from H2020 Monitoring Report.

Although nearly 50% of the SMEI applications do not meet the quality threshold, plenty of them score above that threshold, but cannot access funding. In the long run, a too low success rate might discourage participation. This can occur in countries that have very low success rates, but also in countries where national funding is available and more accessible. The large success of the SMEI is also due to the fact that some countries, such as Spain and Italy, have reduced national R&I budgets. As a consequence, H2020 has become the principal source for financing innovative enterprises, rather than being a complement to national initiatives.

To mitigate the effect of low success rates in the SMEI, in October 2015 the Commission launched a new action, the Seal of Excellence. It consists of a certificate awarded to applicants that submitted excellent proposals (i.e. proposals evaluated above the quality threshold), but that could not be funded under the available budget. The seal was intended to be used for submitting unsuccessful but high quality project ideas to alternative funding sources. The action was pilot tested in the SMEI, because of the relevance of SMEs in most national and regional co-funded programme. It is too early to assess the impact of the scheme, as only some pilots have been launched, including Italy (Lombardy and Piedmont regions), Spain and Sweden.

Early perceptions from participants pointed to the high positive potential of the initiative, but also raised some concerns about the effective execution of the scheme, which rests too much on the availability of compatible national programmes. As an example, regional development funds are place-based and targeted to local entities only, which might result in substantial modifications of the original projects in order to fulfil different award criteria. Initially, there were also cases in which participants got the wrong idea that the seal would have guaranteed them alternative funding for their project in the same manner as a voucher does.

The Phase III of the SMEI, which is designed to support commercialization by increasing access to risk finance or providing brokerage services, has not yet started.

Finally, at this stage of the programme implementation, it is not possible to assess the overall effectiveness of the different support measures that are supported by the Innovation in SME work programme. As compared to the SMEI, the impact of these actions is indirect and takes a longer time to materialize. However, an analysis of the work programme showed that the budget of the programme is dispersed on many objectives and activities that risk to dilute final impacts on the SME support ecosystem. Furthermore, there is little continuity between the 2014-2015 and the 2016-2017 work programmes.

The target of achieving a more geographically balanced distribution of H2020 funds has not been achieved yet, but this is somehow beyond the scope of the FP. Funding in H2020 is allocated on the basis of a very competitive selection and there are no pre-allocated country quotas. As in FP7, the geographical distribution of funds remains uneven, being higher in countries where the innovation ecosystems perform better or where national systems are more effective in filtering applications and supporting applicants.

Finally, participation from scientists in academia has declined as compared to FP7. Within the current programme structure, keeping research organization interest in applying for calls under Industrial Leadership and societal challenge is more difficult, especially when calls are focused on high TRLs.

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2. Collaborative projects

Overall, participants, from industry and research alike, consider the possibility of participating in collaborative projects a value added of Horizon 2020 as compared to national R&I programmes. Participation in H2020 is seen as a driver of internationalization, especially by SMEs, which, beside the SMEI, can also participate in collaborative projects through IA and RIA thematic calls (Box 2).

Box 2. Collaborative projects with SME participants.

**Innovative action supporting projects for the creative industries led by SMEs.** Starting from January 2015, the Call for IA to support ICT innovative Creative Industries SMEs financed 15 projects in different domains, including broadcasting and film production, gaming, fashion, e-publishing, furniture design and music for a total EU funding of EUR 14 million. The calls aimed at supporting the development of products, tools, applications and services with high commercial potential in consortia made up of SMEs, IT providers and research centers.

The *SniffPhone project* aims at developing a small plug-in module for a smart phone that can detect disease from exhaled breath. The project involves a large EU industrial partner (Siemens), four SMEs from different EU countries, two technical research centers and two universities. The project is an example of a complex multinational consortium leveraging participant knowledge in different areas, such as nano-materials and electronics, and addressing the entire innovation cycle up to market exploration.

*Source: DG CNET*

In the Industrial Leadership priority, collaboration between research and industry relies on the presence of medium level TRLs, where synergies between fundamental research and ready-to-the-market technologies can be leveraged. Nevertheless, collaboration between industry and research has to cope with the coexistence of different objectives, time horizons and mindsets in business and academia. Furthermore, building collaborative projects in H2020 has brought about new challenges because of the larger emphasis on innovation and industrial outcomes and the lack of past experience, especially with participants from academia, in properly addressing these dimensions. This makes a successful participation in Industrial Leadership calls very much dependent on the quality of collaboration between industry and research.

Collaboration between research and innovation is also framed in Joint Technology Initiatives and PPPs, which have a prominent role in the Industrial Leadership work programme and contributed to increase participation from the private sector (Table 8).

**Participation in ICT-related PPPs (EC contributions by type of organization).**

<table>
<thead>
<tr>
<th>PPP name</th>
<th>Private sector</th>
<th>Academia</th>
<th>Public sector</th>
<th>Research organization</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factories of the Future</td>
<td>56% (24% SMEs)</td>
<td>19%</td>
<td>0%</td>
<td>24%</td>
<td>1%</td>
</tr>
<tr>
<td>5G</td>
<td>63% (16% SMEs)</td>
<td>21%</td>
<td>0%</td>
<td>16%</td>
<td>0%</td>
</tr>
<tr>
<td>Big Data</td>
<td>47%</td>
<td>24%</td>
<td>2%</td>
<td>24%</td>
<td>3%</td>
</tr>
<tr>
<td>Photonics</td>
<td>46%</td>
<td>24%</td>
<td>4%</td>
<td>24%</td>
<td>2%</td>
</tr>
<tr>
<td>Robotics</td>
<td>24%</td>
<td>47%</td>
<td>1%</td>
<td>27%</td>
<td>1%</td>
</tr>
</tbody>
</table>

*Source: DG CNET*
With respect to calls for projects, projects undertaken under the PPPs are better integrated and coordinated and respond to a number of specific and clear objectives. The global approach pursued in PPPs means it is possible to overcome fragmentation that is brought about by the use of two-year work programmes. In the ICT sector, PPPs are also useful instruments for integrating ICTs in value chains of other industries. As an example, both 5G and Big Data PPPs envisage creating better conditions for integrating ICT in healthcare.

Although the experience of PPPs is generally reported to be positive, experience varies across different PPPs\textsuperscript{175}. Underfunding and oversubscription is largely reported to be a major issue in PPP or JTI calls (e.g. ECSEL). In some PPPs, collaboration between small and big partners is weak. As compared to large companies, SMEs have less resources with which to engage in PPPs and their participation needs to be aggregated through associations that, in turn, need to see their role better structured. Issues of lack of transparency have also been raised by research participants. Under these circumstances, the oversight role of the relevant Commission services is important for ensuring that PPPs are not driven by the interest of few groups.

H2020 also supports the establishment of Knowledge and Innovation Communities (KICs) that facilitate collaboration between research, industry and research centres. EIT Digital addresses the ICT sector, while e-health sector has been integrated in the EIT Health. Nevertheless, participation in EIT calls has been constrained by the mismatch between the low level of available budgets and the work required for preparing proposals and reporting\textsuperscript{176}.

3. Industrial outcomes in LEIT

At this stage of the programme implementation, it is too early to assess outcomes, especially in terms of bridging the gap between basic research and market development. While the LEIT work programme is well designed to deliver modern technologies, the upscaling of these new products and services in the mass market remains a challenge. To have a large impact on markets and standards of living, these enabling technologies need a pull effect for scaling up applications quickly\textsuperscript{177}. To achieve this dual push-pull effect, resources and instruments available under H2020 are not sufficient, but synergies within the programme components and instruments have been envisaged to maximise these effects.

FP7 experience shows that a programme/project approach alone is not effective in addressing barriers to use and in meeting demand for new products and services. In this respect, H2020 has developed a more effective approach that is built upon the combined use of roadmap-based R&I activities and small scale projects and the setting up of complementarities between the Industrial Leadership and the Societal Challenges pillar. The use of the bottom up approach has also been employed more systematically to explore unexpected development paths.

However, all these features of the programme are geared towards pushing innovations to the market, while the use of pull instruments is more limited. To effectively deliver market impacts there are two main areas that require further attention, namely: the capacity to aggregate a mass of early adopters, and the ability to better tackle barriers to use. Use of

\textsuperscript{175} ISE and EuroScience (2016), LERU (2016) and BusinessEurope (2016).

\textsuperscript{176} ECA (2016), IDEA League (2016) and ISE and EuroScience (2016).

\textsuperscript{177} CAF – CONNECT Advisory Forum (2016).
user driven approaches has not progressed much in Industrial Leadership, in spite of the focus on higher TRLs. A larger involvement of user communities along the model of Open Innovation 2.0. will serve the purpose of maximizing societal outcomes by integrating in projects the entire strategic value chain from product/service developers to final users.

**Box 3. Connecting Industrial Leadership and Societal Challenges, the example of the Future of Internet PPP.**

The Future of Internet PPP was established in 2011 in FP7 to develop platform technologies and was concluded in September 2016. The PPP was led by industry and based on the involvement of end users through a three-phase programme framework. The first and second phases aimed at establishing the technological foundation by creating and testing reference software architectures (FIWARE) in different domains, including e-health, smart energy, personal mobility and manufacturing. The third phase was directed at SMEs and start-ups through the establishment of 16 FIWARE accelerator programmes supporting the development of innovative applications based on the reference architectures developed in phase I and II and addressing societal challenges. An example of these accelerator programmes is the Challenge eHealth (FICHe), which challenged SMEs and start-ups to develop innovative applications in the eHealth domain. Eleven success stories can be identified out of the initial 80 participants. These include:

- AlzhUp, a social-health service aiming to delay cognitive impairment and help active ageing;
- HealthApp, a start-up creating m-health services for improving communication between patients and caretakers in long-term and chronic diseases;
- Umanick Identity for Health, a provider of services for accurate patient identification preventing errors in therapy provision, drug administration and fraud; and
- OurPath, a 6-week comprehensive programme to gain control over behaviours, diet, and lifestyle that impact on the possibility of developing type 2 diabetes.

*Source: www.fiware.org*

**For technologies with less mature markets that are highly oriented towards serving institutional clients, market pull from the public sector is key to develop a critical level of demand.** In Europe, because of differences in national procurement systems and language barriers, some of these markets, in spite of their high growth potential, remain fragmented and there are fewer possibilities for European champions to emerge. An example of this is the market of services and applications based on satellite data that is often constrained within national boundaries and lack of a strong pull effect of aggregated public demand at the European level. Similarly, in ICT for health, the role of public procurement is key for the scaling up and market uptake of innovations in the single market.

Such support has been provided since FP7 and CIP in two ways: Public Procurement of Innovative (PPI) solutions for ready-to-use innovations; and Pre-Commercial Procurement (PCP) for technologies that need to be further developed. FP7 and H2020 have supported a total of 26 PPIs and PCPs in the ICT domain (14 related to ICT for health) in which public procurers from different EU countries carried out either PPI or PCP projects. **Results from PCP implementation in FP7** (12 calls with 77 contracts awarded and 130 companies or universities involved) identified substantial achievements as compared to the case in national public procurement. In PCPs, nearly 73% of contracts went to SMEs and 29% of contracts were awarded to bidders from a different nationality to that of the buyers. In national public procurement, the same figures are 29% and 1,26% respectively. Budget

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savings are also significant and up to a 50% cost reduction can be achieved as compared to R&I actions. Data also show that the presence of procurers, as well as their participation, has been more limited in the EU-13\(^79\). Participants agree that the use of these instruments is useful to create a European market for innovations, but awareness and effective use of these instruments remain low.

**Box 4. The use of demand-driven instruments in the LEIT ICT work programme – the case of public procurement.**

*Helix Nebula* is the Science Cloud coordinated by CERN and involving other 11 partners from science and research across Europe. The project has a strong expected impact on the use of Open Data.

*Anti-Superbugs* aims at identifying industry solutions for detecting resistant microorganisms and giving real-time feedback to users and share the information with the healthcare provider electronic record systems.

*SELECT for Cities* addresses the Internet of Everything within the context of developing smart cities. The purpose of this PCP is to foster the idea of cities as a large Internet of Everything by supporting the development of platforms for IoE applications and services.

Source: DG CNET and Cordis

Another important area that would create larger markets is the removal of barriers, such as regulatory constraints or resistance to change, that impede a quick diffusion of technologies on a large scale. The use of ETPs and EIT in identifying opportunities and obstacles for using new enabling technologies has not been extended yet to all thematic areas. The role of these platforms is key to establish a link with markets and users, address resistance to change, regulatory issues and assess compatibility with existing industrial processes and standards. As an example, an area where this type of work is expected to deliver substantial benefit is e-health, where market uptake has been progressing unevenly, because of the lack of appropriate policies that allow up-scaling of implementation and integrating e-health technologies systematically in national healthcare systems.

4. Complementarities and synergies with national programme and structural funds

The European Structural and Investment Funds (ESIF) attach great importance to promoting R&I. In the past programming period 2007-2013, Cohesion Policy allocated EUR 86.4 billion, or nearly 25% of the total allocation, to the innovation ecosystem. This commitment has been even reinforced in the current programming period 2014-2020, where 30% of the total allocations have been earmarked for R&I purposes\(^{180}\). Overall, ESI funds address large disparities between EU Member States and regions in the fields of R&I, which directly affect participation outcomes and success rates in Horizon 2020. In the light of a large unmet demand for H2020 funding, *complementarities and synergies with national programmes and structural funds have gained more prominence.*

Although the EC has promoted the combined use of H2020 and ESI funds, *participants remain skeptical about this possibility, because the two programmes differ significantly*\(^{179}\).  

\(^{179}\) Lieve Bos DG CONNECT F2 unit (“Innovation”). Update on first results from ongoing PCP projects.

in their strategy and implementation modalities. Moreover, within Member States, knowledge about the two funds is rarely combined within the same organizations. Generally, competences in ESI fund management are often decentralized in regional levels, whereas H2020 national contact points are centrally managed. While the combined use of the two funds is not developing as expected, Member States are gradually setting up national or regional schemes that allow using ESI funds to support high quality projects, especially for SMEs, that cannot be financed by H2020. However, it is important to notice that this approach only provides a partial solution to addressing low success rates, because many high-quality proposals are submitted by enterprises located in industrialized and competitive regions that get a lower share of ESI funds.

Box 5. Country examples of complementarities between national/regional funds and H2020.

**Italy.** Applications that were awarded the Seal of Excellence in the SMEI (Phase II) automatically receive the highest technical score in specific calls of the National Operational Programme 2014-2020, which supports R&D projects in southern Italy regions. In Lombardy region, SMEs who received the Seal of Excellence can receive up to EUR 30,000 under the regional R&I call to prepare an application for the phase II of SMEI\(^{181}\).

**Czech Republic.** The South Moravian region launched the SME Instrument Brno to assist companies (up to EUR 50,000) that received the Seal of Excellence in the Phase I of the SMEI for market validation\(^{182}\).

**Hungary.** The Hungarian National Research, Development and Innovation Office published a call aiming to support proposals awarded the Seal of Excellence in the phase I of the SMEI. The grants are set to support feasibility studies for participating in Phase II of the SMEI\(^{183}\).

5. International cooperation

FP7 had a specific scheme for international cooperation, while H2020 has pursued a different approach that is based on mainstreamed international cooperation in different parts of the work programme. Specific targets for international collaboration are thus set in thematic specific work programmes. Participation from third countries is either encouraged in coordinated calls with third country governments or in regular calls. In ICT, international cooperation is highly valued and the approach developed is geared towards implementing strategic partnerships that pursue two different objectives: supporting the adoption of European technological platforms in emerging economies and partnering with technology leaders for developing the next generation of products.

As compared to FP7, H2020 has increased the number of topics that are relevant for international cooperation from 12% to over 27%. However, this increased openness has not yet translated into higher participation from international partners. Since 2014, participation from third non-associated countries has fallen from 4.9% to 2.4%\(^{184}\). In parallel with this, the budget invested by international partners has also declined from EUR 60 million to EUR 29 million a year (EC, 2016b). The fall in international collaboration is partly due to changed funding rules for some countries, but it has also been influenced by H2020


\(^{183}\) https://ec.europa.eu/research/regions/index.cfm?pg=soe_cases

\(^{184}\) University World News (2016).
increased focus on close-to-market activities. As an example, the LEIT NMBP work programme raises concerns related to safeguarding interests of EU’s companies in close-to-market projects. Industry participants also advocate reciprocal access to the research programmes of third countries participating in H2020.

**Chapter V. Conclusions**

- **With its strong focus on research and innovation and widened participation, H2020 has been a game changer as compared to past FPs.** The Industrial Leadership work programme has a strong focus on exploitable innovations and is built on instruments that seek to ensure the largest possible participation from the private sector, including SMEs. However, scalability of innovations to achieve commercialization objectives remains an open question that rests on conditions that are beyond the scope and the core budget of H2020. Concerning the programme attractiveness, it is important to notice that certain categories of potential applicants, especially innovative start-ups that follow quick development cycles, are less interested in participating.

- **The Industrial Leadership work programme relevance is appreciated by participants, especially by industry.** The LEIT ICT work programmes aim at strengthening areas where European industry has consolidated positions, but also at supporting European technological leadership in new areas, such as Big Data. In ICT for health, H2020 supports the development of a digital single market for e-health and addresses the challenge of providing quality healthcare in ageing societies, which are two key priority areas for European healthcare systems.

- **Oversubscription** is a critical issue in Industrial Leadership and SMEI and might lead to declining participation rates, especially from the most qualified researchers and innovators. The existing implementation framework, both at the European and national level, is currently ineffective in filtering applications at their early stage. Thematic calls that pursue a bottom-up approach are more quickly oversubscribed.

- **Success rates in H2020 vary greatly across the different part of the programme.** Two major patterns have emerged, namely: i) a geographical distribution of funding that reflects the different performances of the R&I ecosystems of Member States, and ii) a distribution of funding per category of applicants that sees higher success rates for RTOs than for other categories of applicants, implying that success in FP calls still rests on specific skills and familiarity with the programme’s implementation framework. Another area of concern is that too many high-quality proposals are not funded and that success rates remain low even in two-stage call application processes.

- **Evaluation Process.** The quality of the evaluation feedback emerges as a major weakness in SMEI and Industrial Leadership. Participants are dissatisfied with the quality of evaluation reports as these do not contain enough elements to understand reasons for exclusion. Moreover, in Industrial Leadership the composition of evaluation panels still sees the preponderance of scientists that are less prepared to assess market outcomes.
- **Collaborative projects.** Industrial and research participants highly value being involved in multi-national partnerships. This is perceived as a strong value added of the FP as compared to national R&I programmes. However, managing of large consortia is still perceived to be too burdensome by industry participants. Joint participation of business and academia has improved as compared to the past, but has still to cope with differences in approaching R&D projects, which rest on a different working culture and on the pursuing of diverse objectives.

- **International collaboration has progressed less than expected.** This is due to changes in funding rules concerning participation of third countries, but also to the increased emphasis on market exploitation of technologies developed under H2020.
Chapter VI. Recommendations

- **Approach.** H2020 should continue making progress in combining FP7 heavily technocentric approach with further innovation-related activities.

- **Oversubscription.** Applicants should be made better aware of the criteria used for assessing quality of proposals. In this respect, the role of NCPs could become key to redirect applications that are not Horizon-ready to other sources of funding. At the same time, more guidance is needed from the EC in order to carry out effective pre-application assessments at the national level.

- **Participation.** Openness and flexibility in call design is appreciated by participants, but to further facilitate participation from industry, linkages to industrial research topics should be more clear and specific. This approach will help industry participants better assess if their projects fulfill the call requirements and could also help reduce oversubscription.

- **Evaluation process.** Perception of fairness in the evaluation process is key to keep participation high. Evaluator panels for high TRL calls should have a balanced composition of business and academia representatives to select proposals that have a high scientific and technological quality, but that are also more likely to transit fast to markets.

- **The IPR regime.** Participation from industry, especially in high TRL levels, should be encouraged by removing barriers in the existing IP regime that do not follow market principles. Similarly, open data should not be made a compulsory requirement for participation.

- **Simplification.** To keep participation in H2020 as open as possible, especially from business and SMEs, H2020 should continue pursuing minimal bureaucratic complexity and reduce administrative costs for applicants.

- **Impact.** In order to keep its focus on R&I impacts, the FP should continue supporting close-to-market initiatives and further enhance the use of market pull mechanisms. Within the limit of H2020 budget and scope, targeted initiatives that drive a European demand for innovative services and products should be promoted more effectively. For high TRLs in the ICT sector, the development of user driven approaches should be encouraged to verify the actual scalability and possible penetration in mass markets. In ICT, including ICT for health, the regulatory aspects, as long as privacy and ethical concerns, should be integrated in work programmes and projects as these represents future barriers in large-scale commercialization.

- **Synergies.** ESI Funds and Horizon are well designed to complement each other, but the co-funding of projects is not recommended because of the different rules that guide the implementation of each fund. In particular, this is seen as a source of additional complexity. ESI Funds have rather a key role to play in supporting participation in Horizon 2020 from countries with a below-average innovation performance. Operationally, this can be achieved by better connecting NCPs to ESIF managing authorities and by including Horizon 2020 actors in the RIS3 strategy design process.
Annex A – References


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Annex B – List of people interviewed

<table>
<thead>
<tr>
<th>Category of stakeholder</th>
<th>Name of respondent</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>European or national Institutions</td>
<td>Antonio Carbone</td>
<td>National Contact Point ICT-SME Italy/APRE</td>
</tr>
<tr>
<td>European or national Institutions</td>
<td>Bernd Reichert</td>
<td>EASME (Head of Unit A2)</td>
</tr>
<tr>
<td>European or national Institutions</td>
<td>Claire Ferté</td>
<td>National Contact Point ICT France / Business France</td>
</tr>
<tr>
<td>European or national Institutions</td>
<td>Lucia Russo</td>
<td>EC, DG CNET (F.4 – Digital Economy &amp; Skills)</td>
</tr>
<tr>
<td>European or national Institutions</td>
<td>Gerard Kennedy</td>
<td>National Contact Point ICT Ireland /Enterprise Ireland</td>
</tr>
<tr>
<td>European or national Institutions</td>
<td>Agnes Divinyi</td>
<td>National Contact Point SME Hungary</td>
</tr>
<tr>
<td>European or national Institutions</td>
<td>Sylvie Bove</td>
<td>EIT Health</td>
</tr>
<tr>
<td>Academia</td>
<td>Olivier Kuttel</td>
<td>Ecole Polytechnique Federale Lausanne/CESAER</td>
</tr>
<tr>
<td>Academia</td>
<td>Geleyn R. Meijer</td>
<td>Amsterdam University of Applied Sciences</td>
</tr>
<tr>
<td>Research and technology organisation</td>
<td>Ole Madsen</td>
<td>Alexandra Institute</td>
</tr>
<tr>
<td>Research and technology organisation</td>
<td>Talita Soares</td>
<td>EARTO</td>
</tr>
<tr>
<td>Business</td>
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</tr>
<tr>
<td>Business</td>
<td>Sebastiano Toffaletti</td>
<td>SME Digital Alliance</td>
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<td>Annika Erbstein</td>
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<td>Gerhard Huemer</td>
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<tr>
<td>Business</td>
<td>Christopher Gosau</td>
<td>Association of German Chambers of Commerce and Industry (DIHK)</td>
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</tbody>
</table>
ANNEX IV

THE IMPLEMENTATION OF HORIZON 2020
- INDUSTRIAL LEADERSHIP -

Economic and financial perspective

Briefing paper
by Europe Economics

Abstract

This report is an evaluation of H2020 funding, from an economic and financial perspective, of the Industrial Leadership pillar. The pillar seeks to accelerate the development of the technologies and innovations that will support the businesses of the future, and help innovative European SMEs to develop into world-leading companies.

Horizon 2020 is received positively by different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions by some of our interviewees. There is a good cooperation between institutions to get funding. Cross border cooperation is high in LEIT calls but more limited in the case of InnSME. The participation of non-EU countries is low but this is because at times such participation is not well defined in the objectives of the programmes.

Our main conclusions show some concerning issues around the problem definition, envisaged impacts of the interventions, ex-post monitoring and evaluation of the projects, budgets and the problem of oversubscription, and evaluation of proposals. We also show our conclusions in relation to cross-country cooperation, the synergies with other programmes and the simplification of the regulations. Recommendations are provided to correct for such problems.
AUTHOR
This study has been written by Dr Pau Salsas, Kareen El Beyrouty, Summayah Leghari (Europe Economics) and Jacqueline Snijders (Panteia) at the request of the Impact Assessment Unit of the Directorate for Impact Assessment and European Added Value, within the Directorate General for Parliamentary Research Services (DG EPRS) of the General Secretariat of the European Parliament.

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Manuscript completed in January 2017
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Executive summary

This report is an evaluation of H2020 funding, from an economic and financial perspective, of the Industrial Leadership pillar. The pillar seeks to accelerate the development of the technologies and innovations that will support the businesses of the future, and help innovative European SMEs to develop into world-leading companies. This paper focusses on two areas of Industrial Leadership: LEIT (which also includes NMPB, ICT, and Space) and Innovation in SMEs.

Methodology

We have used the following tools of analysis throughout the study: Data analysis using financial and programmatic data from CORDIS; Information and budgetary data from H2020 Work Programmes; Stakeholder interviews; Case studies; and Desk research.

The current study has been undertaken with limited time and resources and does not aim at a comprehensive evaluation. Our findings have been based on the judgement to inform a high level opinion of the implementation of the programme.

Main Findings and Conclusions

Horizon 2020 is received positively by different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions by some of our interviewees.

There is a good cooperation between institutions to get funding. Cross border cooperation is high in LEIT calls but more limited in the case of InnSME. The participation of non-EU countries is low but this is because at times such participation is not well defined in the objectives of the programmes.

The impacts of the different projects are difficult to measure. This is not only because of the early stage of the evaluation but also because of the difficulty to assess the impacts in terms of the programme objectives (boost EU economy, create jobs and improve lives).

The Work Programmes provide in the introduction, for the different topics and calls, a good description of the specific challenge to be tackled, together with the scope and expected impact. However, it is difficult to identify from this description the rationale for the funding in each case. In this respect, stakeholders seem to find some lack of clarity in the link between the rationale and the impacts and objectives to be achieved.

This leads to a situation where stakeholders may interpret the challenges and objectives in a different way. As a result, we have seen that stakeholders believe that the design of the programme is currently benefiting some type of market players more than others.

The Work Programmes provide some guidelines on the expected impacts of the different calls. However, such indicators are difficult to measure in many cases and there is no indication on how these can be used to estimate social benefits which are not accrued privately (impacts should relate to the effects of externalities or underinvestment that materialises in the form of “spill-over” effects to other members of society).

Stakeholders have also expressed concerns about the monitoring of project outputs and there are also some critical views about the dissemination of the results. There are different opinions asking for more guidelines on how to measure the impacts of the projects and calls, and for a more active dissemination of the results.

As with other parts of H2020, there is high oversubscription of some of the calls. However, we believe that this could be seen as an achievement of the programme in attracting interest from researchers and enterprises (a consequence of achieving excellent research). But low
success rates may discourage some stakeholders and this has encouraged views that advocate for an increase in the available budgets. However, if budgets are to be increased, this may be done selectively by choosing those areas where impacts are expected to be higher.

There are some concerns about the evaluation of proposals and this constitutes an important point that needs correction. This has also implications on the Seal of Excellence (if seen as a “quality stamp”, this should rely in a trusted evaluation process).

Some stakeholders expressed dissatisfaction with the fact that some of the research is consistently being awarded to Member States with certain research capacity or industrial structure. To some extent this is understandable if H2020 is to follow the principles of excellent research. However, the principles of H2020 are also to remove barriers to innovation and make innovations that are beneficial to both the public and private sectors. This second objective could be clarified (or corrected making better use of the dissemination of the findings and discoveries).

We have seen that there are some overlaps with programmes in other areas and other EU-funded programmes. Some stakeholders mentioned that H2020 is overloaded with too many policy objectives which makes it hard to find synergies and complementarities.

Recommendations

Recommendation 1: The strategy for each of the calls under the programme should be more developed. This should take into account issues such as the problem definition (market failure to be corrected for, social impact, externalities and “spill-overs”, as identified in the impact assessment), envisaged impacts of the call and expected ex-post metrics for measurement of outcomes and impacts (the principles and tools for better regulation established by the Commission could be used when defining the guidelines).

Recommendation 2: Assess size and scope of the calls using the evidence provided in Recommendation 1. Given the assessment it may be possible to rank the different calls and prioritise the funding for those that yield higher return to society.

Recommendation 3: There should be a close monitoring of project outputs. The outputs should take into account metrics developed as part of Recommendation 1 but should also design a strategy for dissemination of results. The dissemination objectives of H2020 should aim at removing barriers to innovation and make innovations that are beneficial to both the public and private sectors.

Recommendation 4: Improve quality control mechanisms for the evaluation process of applications. Options could include establishing consensus for the approach to be used in the evaluation of calls or train the evaluators.

Recommendation 5: Clarify the policy objectives of H2020 such that it is focussed on excellence and leadership at the European level. Delimit clearly the scope of the programme such that it is easy to link to other programmes without overlapping in the objectives.

Recommendation 6: The Commission may think about improving further the process in relation to reporting of costs and reducing further the burden for SME.
Chapter 1 – Introduction

The objective of this briefing paper is to assess, from an economic and financial perspective, the implementation of the Horizon 2020 framework programme as regards the priority “Industrial Leadership”. The paper is part of three evaluation studies (the other two being the assessment of “Excellent Science” and “Societal Challenges” priorities) which have been undertaken in parallel to this research.

In this chapter, we present a brief introduction to Horizon 2020 (H2020) and describe the Industrial Leadership section of Horizon 2020, along with the methodological tools we have employed in our investigation on the progress of Horizon 2020 from a financial and economic perspective.

I – Introduction to the programme

The general purpose of Horizon 2020 is to “take great ideas from the lab to the market”. It is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe’s global competitiveness.185

Horizon 2020 has broken down its focus into three main pillars:

- excellent science to strengthen the Union’s world-class scientific excellence and make the Union’s research and innovation system more competitive;
- fostering industrial leadership to speed up the development of technologies that will support businesses and innovation, including for small companies; and
- tackling societal challenges to respond to the priorities identified in the Europe 2020 strategy.

In addition, there are three horizontal programmes (“Spreading excellence and widening participation”, “Science with and for society”, and “Fast Track to Innovation Pilot”) and three smaller blocks (“EIT - European Institute of Innovation and Technology”, “Euratom”, and “Smart Cyber-Physical Systems”). There are also three separate cross-cutting calls: Industry 2020 in the Circular Economy, Internet of Things, and Smart and Sustainable Cities.

The objectives of Horizon 2020 can be summarised in the following high-level goals:

- More breakthroughs, discoveries and world-firsts: The programme aims to deliver radical technological change, not changes by small increments.
- Driving economic growth and creating jobs: Economic impacts of the project are expected to affect two areas — GDP growth and job creation.
- Smart, sustainable and inclusive growth and jobs: The programme is expected to produce a certain type of GDP growth and jobs.
- Produce world-class science: research produced should rank in the top internationally.

---

185 FP7 was the European Union’s Research and Innovation funding programme for projects which started in the time period 2007-2013. Horizon 2020 is the sequel of this programme and covers projects initiated between 2014 and 2020. The focus and the budget of FP7 and Horizon 2020, however, differ. FP7 focused on research only, while Horizon 2020 focuses on both research and innovation. Moreover, FP7 had a budget of €55 billion compared to around €79 billion for Horizon 2020.
- Remove barriers to innovation: Projects funded should have positive externalities for other potential innovations.
- Facilitate public-private cooperation in delivering innovation: it should create partnerships or lead to innovations that are beneficial to both the public and private sectors.

In this briefing paper we focus specifically on the Industrial Leadership section of Horizon 2020. It seeks to accelerate the development of the technologies and innovations that will support the businesses of the future, and help innovative European SMEs to develop into world-leading companies. The section contains three areas:

- Leadership in enabling and industrial technologies (LEIT) which consists of three subcomponents:
  - Nanotechnologies, Advanced Materials, Advanced Manufacturing and Processing, and Biotechnology (NMPB);
  - Information and Communication Technologies (ICT); and
  - Space.
- Access to risk finance; and
- Innovation in SMEs.

Following the terms of reference, this paper focuses on two areas of Industrial Leadership: LEIT (which also includes NMPB, ICT, and Space) and Innovation in SMEs.

II – Methodology

We have used the following tools of analysis throughout the study:

- Data analysis using financial and programmatic data from CORDIS;
- Information and budgetary data from H2020 Work Programmes;
- Stakeholder interviews;
- Case studies; and
- Desk research.

Details on the methodology are provided in the annex.

III – Structure of the document

The current study has been undertaken together with a parallel evaluation of two other priorities (“Excellent Science” and “Societal Challenges”), but this report represents a complete evaluation of the Industrial Leadership pillar, presenting the evidence from data, desk research, interviews and case studies, and our recommendations for potential improvements that could be made for the Industrial Leadership pillar.

The structure of the study is the following:

- Chapter 2: Implementation of the programme (contains the progress made in the spending against the budgets and analysis of the partnerships and cross-border cooperation of the different projects);

- Chapter 3: Evidence from Industrial Leadership covering desk research, interviews and case studies;
- Chapter 4: Conclusions and recommendations based on a review of the evidence in previous chapters and our economic analysis and judgement of the different results.

**IV – Limitations of the study**

The extension and complexities of H2020 make its evaluation a challenging task. The current study has been undertaken with limited time and resources and does not aim at a comprehensive evaluation of all the aspects of the programme.

The scope of the study is to provide a briefing paper assessing, from an economic and financial perspective, the implementation of H2020. We have used evidence from desk research and in-depth interviews. Our findings have been based on the judgement of what we consider most relevant to inform a high level opinion of the implementation of the programme. Our conclusions exclude views and arguments which are hard to prove or contain minor details on its functions which would not allow a high-level critical review of the programme.
Chapter 2 – Implementation of the programme

In this chapter we analyse indicators which compare the indicative and realised budget (by Call, Topic and type of actions and type of funding). We also analyse the partnerships and cross-border cooperation of the different projects.

I – Comparison of indicative and realised budgets

To assess the progress in the implementation of the programme, we analyse the spending in comparison with the actual budgets allocated in the Work Programmes. This is shown using the metrics of total spending, total allocated budget, and the share of the budget spent. For description purposes we also report the number of projects and average size in the two different focus areas of “Leadership in Enabling and Industrial Technologies” (LEIT) and “Innovation in SMEs” (InnSME).

The initial budgets (as reported in the Work Programmes) were allocated unevenly across the two focus areas: LEIT had an allocation of around €1.6bn and €1.7bn for 2014 and 2015 respectively whereas InnSME had about one fifth of this amount (around €289 and €275 million) in 2014 and 2015 respectively, see Table 1.187

The spending for LEIT and InnSME is also rather proportionate to the budgets and hence the spending in LEIT is around 5 times the spending in InnSME. This implies that projects in LEIT and InnSME are more or less in line with their budgets. The only exception is spending on LEIT in 2014 which is around 18% higher than the budget.

More than 1,200 projects have been funded in 2014 and 2015 (see Table 1). Most of these projects were in InnSME despite it having a significantly smaller budget. The average size of the projects was around €3 million for LEIT but for InnSME the average size was significantly smaller around €0.3 million.

Table 1: Details of projects granted under Industrial Leadership (2014-2015)

<table>
<thead>
<tr>
<th>Area</th>
<th>Spending(^{188}), €m</th>
<th>Budget, €m</th>
<th>Share, %</th>
<th>Number of projects</th>
<th>Average size, €m</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEIT</td>
<td>1,850</td>
<td>1,655</td>
<td>1,566</td>
<td>1,693</td>
<td>118</td>
</tr>
<tr>
<td>Inn-SME</td>
<td>291</td>
<td>289</td>
<td>289</td>
<td>275</td>
<td>101</td>
</tr>
<tr>
<td>Total</td>
<td>2,141</td>
<td>1,944</td>
<td>1,855</td>
<td>1,968</td>
<td>115</td>
</tr>
</tbody>
</table>


187 These budget values for InnSME are slightly different from the ones reported in the Monitoring report 2016. The Monitoring report only gives the budget for SME-instruments. The budgets for SME-instruments only are €255 and €270 million in 2014 and 2015 respectively. Similarly, the Monitoring report does not report budgets for calls such as EUJ and EUB and includes a budget for ECSEL (not mentioned in the Work Programme) which leads to the differing budget numbers for LEIT (€1,450 and €1,540 in 2014 and 2015 respectively).

188 The spending for LEIT and InnSME is different from the Monitoring report as the Monitoring report does not account for the spending in ECSEL (which is part of LEIT but does not have budget
In the next tables, we further breakdown the budgets and funding in these two focus areas by Call type and Topics.

- Calls refer to the different programmes being undertaken in the main focus areas.
- Topics describe the different projects (within Calls) being undertaken to achieve the main objectives of the focus areas.

The analysis of expenditure and budgets has been done using CORDIS data (aggregated at Call and Topic levels) and compared with the budgets provided in the Work Programmes. When doing so, we found that some of the Calls referred to in CORDIS did not match any of the Calls in the Work Programmes (for example, projects referred to as “Adhoc” in CORDIS). In some instances, we also found that some of the budgets contained in the Work Programme were not matched by projects from CORDIS (this refers to the “Other actions” in the Work Programmes). For the remaining Calls, it was possible to establish a link between the spending and the allocated budgets in the Work Programmes.

The results are presented in

**Table**. For most of the Calls, there is a good balance between the spending and budget amounts (reaching a share of 100%). However, there are some exceptions:

- Some Calls are over-spent by more than 20%: ICT (122% in 2014), LEIT: Innovation in SME’s (367% and 349% in 2014 and 2015 respectively) and INNOSUP (414% in 2015).
- Some Calls are being under-spent by more than 20%: SCC (80% in 2014) and INT (75% in 2014).

It is also worth noting that the highest spending is in Call ICT (€0.8 billion and €0.6 billion or around 37% and 30% of total budget in 2014 and 2015 respectively). This is followed by FoF (12% and 19% of total budget in 2014 and 2015 respectively). ICT refers to Information and Communication Technologies and FoF refers to Factories of the Future.

**Table 2: Spending, budgets and shares by Call (2014-2015)**

<table>
<thead>
<tr>
<th>Area</th>
<th>Calls</th>
<th>Spending, €m</th>
<th>Budget, €m</th>
<th>Share, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEIT</td>
<td>Adhoc</td>
<td>24</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LEIT</td>
<td>ECSEL</td>
<td>154</td>
<td>142</td>
<td>-</td>
</tr>
<tr>
<td>LEIT</td>
<td>EUB</td>
<td>-</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>LEIT</td>
<td>EUJ</td>
<td>6</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>LEIT</td>
<td>ICT</td>
<td>800</td>
<td>574</td>
<td>659</td>
</tr>
<tr>
<td>LEIT</td>
<td>COMPET</td>
<td>57</td>
<td>35</td>
<td>49</td>
</tr>
<tr>
<td>LEIT</td>
<td>EO</td>
<td>24</td>
<td>24</td>
<td>22</td>
</tr>
</tbody>
</table>

given in the work programme) and also some other calls such as EUB and EUJ in LEIT. Moreover, it only reports spending on SME-instrument for InnSME. The number of projects also differ for the same reason.
<table>
<thead>
<tr>
<th>LEIT</th>
<th>EeB</th>
<th>49</th>
<th>64</th>
<th>50</th>
<th>62</th>
<th>99</th>
<th>103</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEIT</td>
<td>FoF</td>
<td>265</td>
<td>362</td>
<td>275</td>
<td>353</td>
<td>96</td>
<td>102</td>
</tr>
<tr>
<td>LEIT</td>
<td>Galileo</td>
<td>40</td>
<td>25</td>
<td>48</td>
<td>30</td>
<td>84</td>
<td>83</td>
</tr>
<tr>
<td>LEIT</td>
<td>LEIT_BIO</td>
<td>52</td>
<td>33</td>
<td>48</td>
<td>29</td>
<td>108</td>
<td>114</td>
</tr>
<tr>
<td>LEIT</td>
<td>NMBP</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LEIT</td>
<td>NMP</td>
<td>211</td>
<td>227</td>
<td>209</td>
<td>228</td>
<td>101</td>
<td>99</td>
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<tr>
<td>LEIT</td>
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<td>9</td>
<td>7</td>
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<tr>
<td>LEIT</td>
<td>SILC</td>
<td>13</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LEIT</td>
<td>SPIRE</td>
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<td>73</td>
<td>60</td>
<td>75</td>
<td>105</td>
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<tr>
<td>LEIT</td>
<td>OA</td>
<td>-</td>
<td>-</td>
<td>110</td>
<td>145</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LEIT Innovation in SMEs**</td>
<td>80</td>
<td>83</td>
<td>22</td>
<td>24</td>
<td>367</td>
<td>349</td>
<td></td>
</tr>
<tr>
<td>SME</td>
<td>Adhoc</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SME</td>
<td>EEN</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SME</td>
<td>INNOSUP</td>
<td>10</td>
<td>21</td>
<td>10</td>
<td>5</td>
<td>107</td>
<td>414</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>SME</td>
<td>SMEINST</td>
<td>255</td>
<td>268</td>
<td>253</td>
<td>260</td>
<td>101</td>
<td>103</td>
</tr>
<tr>
<td>SME</td>
<td>OA</td>
<td>-</td>
<td>-</td>
<td>27</td>
<td>10</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,141</td>
<td>1,944</td>
<td>1,855</td>
<td>1,968</td>
<td>115</td>
<td>99</td>
<td></td>
</tr>
</tbody>
</table>

Note: * Other actions include budgets in the Work Programme that could not be matched to the projects in the CORDIS database. These primarily consist of public procurement, expert evaluation, subscription etc. **Innovation in SMEs refers to projects that are funded by Leadership in enabling and industrial technologies but awarded and managed under Work Programme Industrial Leadership: Innovation in SMEs.

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Leadership in enabling and industrial technologies. CORDIS data refers to data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.

All the Calls under the three focus areas are funded by different funding schemes. In the table below, we breakdown the spending on projects in Industrial Leadership by different types of actions (funding schemes). Around 75% of the funding is provided under the IA (Innovation Action) and RIA (Research and Innovation Action) funding schemes as can be seen from the shares of total spending. This is followed by SME (Small Medium-sized Enterprises) which consists of around 16% and 5% of total funding in 2014 and 2015 respectively.

Funding schemes categorised as “Other” consist of ERA-NET-Cofund, and Cofund-PCP.\(^\text{189}\)

- ERA-NET refers to the funding of costs related to the coordination of national research programmes, 100% reimbursement rate for coordination and management costs.
- COFUND-PCP refers to pre-commercial procurement funded through programme COFUND grant.

As seen from the table, very small percentage (only 2% in 2015) of funds is coming from these two type of actions (funding schemes).

\(^\text{189}\) Cofund means an action funded through a grant whose main purpose is to supplement the funding of individual calls or programmes which are funded by entities managing research and innovation programmes, not including the Union funding bodies.
Table 3: Spending by type of action (2014-2015)

<table>
<thead>
<tr>
<th>Funding scheme</th>
<th>Spending 2014, % of total</th>
<th>Spending 2015, % of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSA</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>RIA</td>
<td>49</td>
<td>53</td>
</tr>
<tr>
<td>IA</td>
<td>25</td>
<td>37</td>
</tr>
<tr>
<td>SME</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Other*</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: Other includes ERA-NET-Cofund, and COFUND-PCP.

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Leadership in enabling and industrial technologies. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.

II – Partnerships and Cross-border cooperation

Transnational co-operation between MS and/or between MS and non-European countries is a condition for participating in the programme, and this is reflected in the analysis for country participation.

In the table below, we show the spending on different focus areas between different groups of participating institutions. We constructed the groups based on the number of participating institutions in each project such that projects consisting of between 1 and 4 participating institutions were grouped together under one group. Similarly, projects between 5 and 9 participating institutions were grouped together under group 5-9 and so on.

We then summed the total spending on projects within these groups and calculated the share of total spending as shown in Table below. For instance, projects consisting of between 1 and 4 participating institutions in LEIT have a total spending of €268m which is 7% of total spending in Industrial Leadership in 2014 and 2015.

The highest amount of money is spent on projects which have between 5 to 9 participating institutions (60%). Overall, 79% of total spending is on projects with 5 or more institutions.

Table 4: Spending by groups of institutions, €m, and % of total spending (2014-2015)

<table>
<thead>
<tr>
<th>Focus area</th>
<th>1-4</th>
<th>5-9</th>
<th>&gt;=10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEIT</td>
<td>268 (7%)</td>
<td>2,186 (59%)</td>
<td>689 (19%)</td>
<td>3,143 (84%)</td>
</tr>
<tr>
<td>InnSME</td>
<td>539 (14%)</td>
<td>38 (1%)</td>
<td>2 (0%)</td>
<td>581 (16%)</td>
</tr>
<tr>
<td>Total</td>
<td>807 (22%)</td>
<td>2,224 (60%)</td>
<td>691 (19%)</td>
<td>3,724 (100%)</td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Leadership in enabling and industrial technologies. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.

In Table 5, we show the spending by number of participating countries. For each project, we calculated the number of different countries participating in the project. The projects
are then divided into groups consisting of 1-4, 5-9 and 10 or more EU participating countries (a separate group is used to contain projects with any partner from outside the EU).

The total spending on projects in these groups is calculated, together with the share of the total Industrial Leadership spending. For instance, projects in LEIT which consist of 1-4 EU participating States had a spending of €1bn in 2014 and 2015, which was 28% of total spending in Societal Challenges (Table 5).

The data shows significant cross-country cooperation in the projects: 53% of the spending is on projects with 5-9 participating EU Member (overall, 57% of total spending is on projects with more than 5 EU Member States). The share of non-EU participating countries is low: non-EU participate in €42 million worth of projects (a 1% of total Industrial Leadership amount spent).

**Table 5: Spending by Non EU and different group of EU countries, €m, and % of total spending (2014-2015)**

<table>
<thead>
<tr>
<th>Focus area</th>
<th>Non EU</th>
<th>EU 1-4</th>
<th>EU 5-9</th>
<th>EU &gt;=10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEIT</td>
<td>11 (0.3%)</td>
<td>1,031 (28%)</td>
<td>1,951 (52%)</td>
<td>149 (4%)</td>
<td>3,143 (84%)</td>
</tr>
<tr>
<td>InnSME</td>
<td>31 (0.8%)</td>
<td>528 (14%)</td>
<td>18 (0.5%)</td>
<td>3 (0.1%)</td>
<td>581 (16%)</td>
</tr>
<tr>
<td>Total</td>
<td>42 (1%)</td>
<td>1,559 (42%)</td>
<td>1,970 (53%)</td>
<td>152 (4%)</td>
<td>3,724 (100%)</td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations of signed grants based on CORDIS database and Work Programme 2014-2015: Leadership in enabling and industrial technologies. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.
Chapter 3 – Evidence Industrial Leadership: interviews and case study

This chapter discusses the evidence gathered on the Industrial Leadership pillar of Horizon 2020 via interviews, case studies, and reviews of stakeholder documents.

I - Objectives

It is believed that Horizon 2020 is a step forward in its shift of focus on innovation. The H2020 is aiming to tackle the paradox where Europe is a centre of knowledge creation, but not on gaining public and economic value through innovation (research is not followed by production in Europe but rather elsewhere resulting in little economic impact, no job creation and increasing dependence on importing key enabling technologies and products from outside Europe, such as the US or Japan).

However, interviewees have identified three issues which affect the achievement of the objectives:

- The industrial cycle;
- The bottom-up/top-down approach;
- The Level of technological innovation (TRL).

The industrial cycle

There are differences in the industries and the business cycles in which they operate. Some industries can offer returns in the short-term (ICT and technology start-ups have short product cycles, reasonable investment needs, short payback times) but other sectors may require 10 years of investment before seeing some results (manufacturing and technologies require larger and long-term investment, long term planning and developments, long-payback times and long-term investor confidence). Hence, there is a perception that some sectors may be negatively discriminated simply because of the cycle length in which they operate.

The financial support should also be extended (especially in the case of SME). According to one interviewee some sectors meet better the H2020 objectives of sustainable development but may not see the results materialised if the funding is not continued.

The bottom-up/top-down approach

The currently applied bottom-up approach (initiatives originated from the researching end) is good for research and inventions, but innovation projects are much broader and need consumer and investor confidence. There is need for top-down planning on the political side to build confidence in the reliability of Europe all of which might help bring other types of investment (private or national support schemes) into priority areas. The level of political leadership must be greater in driving the R&I vision of where Europe wants to be in ten years.\(^{190}\)

\(^{190}\) In other countries (the US, China and Japan) the innovation committees are chaired by political leaders.
The Level of technological innovation (TRL)

In the Industrial Leadership area, the participation and cooperation of Member States is influenced by the different preferences over high versus low Technology Readiness Levels (TRL) projects among other factors.

Hence, the degree of industry development in some new Member States may determine their participation in some programmes: some Member States favour the lower-TRL projects that are broader and can be carried out across many Member States, rather than high-TRL projects that require an established industry to carry out (this is commonly found in the space industry). This leads to a conflict of interest in the way the programme is structured, with one stakeholder saying there is not enough emphasis on high TRL projects to achieve the objective of a more competitive space industry.

II - Impacts

The impacts of the programme are very difficult to measure. First and foremost, the programme is at its early stages which makes it difficult to try to quantify the outcomes of different projects (even more to assess the impacts in terms of growth and jobs). In addition, some of these projects will take time to materialise in the form of the envisaged impacts (in some cases it may be 10 years or longer).

In addition, the high-level indicators of the programme are seen as too generic (distribution of funds among Member States, publications, patents, gender equality, or SME participation). While interviewees agree that in general indicators are transparent and easy-to-measure it is also understood that they do not properly represent the outcomes of the different programmes.

Another interviewee believes that the indicators may be good for measuring research programmes but the impacts should be better delimited for innovation projects. Other views also mention that employment and growth may be very difficult to measure as it may arise only after some years. In the case of SME it may be even more complicated if some of these companies have disappeared after some years (something common if they are operating in innovative environments).

Finally, the objectives of the programme may be related to the ability to find market opportunities and describe competitors, and some impacts may need to be related to social, as well as economic objectives.

The evidence from the three case studies confirms the difficulties in measuring any impacts related to jobs and economic growth. Although the respondents explain the need to provide measures of impacts (as established in their grant contract) it has become clear that the measurement of impacts is very different across projects.

- Some of the early qualitative effects provided have been related to creation of knowledge of technologies and higher engagement of the industry.

- There are also impacts related to: bringing together cross border, multinational teams, in order to create more ICT entrepreneurs; policy recommendations (for the improvement in European cohesion in relation to research and the formation of enterprises); and removing the geographical barriers and allowing ICT entrepreneurs to think as a ‘European entrepreneur’.

- Other impacts relate to improving development services by learning from other agencies participating and indirect impacts through support (participants in the project learn from each other, from other innovation agencies, from other business
environment institutions, and they can get new experiences and develop new instruments and carry out services more efficiently).

As a result some stakeholders believed that there is need for guidelines on how to measure and report the impact of the programme. Criteria are needed for the measurement of the implementation upfront and ex-post output evaluation to be able to assess the economic impacts for innovation-related areas. The Expert Advisory group for Innovation in SME also stresses the importance of a process of evaluation of outcomes and recommends the measurement of the impact of the scheme as one of the key priorities of the Commission for the upcoming mid-term assessment. Part of the concern stems from the fact that proposals are becoming very professionalised and may be overly optimistic in what is being promised in comparison to what is feasible to be achieved.

One option could be to request an “opportunity business plan” as part of application for evaluation and selection. Projects which relate to implementation of innovations, should present a “business plan” that describes, for example, up-front impact assessment, cross-border cooperation, adding value along the local supply chain, or dissemination once successful. Another option suggested has been to develop benchmarking tools within the programme between Europe and the rest of the world (not only between different EU Member States).

The different Work Programmes envisage expected impacts for each of the actions and the Monitoring Report 2015 documents on the different dissemination and communication activities of the different areas. The interviews for the three case studies indicate that monitoring does take place and a lot of data is collected on a variety of different items (intentionality, competencies, marketing skills, internationalisation) showing before-and-after improvements. It is however, difficult to monitor them beyond the project due to a lack of resources.

However, in some of the interviews with stakeholders we have been told that the dissemination of the results can be improved: at the moment, when the project is over and the funding stops, the work stops and there is only a workshop/website at the end of the project, the results are poorly executed and only in a small number of cases data have been collected for research in the way described in theory. The focus should therefore be on a structural active dissemination of the results, according to one interviewee. Such evaluation and selection criteria can be added and enforced (for example retaining a share of funding and paying only after one year of finalisation of the project). An additional option could be to include value-chain partners in the project or at least in the project governance. For example, both clients and suppliers could be included as part of the consortia/advisory panel for the project.

III - Structure of the programme

Oversubscription remains a core issue in the Industrial Leadership pillar, as with the other two pillars. This has implications in the funding available for researchers.

- Stakeholders stress that there are a lot of topics and too little funding at the same time. In particular, this discourages industry from applying. Some stakeholders

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191 Interviewees from other areas of H2020 have informed us about the proliferation of specialised “grant-writing agencies” which would prepare bids in exchange of a management fee.

192 In some cases the information may be confidential if the project has been co-funded privately.
recommend decreasing the number of topics released and have larger awards, especially to try to shift to higher TRL projects, which require more funding.

- Stakeholders appear very concerned about the oversubscription and consequential low success rates in many parts of Horizon 2020. One of the reasons mentioned is the lower national funding available for research and innovation which may have contributed to higher subscription in some of the topics (and therefore are contributing to the low success rates).

- Interestingly, the Expert Advisory Group for Innovation in SMEs acknowledges that the budget allocation should not be entirely demand-driven (demand will always be higher than the amount of grants). It recommends, however, some flexibility in the budget allocation to avoid too much variation in the thresholds between themes.

The different type calls can also be subject to criticism. In some cases respondents express concerns that they cover one type of action which may benefit some sectors in particular (and not others):

- Some stakeholders note that some of the tools (“Fast Track to Innovation”) are designed to support certain type of projects. This is a tool that is good for innovation projects with market potential but it is unsuitable for industries without mass production and narrow markets (like space). The cycle dimension (in space it takes a long time to progress through the TRLs to get to market) means that no space proposals have won Fast Track to Innovation funding in the past two years.

- The programme targets low TRLs hence many projects with low budget. The aim should be at changing the focus (to high TRLs) with more budget per project. The priority is making better use of existing resources which is significant (it has been mentioned that some MS would oppose high TRL as it requires funding established industries, whereas low TRL would cover a broader range of activities and more MS).

Another concern was raised in the evaluation process with respect to high scoring proposals that are not initially funded due to the unavailability of budget. At the moment the Commission considers all of those together to decide which ones get funded out of re-allocated H2020 budgets, however, an Advisory Group stakeholder recommended that the programme committees do this instead.

Moreover, industry representatives are not represented at group meetings, which is seen as crucial for supporting competitiveness (according to one interviewee). Furthermore, funding goes to national research institutes which lack focus on industry.

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193 The sheer magnitude of the oversubscription can be appreciated by the EC’s calculation that an additional €41.6 billion would have been needed to fund the remaining high quality proposals that were not awarded funding. EC 2016 “Horizon 2020 Monitoring Report 2015”.

IV - Synergies with other programmes

The European Commission and the Member States are mandated to ensure coordination, synergies and complementarities of the different EU funds.\textsuperscript{194} In order to do so, the Commission specifically set up a website and handbook in order to guide and support the creation of synergies between European Structural and Investment Funds (ESIF), Horizon 2020 and other related EU programmes, showing examples of good practices.\textsuperscript{195} In their guidance, the EC identified five different typologies of synergies.\textsuperscript{196}

As a result, there is some general support that H2020 generates synergies with national programmes: an EC-commissioned survey of National Contact Points (NCPs) found that more than three-quarters of respondents either agreed or strongly agreed that H2020 adds value to national programmes in supporting cross-border R&I.\textsuperscript{197} Moreover, the broader spectrum of projects from research all the way to innovation funded in H2020 (as opposed to FP7 which only focused on research), allows for more synergies (according to one interviewee).

The different sources of evidence showed the following:

- In the Space Programme, the H2020 Advisory Group for Space recommends the formulation of the Work Programme to explicitly link Space to other work areas/sectors in order to strengthen European competitiveness with an interdisciplinary approach and state-of-the-art technologies.\textsuperscript{198} The Advisory Group also felt that synergies could be increased with more cooperation between the European Space Agency and the EU and that there was scope to further align with national research priorities and foster greater cross-country cooperation in the development of national research programmes.\textsuperscript{199}

- In the SME area, there are two slightly conflicting viewpoints. One is that national funding and selection mechanisms are necessary conditions for applying to the European funding. This means that some applicants go through their national programme first for lower amounts before applying for H2020 funding. In this view, the complementarity of the EU and national programmes is designed ex ante. But the SME programme has also received some criticisms on the grounds of duplication and redundancies. Phase 1 funding is a level of funding that is already available from national financial instruments in many Member States that have

\textsuperscript{194} This is established in the regulations that lay down the rules for the European Structural and Investment Funds, (ESIF), Horizon 2020, and other EU programmes directly managed by the Commission in the areas of research, innovation and competitiveness (in particular COSME, Erasmus+, Creative Europe, European Union Programme for Employment and Social Innovation, EaSI, and the digital services part of the Connecting Europe Facility). See “Enabling synergies between European Structural application: and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes Guidance for policy-makers and implementing bodies”.

\textsuperscript{195} See https://ec.europa.eu/research/regions/index.cfm?pg=synergies.

\textsuperscript{196} See https://ec.europa.eu/research/regions/index.cfm?pg=synergies.

\textsuperscript{197} EC (2016) “Horizon 2020 Monitoring Report 2015”.

\textsuperscript{198} HORIZON 2020 Space Advisory Group (July 2014) “Advice on potential priorities for research and innovation in the work programme 2016-2017”.

\textsuperscript{199} HORIZON 2020 Space Advisory Group (July 2014) “Advice on potential priorities for research and innovation in the work programme 2016-2017”.
good SME funding programmes.\footnote{In some cases, SMEs that apply at the European level at Phase 1 have good-quality applications that demonstrate that they already have had access to some form of financing.} Better co-ordination is needed in this respect. The recommendation by one interviewee was to concentrate Phase 1 funding more in countries with less national funding.

- In \textbf{Industrial Leadership} programmes many interviewees pointed out at an overlap of goals and topic, or even poor co-ordination, between H2020 and other EU-funded programmes (the Structural funds, ERDF) as well as between H2020 and national programmes. One potential reason is that the H2020 programme is overloaded with objectives which can be taken care of under other programmes.

- Another interviewee also mentions that the amount of funding is not used very well: there are unnecessary overlaps between programmes and their specific focus is not clear enough to attract investments and industrial cooperation.

One specific mechanism implemented to maximise synergies has been the Seal of Excellence: a seal or mark that is used as a signal of a high quality proposal which applicants can use to obtain funding from other sources. So far, this has been piloted for the SME Instrument within Industrial Leadership only.\footnote{See \url{https://ec.europa.eu/research/regions/index.cfm?pg=soe_what}}

The Seal of Excellence introduced as part of H2020 received mixed views in our stakeholder interviews. While some interviewees regarded it as a useful tool that would help good applicants search funding elsewhere, e.g. other EU funds or national funding programmes, other interviewees noted that the Seal might not be useful as “H2020 might be the only programme that provides funding for a given topic”. The strongest criticism comes from the Expert Advisory Group for Innovation in SMEs who states that the “quality stamp” of applications require that the quality of the evaluation process is trusted. At the moment the advisory group sees some weaknesses in the evaluation process. This is related to the technical experience and background of independent evaluators but more importantly to the overly optimistic proposals being submitted which may not reflect a feasible realisation of outcomes.

The main conclusion from the interviews is that the role of H2020 has to be more clearly defined vis-a-vis other programmes such as MS funding, structural and regional funds, SME programmes, and different EU Commission programs. The H2020 programme appears to be politically overloaded, with project developing too many policy objectives (at the same time serve policy goals like gender, societal challenges, industrial contribution, innovation divide East-West.). It has been suggested that the specific targets and roles of the multitude of EU and MS programs are clearly defined. For example, differentiating clearly the structural funds (which can set levelling the innovation divide as a priority) from SME programs (which specifically deal with start-ups regardless of their location). In this regard, H2020 should focus on issues at the European level to provide EU added value, and not search to simply fund projects in single member states.

There are too many different political based criteria that each project must fulfil at same time to be accepted. Giving a clearer dedicated policy focus on each of the multitude of EU programmes would improve the complementarity of the innovation landscape and thus improve confidence and understanding of stakeholders.
V – Cross-country cooperation

H2020 is good at bringing EU cross-border cooperation according to stakeholders. In addition, while MS programmes traditionally still focus on research, Horizon 2020 presents an opportunity to Research and Innovation (R&I) including other Member States.

While stakeholders from other areas of Horizon 2020 generally encouraged greater non-EU participation in the programme, stakeholders in Industrial Leadership were less receptive to this. They explained that the Industrial Leadership programme aims, among other things, to improve Europe’s security of supply. Hence, the participation of non-EU partners may detract from this objective.

VI – Regulation/simplification

Horizon 2020 introduced a radical simplification of the architecture, rules, procedures and control strategy of the programme. This was done in an effort to make the funding programme more attractive and easier to navigate. The ultimate objective was to make the programme more attractive to the top researchers and innovative enterprises. There were three specific dimensions of simplification (related to the structure, the funding rules and the strategy for control) and various other simplifications made.202

The evidence we reviewed showed that the simplifications made were a very positive step forward (especially in relation to FP7). An online survey undertaken after the first 20 months of Horizon 2020 found broad agreement among H2020 project participants that the simplification measures introduced were helpful. Most participants (75%) believed that processes in H2020 were simpler than in FP7. The views of experienced participants in relation to the different simplification measures introduced with Horizon 2020 were also very positive in relation to the electronic-only signature of grant agreements, the Participant Portal, the 8-month time-to-grant benchmark, the reduced number of financial statements certificates required and the single flat rate for indirect costs.

The general agreement is that simplification has reduced the administrative requirements for process and control of applicants. However some interviewees expressed a view that such simplifications can be further improved. For example, in relation to reporting the “cost per work package”, “the unit cost per capital”, and “machine hours”. Some interviewees agree that, despite simplification, reporting still requires a “significant amount of time” and “paperwork”, which creates a financial burden, in particular, for SMEs.

One of the major novelties/simplifications relates to the elimination of negotiation. It is agreed that this clearly speeds up the project and minimises the time-to-grant but there are concerns in that there is no room to negotiate the grant and/or adjust the budget. This means that there is less scope for errors: the “application pack has to be of sufficiently high quality to win funding”.

VII – Evidence from case studies

The case studies are helpful to visualise the range of projects funded and the views of respondents on different aspects of the programme.

Ukraine Replication, Awareness and Innovation based on EGNESS (UKRAINE)

This is a Space-funded project (under the Galileo 3 topic) which aims to strengthen Europe’s position in the application of Global Navigation Satellite Systems in the Ukrainian market. It does this by focusing on the necessary legislative framework, technological advances and procedural innovations for Ukraine and by linking relevant companies in the Ukraine with companies in EU Member States.

Cross-border cooperation is mandated for H2020 applicants and this is seen as very positive because it widens the networks of participants. Another obligation imposed on the funded entities is a set of outputs agreed to in the contract. These are related to qualitative impacts such as the creation of a procedure for adoption of the technology in the Ukraine aviation sector and the identification of 2-3 airports in the country willing to undertake this. In addition, the project achieved higher industry engagement overall on the technologies. There are no quantitative impacts such as jobs or growth, as it is understood that these would take another 2-3 years after the completion of the project and are, in any case, difficult to measure.

The project management and monitoring requirements are perceived as cumbersome. They are experienced in project managing and reporting for EU-funded projects so it is feasible on their part but they acknowledge it would be difficult for the average SME.

The project coordinator, a newcomer to EU R&I funding schemes, found the funding application process fairly straightforward. However, one of the partners made an error in the application form which could not be amended (this is because new regulations do not allow changes to a project once it has been approved for funding). In this case it did not have severe implications as that partner could find other sources of private funding.

The project coordinator perceives positively the availability of different instruments for different types of projects. In their case the project was appropriately funded through the Innovation Action (IA) scheme, meant for activity closer to the market with higher TRL levels. However, they recognise that identifying the correct instrument may be sometimes difficult for organisations (SMEs) which are not familiar with the sector. One weakness of the funding aspect of H2020 identified, however, for this project is the lack of continuity in calls in different years (there were no Galileo calls in 2016).
FUND raising acCELERATOR for long time-to-market path SMEs

The FUNDCELERATOR project aims at developing a new fund raising support methodology targeting innovative and high-growth potential SMEs operating in markets characterised by long time-to-market paths (typically more than 3 years, such as in biotech, medical devices, materials, clean tech, aeronautics, etc.). Based on their respective experience, knowledge and already developed fund raising support tools and methodologies, the four involved innovation support organisations make use of the “Twinning advanced” methodological approach to collaboratively build and test an improved fund raising acceleration support program dedicated to the target group SMEs, relying also, in a systemic mode, on all the existing fund raising support services provided by other regional private or public stakeholders.

As they were a newcomer to Horizon 2020 projects, the project coordinator noted that they decided to use the services of a consultant to arrange the application and locate potential partners. This cost was borne by the project leader.

Although they were satisfied with the funding allocation for the type of project, there was a difficulty in determining the prior allocation of the budget before the actual allocation of work has been carried out. They felt it should be possible to adapt the allocation based on the work that partners have carried out.

An area of difficulty was finding partners for the project who were interested in the same topics and fields, particularly for newcomers. Due to this, they required the services of a consulting firm. If they did not have the resources to hire this consultant, they would have had difficulties in finding suitable partners. Without the help of the consultant they could have ended up working with second tier partners who are looking for projects, who are not really interested in the topics or preparing a successful project of which the results would also be used in the future work of the participants. Although there are forums and platforms to find partners, it is useful for those who are familiar with European projects but it is very difficult for those new to European projects to understand. The project coordinator also noted that there are relatively short time periods to fill in the documents and it is difficult to prepare them, hence the use of the consultant.
Chapter 4 – Conclusions and Recommendations

In this chapter we show the main findings of the evaluation undertaken and recommendations for its improvement. A summary of the findings is provided in the form of outline based on the desk-based research, interviews and case studies described in the previous chapter. The conclusions and recommendations are based on the list of findings and our economic analysis and judgement of the different results. The reasoning of our analysis is properly described.

I – Findings

The findings evolve around the following topics: the take up (evolution of expenditures), the cross-border objectives, outcomes, impacts, the synergies with other programmes and the regulation/simplification process.

1. Take up (evolution of expenditures)

Programmes are progressing adequately in relation to their envisaged aggregated budgets. However there are disparities when viewed at the Section or Call level:

- In Industrial Leadership, LEIT and InnSME spending is more or less in line with their budgets. LEIT is a bit overfunded in 2014 with a share of 118%. Funding in InnSME has gone slightly beyond 100% (for both 2014 and 2015).
- For most of the Calls, there is a good balance between the spending and budget amounts (reaching a share of 100%). However, there are some exceptions of calls

Young and Innovative: how to help young entrepreneurs be more innovative – a peer learning project (YoungInnovative)

The main objective of this project is to develop recommendations to improve systems supporting innovation among young entrepreneurs, applied by specialised business environment institutions, using the Twinning Advanced method and then to disseminate them in the partners’ regions and countries and other EU Member States.

The project coordinator noted that they are newcomers to Horizon 2020 and in comparison to the application process in Poland, the application process of H2020 is very simple and clear. Everything went very fast and everything was available on the Internet. The financial part was very clear. It is a lump-sum, so they did not have any problems with preparing the budget.

In general they feel that the funding is appropriate. However, if they would like to widen the range of the tasks and to test the findings of the study, the budget should be bigger and the projects should take longer. It was said that the project could only take 7 months, which is too short to test some instruments developed in the project. The mechanism of providing a lump-sum is very good, and is very friendly for newcomers. This should be emphasised to newcomers in order to encourage the use of these types of tools as they are very user friendly.

The strengths of H2020 that they would like to emphasise are the clear procedures and good communication with the project officer. A possible recommendation would be to focus more on preparing the national officers in the national contact points to explain some rules.
spending more than 20% of the budget and calls spending 20% less than the budget. One call INNOSUP is overspent by 414% in 2015.

- All the Calls under the two focus areas are funded by different funding schemes but IA (Innovation Action) and RIA (Research and Innovation Action) predominate (75% of the funding is in those schemes).

2. Cross-border objectives

There is a good cooperation between institutions to get funding (79% of total spending is on projects with 5 or more institutions). Cross border cooperation is high in LEIT calls but more limited in the case of InnSME, which reflects the different cross-border objectives of the calls. In aggregate, 57% of total spending is on projects with more than 5 EU Member States. The participation of non-EU countries is low (1% of total Industrial Leadership amount spent in 2014-2015).

The cross-border cooperation is compromised in situations where the programme aims to improve Europe's security of supply. The participation of non-EU partners may not be achieved but this is because it goes against the objectives of the programmes.

3. Outcomes

The perception among stakeholders is that some projects are not funded because of the different industrial cycles, the bottom-up/top-down approach planning of the initiatives or the level of technological innovation envisaged in the different calls.

There are also different opinions on the structure and type of funding of the topics. In some cases it is believed that funding is too limited and it is recommended to reduce the number of topics and have larger rewards. In other cases the scope of actions is criticised for targeting specific sectors.

Re-allocation of budgets is done by the Commission without consultation of programme committees and this is seen as inefficient allocation of funding as it does not take into account the industry’s views.

Stakeholders are concerned about the funding of some of the calls and the oversubscription in some of these. It is believed that oversubscription can lead to demotivation of excellent researchers. This is because stakeholders take into account the success rates when deciding to apply to different grants.

4. Impacts

The impacts of the different projects are difficult to measure. This is not only because of the early stage of the evaluation but also because of the difficulty to assess the impacts in terms of the programme objectives (boost EU economy, create jobs and improve lives).

Stakeholders are of the opinion that the outcomes are not properly defined when these are referred to innovation. Interviews also revealed that economic impact is not amongst the monitoring criteria. On the other hand, the Monitoring report shows that there are some KPIs aimed at such outcomes:

- In LEIT: “Number of patent applications”, “Number of patents awarded”, “Percentage of participating firms introducing innovation new to the company or to the market” and “Number of joint public-private publications” are mentioned.
- In the Innovation in SMEs the KPI are: “Share of participating SMEs introducing innovations new to the company or the market” and “Growth and job creation in participating SMEs”.
However, we understand from the interviews that these may be a bit too general and may not reflect entirely the scope of the different calls (especially, they do not reflect well outputs related to innovation projects). Evidence from the case studies shows that the envisaged impacts are very different across the three projects.

Additional concerns about the evaluation of the outcomes stem from an increased professionalization of proposals, according to some interviewees. These may be overly optimistic in describing objectives which may be difficult to achieve in practice.

In the Monitoring Report 2015 there is information on different dissemination and communication activities of the different areas. However, some interviewees have mentioned that the efforts for dissemination of the results should be greater, as these can sometimes be limited. According to some interviewees the results are poorly executed and only in a small number of cases data have been collected for research in the way this was envisaged.

5. Synergies with other programmes

There is some support that H2020 generates synergies with national programmes. However, two problems have been identified. First, the Advisory Group for Space mentions that there could be more explicit links with other areas/sectors to strengthen European competitiveness. Secondly, there are overlaps in some of the programme areas and other EU-funded programmes, and the H2020 programme appears to be politically overloaded with too many policy objectives.

The Seal of Excellence received a very critical review by the Expert Advisory Group for Innovation in SMEs: the “quality stamp” needs to be linked to a trusted evaluation process but there are doubts on the quality of the evaluations. This is related to the lack technical experience and the background of independent evaluators but more importantly to the overly optimistic proposals being submitted which may not reflect a feasible realisation of outcomes.

6. Regulation/simplification

There is consensus that the simplifications made have been a very positive step forward. This has been particularly mentioned in relation to improving the understanding of the application process, reducing the time-to-grant, and speeding up the payments made.

Some interviewees expressed a view that such simplifications can be further improved, especially in relation to the reporting requirements of some of the costs.

II – Conclusions

Horizon 2020 is received very positively by the different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions by some of our interviewees.

Our main conclusions show some concerning issues around the problem definition, envisaged impacts of the interventions, ex-post monitoring and evaluation of the projects, budgets and the problem of oversubscription, and evaluation of proposals. We also show our conclusions in relation to cross-country cooperation, the synergies with other programmes and the simplification of the regulations.
Problem definition

Horizon 2020 proposals are accompanied by appropriate impact assessments (SEC(2011) 1427 and SEC(2011) 1428) which provide the intervention logic of the programme. The needs for intervention (and market failures to be addressed) are also extensively described in the impact assessment and in its annex. The Work Programmes provide in the introduction, for the different topics and calls, a good description of the specific challenge to be tackled, together with the scope and expected impact. However, it is difficult to identify from this description the rationale for the funding in each case. In this respect, stakeholders seem to find some lack of clarity in the link between the rationale (identified in the impact assessment) and the impacts and objectives to be achieved (described in the Work Programmes).

According to the Commission’s principles for better regulation, a financial instrument should identify “market imperfections or failures, or sub-optimal investment situations” in order to assess the investment needs. This should be done in view of the policy objectives in mind. Although, some of the principles may be underlying the different identified challenges in the Work Programmes, it is difficult for the reader to relate them to the typical identified policy drivers (common issues identified in this context are: externalities or “spill-overs” when developing new ideas or processes, underinvestment in some markets, lack of funding, …).\textsuperscript{203}

This leads to a situation where stakeholders may interpret the challenges and objectives in a different way. As a result, we have seen that stakeholders believe that the design of the programme is currently benefiting some type of market players more than others, and they voice their views for more support on some type of actions or for grants of certain size. Therefore, a clearer definition of the problem (and objectives to be achieved) for each of the financial instruments would improve the situation.

Envisaged (ex-ante) impacts of the interventions

The Work Programmes provide some guidelines on the expected impacts of the different calls. However, we have identified a few problems with such indicators\textsuperscript{204}.

The indicators reflect well a concept to be achieved, but in many cases these are difficult to measure (effectiveness, productivity gains, …). There is no indication on how additionality should be measured (impacts that would not have occurred in the absence of the intervention) or any costs derived from market distortions or crowding-out of private funding.

Indicators are provided for reporting the benefits of the industry players (increase competitiveness, market share,...) but the real impacts should come from the social benefits which are not accrued privately. In this sense, the impacts should relate to the effects of externalities or underinvestment that materialises in the form of “spill-over” effects to other members of society (agents along the supply chain or in other industries, competitors in other markets, the consumer or the public sector).

There are some KPI indicators provided for the different areas which try to simplify and homogenise the reporting of different areas. However, we have seen that these are not perceived as adequate indicators of innovation by some stakeholders. Furthermore, we

\textsuperscript{203} In addition, interventions should also demonstrate that the market needs cannot be addressed with market-led activities or other types of intervention.

\textsuperscript{204} The impacts envisaged in the Work Programmes are specific for each call and different to the KPI used for monitoring and evaluating the programme objectives.
understand that the ultimate objective of H2020 may be to drive economic growth and create jobs but the different indicators cannot measure this. In fact, the quantification of such impact may be a very difficult matter.

The impact assessment (SEC(2011) 1427) prepared a roadmap after consultation and extensive analysis. However, we have seen that there is a lack of sense of the expected impact of the different projects among some of the interviewed stakeholders: the challenges and the role the programme can play in addressing them. This is problematic because it is difficult to establish agreement on (or a ranking of) the expected impacts of calls and a prioritisation of objectives. This is even more relevant in a context with oversubscription and where stakeholders are declaring a need for more funding, because it is difficult to establish where and how this should be directed to.

The indicators are skewed towards the report of successful outcomes. However, in many instances projects may not deliver according to the expected outcomes and this should also be reported and revealed. This is especially relevant in the context of H2020 that aims at funding projects in a risky environment. In such context, the dissemination of lessons learned, good and bad practices would provide some useful guidelines to the scientific community.

**Ex-post monitoring and evaluation of the projects**

The impacts of the programme are difficult to measure for different reasons. One is because the programme may be at early stages and hence the impacts may not be yet material. But there are also difficulties in trying to quantify the outcomes of different projects, especially if these have to be assessed in terms of economic growth and jobs. Finally, some of the impacts may be difficult to materialise if these arise more in the long run (after some years).

Stakeholders have also expressed concerns about the monitoring of project outputs. As proposals are becoming more professionalised there is a risk of mismatch between what is being promised in comparison to what is finally achieved. There are also some critical views about the dissemination of the results. Some of the people interviewed in the case studies have described the indicators and data requested as part of the monitoring process for each project. However, the views of some stakeholders and the risk of overpromising make this an important issue to be addressed.

The reporting of the outputs is a crucial aspect as it is what provides legitimacy to the whole programme. These should be aligned with the envisaged objectives for every call (as discussed in the previous paragraphs). In general, we have heard different opinions asking for more guidelines on how to measure the impacts of the projects and calls. The suggestions proposed included requesting a “business plan” as part of the evaluation and monitoring process, or include external advisors (who could be stakeholders or part of the value chain) as part of the consortia or advisory panel for the project. There are also suggestions for more active dissemination of the results, which reinforce the idea of a need for more ex-post output evaluation.

In any case, the measurement of the project impacts will always be a very challenging matter. It may be unfeasible to translate the impacts of every call in terms of indicators of growth and jobs, especially if some of the data only becomes available after some years. However, the Commission could develop a methodological approach to assess the impacts of the different projects (for reporting purposes when these are finalised). These would need to be proportional to the sizes and efforts of every project. This analysis should go
beyond the assessment currently being done by the Commission and should stand scrutiny by the scientific community (as to avoid discrepancies in opinions). In this respect, the Commission may want to establish an independent board of experts/evaluators (or industry stakeholders) that assess and judge the outcomes and impacts of the different projects awarded (this could be done in close cooperation with the manager of each project). This should also be made extensive to the dissemination efforts of the different projects. In case of under-reporting or misuse of funds, penalties could be applied (or, as suggested in some interviews, part of the budget could be released only after the results and dissemination have been accomplished).

**Budgets and the problem of oversubscription**

Oversubscription could be seen as an achievement of the programme in attracting interest from researchers and enterprises. The low success rate is a reflection that competition is high and the selection process aims for the best proposals only. In this regard, it is a consequence of the objective of achieving excellent research (along the lines of: discoveries and world-firsts, world-class science, and innovations that are beneficial to both the public and private sectors).

According to interviewees, however, the current process leads to a situation where the results may be seen as a “lottery”. In addition, the low success rates may discourage some stakeholders, as these take into account the success rates of the different areas before deciding to apply to different grants.

The low success rates have encouraged views that advocate for an increase in the available budgets. This is linked to the fact that many of the rejected bids are of a “very good” quality (as assessed in the evaluations of proposals). The opinions suggest that this is evidence that the programme budgets could be increased and achieve efficient outcomes.

However, there are also concerns that some of the proposals may be overly optimistic (overpromising their potential achievement). On the other hand, stakeholders have also acknowledged that allocation should not only be demand-driven (demand will always be larger than the amount of grant).

In the previous paragraphs we have also argued about the need to clearly establish the potential impacts of the different actions and their achievements (strategic priorities). If budgets are to be increased, this may be done selectively by choosing those areas where impacts are expected to be higher. As an alternative (and following the same rationale) it may be efficient to re-allocate some of the budgets between areas in order to achieve allocation efficiency of the programme, before expanding the budgets of some areas.

Our analysis shows that expenditure in the different calls does not follow the allocated budgets. Funding in some calls goes beyond 100% whilst in other is below the budget. We understand that the re-allocation of budgets is done by the Commission. Because of that, some stakeholders have mentioned the need for this to be done in consultation with programme committees. In any case, if programmes can be assessed in terms of the expected impacts (strategic priorities, as suggested above) this could provide some objective guidance on how re-allocation could be done. This could be agreed ex-ante with different advisory groups or programme committees.

Another possibility to deal with oversubscription has also been mentioned. This would be making the calls narrower so that they attract less people. This is something we would not

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recommend if it is aimed only at reducing competition. However, the Commission could take the opportunity to make the calls more demanding in terms of the outputs required in each one. This could also include wider or more intensive dissemination strategies envisaged before the closure of the projects. This would ensure that only the more efficient partners apply to the different bids, and would also ensure that the calls select those projects which better revert back to society the results of the research (in the form of knowledge or “spill-overs”).

Evaluation of proposals

There are some concerns about the evaluation of proposals (in relation to problems of oversubscription) and this constitutes an important point. In procurement markets, losers accept the outcome of buyers but they do so as long as there are reassurances that the selection has been made in a fair and transparent way (this may be especially important in markets where there are established players). The lack of confidence in the evaluation process is a potential weakness and should be corrected by providing more reassurance on the process and outcomes of the evaluation.

The evaluation concerns are even more pronounced because these have implications on the Seal of Excellence. The “quality stamp” is valuable to the extent that it is linked to a trusted evaluation process. The quality of the evaluation is therefore also important to provide credibility to the Seal of Excellence.

Cross-country cooperation

Cross-border comparisons are mainly being reported in terms of the engagement of Member States in the different projects. As a result, there are voices that express dissatisfaction with the fact that some of the research is consistently being awarded to Member States with certain research capacity or industrial structure. It is believed that countries that are not at the research forefront are being discriminated from accessing some funds.

If H2020 is to follow the principles of excellent research it has envisaged (discoveries and world-firsts and world-class science) it is not surprising that the research originates in those centres where it is undertaken more efficiently. This is likely to continue in this way in the next years or it may even tend to a higher concentration if economies of agglomeration are exploited (research tends to be focused around some “clusters” or “networks”). This may be seen as a positive development in terms of allocation efficiency.

However, the principles of H2020 are also to remove barriers to innovation and make innovations that are beneficial to both the public and private sectors. This second objective implies a dissemination of the findings and discoveries which have been granted with public funds. The programme should focus more on this second aspect. By doing so, the projects would need to show that the findings and innovations are being shared in other places (where it may be more efficient to exploit commercially some of the innovations). This would imply “sharing” and “collaborative” approaches which will promote knowledge in areas where there is less active research. If effective and sustained on time this would help reduce the “knowledge gap” between countries at the forefront of research and those catching up (it may also develop into specialisation clusters where, for example, 206

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206 There may be occasions where the results of the project include commercial sensitive information. In such cases it may be important to find a balanced approach in the “sharing” or “collaborative” approach.
research and innovation takes place in some regions but processing and implementation takes place in other areas where it is commercially more efficient to do so).

**Synergies with other programmes**

We have seen that there are some overlaps with some of the programme areas and other EU-funded programmes. Some stakeholders mentioned that H2020 is overloaded with too many policy objectives. This makes it hard to find synergies and complementarities between programmes.

If H2020 is to follow the principles of excellent research it will be difficult to do so attending to alternative objectives (such as regional cohesion). Therefore, there may be limited scope for synergies when pursuing this type of objectives (only as long as other programmes support the same principles for excellence).

However, the synergies with other programmes could be interesting to ensure that the benefits of research revert to a wider scientific community (hence other Member States). In this respect, linking with other programmes could be used to ensure that dissemination objectives are achieved (in cases where there is insufficient budget, or when there are actions that can be aligned to fulfil the objectives of two programmes). At the same time, this implies that in some occasions some objectives may end up being funded by more than one programme, and this has been mentioned as “overlaps” in goals.

Therefore, there seems to be a need for clarifying the scope of the objectives of the different funds and avoid overlaps. It should be clearly stated which objectives are part of H2020 and which objectives belong to other funds. This would also facilitate monitoring of the impacts of each of the funds.

We have also received views that there could be some additional synergies between H2020 areas in order to strengthen competitiveness (especially in the area of space). The extent to such additional complementarities could be studied and developed when designing the different objectives and challenges for each call. It may be beneficial to seek the views of the industry when developing the strategic view of each call.

**Simplification of the regulations**

The simplifications are seen as an achievement of the programme. As always, there are views that express that simplifications can be further improved.

**III - Recommendations**

To correct for the identified problems we would recommend the following.

**Recommendation 1:** The strategy for each of the calls under the programme should be more developed. This should take into account issues such as the problem definition (market failure to be corrected for, social impact, externalities and “spill-overs”, as identified in the impact assessment), envisaged impacts of the call and expected ex-post metrics for measurement of outcomes and impacts (the principles and tools for better regulation established by the Commission could be used when defining the guidelines).

The design of a clear strategy should also envisage some clear objectives for each of the calls. This should include the envisaged impacts under H2020 and potential for including additional impacts from other programmes (not envisaged under H2020 but to be exploited through synergies with other programmes). The clarity of objectives and targets will also help in monitoring or evaluating the projects.
The envisaged project impacts of the calls should take into account the principles of additionality and potential market distortions ("crowding-out" of private funding). Where possible, impacts should be estimated in relation to a counterfactual (control group or situation without the intervention).

Given that data may be scarce or unavailable a methodology or consensus approach should be developed to assess the relevance or expected value added in the different topics. The findings from the impact assessment and data from previous research framework programmes could be used to inform this analysis. Industry stakeholders or external experts could be involved at this stage to reach a consensual view.

**Recommendation 2:** Assess size and scope of the calls using the evidence provided in Recommendation 1. Given the assessment it may be possible to rank the different calls and prioritise the funding for those that yield higher return to society. This may imply reducing the number of topics, or making the topics more general. Given the different priorities it may imply rethinking the grant amounts in each call.

The assessment of the different calls could also provide guidance when re-allocation of funding needs to be done. There could be some guidelines (based on rankings of envisaged impacts) so that the re-allocation is done automatically without further evaluation or judgement.

**Recommendation 3:** There should be a close monitoring of project outputs. The outputs should take into account metrics developed as part of Recommendation 1 but should also design a strategy for dissemination of results. This could include a “business plan” to be developed as part of the project or include external advisors as part of the consortia or advisory panel for the project. The role of the project managers could be considered for contributing to such monitoring tasks.

The dissemination objectives of H2020 should aim at removing barriers to innovation and make innovations that are beneficial to both the public and private sectors. This may include developing new processes in areas where it is more efficient to do so (so that potential “spill-overs” are exploited).

**Recommendation 4:** Improve quality control mechanisms for the evaluation process of applications. Options could include establishing consensus for the approach to be used in the evaluation of calls or train the evaluators. The ultimate objective is to provide reassurance of the expertise of the evaluators.

Because of the complexity of projects, it may be difficult to find capable evaluators, so selection criteria for evaluators (and their rewards) may need to be considered.

This would also help detecting projects which over-estimate objectives set out in the proposals and improve the credibility of the Seal of Excellence.

**Recommendation 5:** Clarify the policy objectives of H2020 such that it is focussed on excellence and leadership at the European level. Delimit clearly the scope of the programme such that it is easy to link to other programmes without overlapping in the objectives. Provide guidance on how should synergies between programmes be achieved.

**Recommendation 6:** The Commission may think about improving further the process in relation to reporting of costs and reducing further the burden for SME.
Annex – Methodological approach

We have used the following tools of analysis throughout the study:

1. Data from CORDIS

The Community Research and Development Information Service (CORDIS) database contains information on all EU-funded research projects and their results. In addition to data on H2020 projects funded, it also has data on FP7, FP6, FP5 and earlier research programmes since 1990.

We have used the latest available CORDIS data (data added on 2015-07-29 and updated on 2016-09-01). Our data analysis concentrates on the Programme, Topic, Call Id, Funding Scheme, Coordinator Country and Participant Country fields to assess the financial progress of the programmes.

2. H2020 Work Programmes

All funding available under Horizon 2020 is set out in multi-annual work programmes formulated by the European Commission in accordance with the Horizon 2020 legislation and EU policy objectives. In the period of our evaluation, there have been two rounds of Work Programmes formulated, 2014-2015 and 2016-2017.

The Work Programme describes the various funding opportunities available in each section of H2020 via calls for proposals that have various topics specified within each call for proposals. In addition, there are some additional funding opportunities via other mechanisms such as public procurements and opportunities where demand for innovative products is first created by governments to bring solutions earlier to the market. Every topic in the Work Programme sets out the challenge the topic intends to address, the range of activities the Commission intends to be carried out under each topic, and the impacts expected from projects. The Work Programme is formulated in consultation with stakeholders, including the Horizon 2020 Advisory Groups for each area.

We have used the Work Programmes to provide background and budgetary information on the range of activities planned. This is in order to compare the expected activity under H2020 as set out in the Work Programme and make a comparison with the actual activity funded as recorded in CORDIS.

3. Stakeholder interviews

We have supplemented our data analysis with stakeholder interviews to qualitatively understand the reasons behind our programme implementation findings and to explore other qualitative questions on the programme’s implementation. These questions cover some measures of success of H2020 (boost the economy, provide jobs, cross-border cooperation, and synergies/complementation with national and EU programmes and policies). They also explore the financial envelope of the programme, the financial incentives provided and monitoring mechanisms, along with the strengths, weaknesses, opportunities and threats of the programme. Persons interviewed broadly fall under four categories:

- DG RTD
- Organisations responsible for H2020 implementation.
- Horizon 2020 Advisory Groups
- National Contact Points
For this briefing paper, we have interviewed nine stakeholders. Three have responsibilities in different advisory groups. One is from an implementing agency and another is an NCP. Another four are from RTD (combined into two interviews). Their details are in the table below:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Agency for Small and Medium-sized Enterprises (EASME)</td>
<td>Bernd Reichert</td>
<td>Head of Unit A2, H2020 SME</td>
</tr>
<tr>
<td>Horizon 2020 Advisory group for Innovation in SMEs</td>
<td>Edwige Avice</td>
<td>Chair</td>
</tr>
<tr>
<td>Horizon 2020 Advisory Group for Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing</td>
<td>Dr Gernot Klotz</td>
<td>Chair</td>
</tr>
<tr>
<td>Horizon 2020 Advisory Group Space</td>
<td>Jean-Jacques Tortora</td>
<td>Former Chair; Director of European Space Policy Institute</td>
</tr>
<tr>
<td>CNES - Centre National d’Études Spatiales</td>
<td>Hélène Bonfils</td>
<td>National Contact Point: France-Space</td>
</tr>
<tr>
<td>DG RTD. Directorate A - Policy Development and Coordination</td>
<td>Kurt Vandenberghe</td>
<td>Director</td>
</tr>
<tr>
<td>DG RTD. Directorate A, Unit A5 - Evaluation</td>
<td>Nelly Bruno</td>
<td>Policy Analyst,</td>
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<tr>
<td>DG RTD. Directorate B - Open innovation and science</td>
<td>Doris Schroecker</td>
<td>Head of Strategy Unit</td>
</tr>
<tr>
<td>DG RTD. Directorate B - Open innovation and science</td>
<td>Nicholas Deliyanakis</td>
<td>Deputy Head of Unit</td>
</tr>
</tbody>
</table>

We thank interviewees for their time and for the contributions made for the study. All contributions have been anonymised.

4. Case studies
The paper will provide three case studies to illustrate some of our findings. The initial selection of the projects studied here have been made after obtaining initial results from our data analysis showing which topics have achieved higher or lower funding rates from that planned in the Work Programmes. Within each of the areas of Industrial Leadership we focus our evaluation on, we selected a topic and a particular project funded within the topic. Our selection was guided by the following principals:

- The project has already started;
- Multiple countries are involved in the project;
- The identity of the coordinator and partners of the project and their experience;
- The project funded is substantial (based on the EU contribution); and
- Sufficient information about the project is available on the website.

Due to time limitations for conducting the study, we complemented our planned selection process with a random selection of some projects. In addition to the desk research conducted online, we interviewed project coordinators on the objectives of the projects and H2020, regulations and simplifications introduced in the programme, financial mechanisms and monitoring, strengths and weaknesses of the programme, and recommendations for future programmes and/or future work programmes.
5. Desk research

Finally, we undertook a review of materials available on the background and implementation of H2020 to inform our analysis. The three main types of documents reviewed include previous reports on H2020 and FP7, its predecessor, reports from Horizon 2020 Expert Advisory Groups, reports from stakeholders who have publically responded to the Commission’s ongoing interim H2020 evaluation online questionnaire, and project specific documentation stored on CORDIS. These sources include the Commission’s Horizon 2020 Monitoring Reports for 2014 and 2015.

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207 The questionnaire closes in January 2017, but some of the respondents have made public their general response to the questions. The link to the questionnaire can be accessed at http://ec.europa.eu/research/consultations/interim_h2020_2016/consultation_en.htm.
ANNEX V

THE IMPLEMENTATION OF HORIZON 2020

- SOCIETAL CHALLENGES -

Research and industry perspective

Briefing paper
by CSES and CSIL

Abstract
This briefing paper reviews the evidence on the involvement of research organisations and industry in the implementation so far of the Horizon 2020 pillar addressing Societal Challenges. With some focus on three particular Societal Challenges, the different approaches of each are highlighted particularly in relation to the key Horizon 2020 objective fostering better exploitation of the industrial potential of research and innovation.
AUTHOR
This study has been written by Mike Coyne from the Centre for Strategy and Evaluation Services, at the request of the Impact Assessment Unit of the Directorate for Impact Assessment and European Added Value, within the Directorate General for Parliamentary Research Services (DG EPRS) of the General Secretariat of the European Parliament.

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### Abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>EAG</td>
<td>Expert Advisory Group</td>
</tr>
<tr>
<td>H2020</td>
<td>Horizon 2020</td>
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<tr>
<td>HES</td>
<td>Secondary and higher education establishments</td>
</tr>
<tr>
<td>OTH</td>
<td>Other entities</td>
</tr>
<tr>
<td>PRC</td>
<td>Private for profit companies</td>
</tr>
<tr>
<td>PUB</td>
<td>Public bodies (excluding research and education)</td>
</tr>
<tr>
<td>REC</td>
<td>Research organisations (excluding education)</td>
</tr>
<tr>
<td>SC(1,3,6)</td>
<td>Societal Challenges identified by number in Horizon 2020</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium-sized Enterprise</td>
</tr>
<tr>
<td>SSH</td>
<td>Social Sciences and Humanities</td>
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</tbody>
</table>
Executive summary

Among the key new features of Horizon 2020 were the emphasis on fostering a better exploitation of the industrial potential of research and innovation, the inclusion of addressing Societal Challenges as one of the three pillars of the Programme and the emphasis on encouraging a better interaction between research and industry. This briefing paper examines how this interaction is progressing in the Societal Challenges part of Horizon 2020.

While there is reference to the research and industry aspects of the Societal Challenges in general, particular attention will be paid to three areas:

- Health, demographic changes and wellbeing,
- Secure, clean and efficient energy,
- Europe in a changing world - inclusive, innovative and reflective societies.

The methodological approach for the briefing involved an initial review of policy documents, position papers and published data, followed by investigations of data available through the Monitoring Reports and Cordis and interviews with people responsible for implementing H2020 and with experts involved in the Expert Advisory Groups.

Overview of Implementation

The objectives of this pillar are first summarised, especially the three Societal Challenges under particular consideration.

Horizon 2020 has just completed its third year. The number of projects and funding for each Challenge so far are given, to provide some basic information that is to be considered in greater detail in other briefings. Of greater relevance to this particular briefing are the participation rates of different kinds of organisation. Here distinct differences between Challenges in participation of Private for profit companies is observed. This ranges from 55.3% in Smart, green and integrated transport (SC4) and 44.0% in Secure, clean and efficient energy (SC3), well above the H2020 average, to 27.2% in Health, demographic change and wellbeing (SC1) and 17.9% in Europe in a changing world (SC6). Even among the lower private sector participation rates, however, there have been improvements since FP7. There is considerably less variation in the participation rates of SMEs, which vary from 28.4% in the case of Secure, clean and efficient energy (SC3) to 21.3% for Health, demographic change and wellbeing (SC1) and 16.6% in the case of Europe in a changing world (SC6). All but SC6 exceed the H2020 target of 20% SME participation for SME participation.

Distinctively different patterns and modalities of participation are observed. The relative utilisation of the differing actions or ‘instruments’ affects the extent of the involvement of the different partners. It is seen that there are marked differences in the type of action supported, particularly as between SC1 (Health), where over 80% of the Work Programme budget is devoted to Research and innovation actions (RIA) – actions primarily aiming to establish new knowledge and/or to explore the feasibility of a new or improved technology, product, process, service or solution – and SC3 (Energy), where over 40% of the budget has been allocated to the more applied Innovation actions. However, closer examination shows that the picture is more complex. Not only do the different areas
intrinsically differing amounts of basic research, but the details show that SCI RIAs, for instance, often involve clinical trials and there are significant areas of applied work, such as Innovative Medicines Initiative, that are not included in the Work Programme figures.

Actual expenditure is then examined against objectives and targets, showing that this pillar is broadly on track, but with some commitments that exceed the planned amounts evident in the detail, with shortfalls elsewhere.

**The Effectiveness and Efficiency of Implementation**

Information of the effectiveness and efficiency of the implementation of the Societal Challenges is largely derived from interviews and position papers.

It is generally agreed that there have been improvements since FP7 in procedures, but that further progress is needed. A particular comment from a number of sources was that it is important to have staff with the appropriate knowledge and experience in place in the relevant units of the Commission and the agencies. These are critical to the whole Programme.

A major consideration is that H2020 is a highly competitive Programme, which ensures high quality, but is also characterised by low success rates, which can be very discouraging, especially for newcomers. There is also a tendency to concentration of funding in elite institutions, but it is also pointed out that some Member States that have not been involved in the past are being successful. Possible responses to the problem of oversubscription are considered, but there is no consensus on this matter.

Some concerns are reported in the energy area relating to the quality of proposal evaluation, giving rise to a potential bias against certain forms of energy technology.

Consideration of the interaction of this pillar of H2020 and other EU and national programmes points to differences in the objectives of the respective programmes (for example ‘smart specialisation’) that need managing, if conflicting developments are to be avoided. The extent of interaction with third countries in the Societal Challenges is found to be relatively low.

Examples of specific projects are presented illustrating not only different types of focus for research and innovation, but also different types of action, involving a variety of participant organisations. Some early indications of results are already apparent and these are presented.

**The Design of Horizon 2020 – Societal Challenges**

Views about the future development of the Programme are presented, especially based on the reports of the Expert Advisory Groups in relation to the three Challenges in focus and interviews with the EAG Chairs. A number of specific points relating to each Challenge are set out, but overall key common issues for the future relate to ICT developments and especially the exploitation of big data, where Europe is perceived to have a number of competitive advantages.

The ‘valley of death’ between obtaining research results and commercialisation is still an important issue. Some Challenges are doing better than others in addressing it, but further
investigation is required of issues including access to finance, the use of facilities such as science parks, strengthening assistance for IPR management.

The EAG for SC6, which considered the contribution of the Social Sciences and Humanities to H2020 proposed a concentration on three major themes over the rest of the Programme: migration; the human and social dynamics of the Fourth Industrial Revolution; and governance for the future. Progress is reported in integrating SSH into the work of other Societal Challenges, but, as the 2015 Monitoring report acknowledges, further efforts in this direction are required.

Conclusions & Recommendations

The conclusions of the briefing are summarised, though at this stage of the Programme, they are still provisional.

Recommendations include:

- Greater cross-fertilisation and learning is required from the experience of the different Societal Challenges, especially in terms of using the full range of actions or instruments available and of engaging industry input into research and innovation.

- ICT support and especially big data are issues that affect all of the Challenges.

- Further progress is needed in the integration of Social Sciences and Humanities elements into mainstream research and innovation processes.

- Oversubscription is a major problem in the Societal Challenges area, as much as in other parts of H2020, and suggests that there are considerable innovation opportunities in the form of good projects that are seeking funding, but which are unable to access it from H2020.

- The possibility that evaluation processes are introducing a bias in favour of certain alternative energy technologies needs to be investigated.

- Further definition is required of the issues affecting enterprises seeking to exploit initial research results and facing the ‘valley of death’ and the remedies suggested (especially by the EAG SC1) need to be examined in greater detail.

- The interaction with other EU programmes, especially the European Structural and Investment Funds, needs to be examined more closely on the ground in order to ensure that the differing approaches are consistent or reinforce each other. Smart specialisation, for instance, should not detract from tackling broad societal challenges.

- Efforts should continue to present an overall picture of EU expenditure in the annual Monitoring Reports and not only expenditure covered by the Work Programme.
Chapter 1. Introduction

I - Background

The general objective of Horizon 2020 is to contribute to building a society and an economy based on knowledge and innovation across the Union by leveraging additional research, development and innovation (‘RDI’) funding in an integrated approach and by contributing to attaining R&D targets, including the target of 3 % of GDP for research and development across the Union by 2020. In this way, Horizon 2020 is supporting the implementation of the Europe 2020 strategy and other Union policies, including the achievement and effective functioning of the European Research Area (ERA).

In pursuing this objective, the aim is explicitly to ensure that the conditions exist for the competitiveness of Union industry. For this reason, Horizon 2020 has put further emphasis on actions intended to foster better exploitation of the industrial potential of research and innovation, by facilitating collaborative and industry-driven research, easing access for a wider range of partners and aiming to reduce time to market. At the same time, Horizon 2020 also differs from earlier Framework Programmes in its focus on Europe 2020 priorities and on addressing societal challenges and key technologies while also further strengthening excellence. In fact, addressing the major societal challenges being faced in Europe and across the world as one of the three pillars of the Horizon 2020 Programme was one of its key new features. The extent to which the interaction of research and industry is contributing to this process is the subject of this briefing paper.

The rationale for the focus on societal challenges is that tackling the concerns of EU citizens and society and the challenges identified in the Europe 2020 strategy cannot be achieved without supporting activities covering the entire spectrum from research to market. Potential breakthrough solutions need to be tested, demonstrated and scaled up. Horizon 2020 has stressed that addressing societal challenges was an important duty for the EU in the current period, but also a major opportunity for future economic development and employment and a clear example of how it is possible to pursue “smart, sustainable and inclusive growth” in a coherent contribution to the Europe 2020 strategy.

The primary challenges have been identified as those in the following areas and funding has consequently been focused on them:

a. Health, demographic change and well-being;
b. Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bio-economy;
c. Secure, clean and efficient energy;
d. Smart, green and integrated transport;
e. Climate action, environment, resource efficiency and raw materials;
f. Europe in a changing world - Inclusive, innovative and reflective societies;
g. Secure societies - Protecting freedom and security of Europe and its citizens.

According to Regulation EU no. 1291/2013 establishing H2020, the societal challenges pillar within the programme had a total indicative budget of EUR 29.68 billion, higher than for either Excellent Science (EUR 24.44 billion) or Industrial Leadership (EUR 17.02 billion).
Societal challenges are also being addressed through the Strategic Innovation Agenda for the European Institute of Innovation and Technology (EIT).

II – Purpose of the study

The Ex-Post Impact Assessment Unit (IMPT) of Directorate C - Impact Assessment and European Added Value (within Directorate General for European Parliament Research Services) is providing expertise to support the European Parliament’s Committee on Industry, Research and Energy (ITRE) in the development of an own-initiative report on the Implementation of the Horizon 2020 framework programme. As a contribution to the overall task, this particular briefing paper will assess the research and industry perspective on the implementation of the Societal Challenges priority within the Horizon 2020 framework programme. In parallel, other briefings will examine other aspects of Horizon 2020, including the economic and financial perspective on societal challenges.

While the briefing will refer to the research and industry aspects of the Societal Challenges in general, particular attention will be paid to three areas, by way of illustrating the general approach:

- Health, demographic changes and wellbeing,
- Secure, clean and efficient energy,
- Europe in a changing world - inclusive, innovative and reflective societies.

These three areas illustrate the innovative approach adopted by Horizon 2020 in making societal challenges one of the three main priorities of the Programme. In responding to demographic change in the form of an ageing population, for instance, by supporting the development of new monitoring and support equipment and new forms of care, not only can EU programmes help address growing problems for health systems and help combat social exclusion, but also open up business and employment opportunities, both within Europe and elsewhere in the world where societies are facing similar problems. Similarly, addressing other societal challenges - energy efficiency, climate change and other environmental problems, food security and the bioeconomy and making our society secure - are all both important responses to significant social or sustainability concerns and examples of major economic opportunities.

III – Research issues

The Briefing is primarily intended to throw light on the way that the Societal Challenges pillar of Horizon 2020 is being implemented, especially in relation to the involvement of a balanced range of relevant partners – higher education, research organisations, public authorities and private sector businesses. Evidence on participation has therefore been one of the focal points for the investigation. At the same time, potential future developments in the priorities and implementation of the Programme have been of interest, both in terms of the substance of the research and innovation actions to be undertaken and in relation to the involvement of the different partners.

IV – Methodological approach

After an initial review of the literature – policy documents, position papers and published data, the team have undertaken investigations of the data available through the Monitoring
Reports and Cordis and have conducted interviews with people responsible for implementing H2020 and with experts involved in the Expert Advisory Groups. The findings are presented in the following sections, which also feature brief descriptions of illustrative cases of projects supported under particular Societal Challenges.
Chapter 2. Overview of implementation

**Key findings**

- Horizon 2020 has just completed its third year. This chapter first sets out the objectives, especially of the three Societal Challenges under particular consideration.

- The number of projects and funding for each Challenge are set out, followed by participation rates of different kinds of organisation, where the distinct differences between Challenges in participation of Private for profit companies is observed, though less so for SME participation.

- Distinctively different patterns and modalities of participation are observed across the Societal Challenges, reflecting a complex situation in terms of developing applications.

- The relative utilisation of the differing actions or ‘instruments’ affects the extent of the involvement of the different partners. It is seen that there are marked differences in the type of action supported, particularly as between SC1 (Health) and SC3 (Energy). However, it is explained that the picture is more complex than this initially suggests. The major Innovative Medicines Initiative, for instance needs to be taken into account.

- Actual expenditure is then examined against objectives and targets, showing that this pillar is broadly on track, but with some interesting differences.

I – The Focus of the Societal Challenges Priority

The specific objectives of the Societal Challenges priority were determined by the societal challenges and policy priorities identified in the Europe 2020 strategy. As the Regulation establishing Horizon 2020\(^{208}\) itself explained, all the activities undertaken were intended to take a challenge-based approach, focusing on policy priorities without predetermining the precise choice of technologies or solutions to be deployed. The activities can therefore involve basic research, applied research, knowledge transfer or innovation and promote non-technological, organisational and systems innovation as well as technology-driven solutions.

A significant question in assessing progress with the Societal Challenges priority, is the extent to which this characteristic approach has been applied and, especially for the current briefing, how this has involved an effective combination of inputs from academic

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institutions, research organisations and industry. An assessment of this begins with a consideration of the stated objectives of the Programme.

Each of the seven Societal Challenges has its own specific objective set out in the Regulation and a definition of the broad lines of the activities to be carried out. Implementation has begun with two sets of Work Programmes for each Challenge, in each case setting out the subject of the calls for proposals to be published over a two-year period – 2014-15 and 2016-17.

There is not scope in this briefing to cover all the Societal Challenges in detail, but by way of example, developments in relation to three of them are set out in the next sections.

**Health, demographic change and well-being (SC1)**

The specific objective of this Societal Challenge is to improve the lifelong health and well-being of all. This includes keeping older people active and independent for longer, supporting the development of new, safer and more effective interventions and contributing to the sustainability of health and care systems. Over €2 billion is being invested in this Challenge during the first four years of Horizon 2020. By way of illustration of the type of project supported, the following provides a summary of a single project.

**Box 2.1 Project relating to Rare Diseases.**

<table>
<thead>
<tr>
<th>Societal Challenge: Health, Demographic Change and Wellbeing Rare Diseases</th>
<th>Development of an innovative gene therapy platform to cure rare hereditary muscle disorders (MYOCURE)</th>
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<tbody>
<tr>
<td>Diseases are considered to be rare when they affect not more than 5 per 10 000 persons in the European Union’s population. It is estimated that there are between 5 000 and 8 000 different diseases in this category and these can affect an estimated 29 million people. This is an area where the EU can add value, since although because of their rarity, research into these diseases may find difficulty in securing funding nationally, at a European scale there is greater scope to address them. Research into ‘New therapies for rare diseases’ is therefore supported under Horizon 2020 (H2020-PHC-14-2015).</td>
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<tr>
<td>MYOCURE is a project that aims to develop an innovative gene therapy platform to cure rare hereditary muscle disorders, specifically focusing on myotubular myopathy (MTM) and glycogen storage disorder (GSD) type II. These are rare genetic diseases typically caused by single gene defects that often provoke significant morbidity and mortality. There are no effective cures and current treatment is suboptimal.</td>
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<td>MYOCURE seeks to overcome the bottlenecks that hamper muscle-directed gene therapy by boosting gene transfer and expression, minimizing undesirable immune reactions and improving efficacy and safety, developing a scalable GMP-like manufacturing process, applying for an orphan drug designation for the advanced therapy medicinal product (ATMP) and consolidating a Phase I gene therapy clinical trial.</td>
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<td>The MYOCURE consortium consists of 8 partners (4 universities, 1 research organisation and 3 enterprises - SMEs) from 5 countries. Its composition shows an interesting interaction between partners specialised in different parts of the complex process of</td>
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</table>
translating research into effective therapies. As well as the academic input into scientific investigations into hereditary monogenetic diseases, targeted tissue-specific gene transfer, the development of AAV vectors and the immune consequences of gene therapy, the universities are contributing experience in developing therapies, including pre-clinical development of safe and effective gene therapy. The role of the enterprises ranges from overall project management, development of IP strategies, dissemination and networking to managing regulatory strategy and certification processes and regulatory support during the non-clinical phase and the conduct of preclinical safety studies required by regulatory authorities to assess the safety, toxicity and biodistribution of the products.

The outcome of MYOCURE will constitute the basis of a Phase I gene therapy clinical trial in MTM and GSD patients, impacting directly on an estimated 20,000 people. The intention is that this will provide not only a long-term solution to life-threatening muscle disease and severe myopathy that will be safer than current gene therapy options, but also improve the patient’s quality of life and survival and assist the family by an improved independence on the part of the patient. MYOCURE will ultimately lead to a significant reduction in Europe’s healthcare costs associated with the home or hospital care needed for the treatment of inherited rare monogenic muscle diseases.

The technology platform developed within MYOCURE has implications beyond MTM and GSD II and would ultimately have a broader impact on patients and their families suffering from other rare muscle disorders.

MYOCURE is linked to several national or international research initiatives. The consortium seeks to establish synergies with related activities and organisations to maximise impact and mutual benefit.

The SC1 Work Programme for 2014 and 2015 had 34 topics under the theme of ‘personalising health and care’, with a further 16 topics in a call on ‘co-ordination activities’. In addition, 8 other actions designed to support the implementation of the challenge were also included and were not subject to competitive calls for proposals.

Topics were divided into 7 areas, providing support to longer and mid-term research as well as to shorter term innovation activities. The idea was that topics in the areas of ‘understanding health...’ and ‘improved health information and data exploitation’ would provide underpinning, and longer term support would be provided to topics in the areas of ‘prevention...’, ‘diagnosis...’, ‘treatment...’, ‘advancing active and healthy ageing’ and ‘delivering integrated, sustainable and citizen centred care’.

The Work Programme also included significant, tailored support to small and medium sized enterprises, in particular through topic PHC 12 which made use of the new SME Instrument.

A novelty introduced at this stage was the Open Research Data Pilot which aimed to improve and maximise access to and re-use of research data generated by projects.

The more recent Work programme for 2016 – 17 developed the earlier theme as ‘promoting healthy ageing and personalised healthcare’. Research priorities were: personalised medicine, rare diseases, human biomonitoring, mental health, comparative effectiveness research, advanced technologies, e/mhealth, robotics, patient empowerment, active and
healthy ageing, data security, big data, valorisation, anti-microbial resistance, infectious diseases including vaccines, maternal and child health and the silver economy.

In addition, Pilot 1 'Smart Living Environments for Ageing Well' of the focus area call on the 'Internet of Things' was jointly implemented with "Leadership in enabling and industrial technologies Information and Communication Technologies" (ICT LEIT). Together the priorities were intended to support the development of evidence-based health and care policies, resulting from scientific research data, ICT solutions and good practice in interventions improving the efficiency and quality of health and care systems.

An important additional dimension for SC1 are the activities beyond the Work Programme, such as EU support for the Innovative Medicines Initiative (IMI.2), the European and Developing Countries Clinical Trials Partnership (EDCTP), and the Active and Assisted Living Programme. IMI, for instance, is Europe's largest public-private initiative, in a joint undertaking between the EU and the pharmaceutical industry association EFPIA. It supports collaborative research projects through open calls for proposals and builds networks of industrial and academic experts in order to boost pharmaceutical innovation and speed up the development of better and safer medicines for patients. The IMI 2 programme (2014-2024), has a total budget is €3.276 billion, half of which is provided by the EU from the SC1 budget. The significance of this initiative can be gauged by the fact that the EU contribution represents over 20% of the entire SC1 budget.

**Secure, Clean and Efficient Energy (SC3)**

The specific objective of this Societal Challenge is 'to make the transition to a reliable, affordable, publicly accepted, sustainable and competitive energy system, aiming at reducing fossil fuel dependency in the face of increasingly scarce resources, increasing energy needs and climate change'.

The foundation for this objective is the Union’s commitment to reducing greenhouse gas emissions by 20 % below 1990 levels by 2020, with a further reduction to 80-95 % by 2050, and also the commitment that renewables should cover 20 % of final energy consumption in 2020 coupled with a 20 % energy efficiency target. This provides a clear orientation, but the developing research programme does have to take into account the fact that this is now a relatively complex policy area, with a number of other commitments such as those of the Roadmap for moving to a competitive low-carbon economy in 2050, the Strategic Energy Technology Plan and the Commission Communication on “Energy Technologies and Innovation”. More recently, there has been the 2015 'Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy'. The role of the activities supported under this Societal Challenge in particular, is therefore to support these policy aims and to this end the activities in the first Work Programme contributed to the three focus areas "Energy Efficiency", "Competitive Low-Carbon Energy" and "Smart Cities and Communities".

For Energy Efficiency, the EU aims progressively to decrease primary energy consumption by 2020 and 2030. Activities therefore focused on buildings, industry, heating and cooling,

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209 COM(2011) 112 final of 8.3.2011
210 COM(2013) 253 final of 2.5.2013
211 COM (2015) 80 final
SMEs and energy-related products and services, integration of ICT and cooperation with the telecoms sector. For Low Carbon Technologies, the aim was to develop and bring to market affordable, cost-effective and resource-efficient technology solutions to decarbonise the energy system in a sustainable way, secure energy supply and complete the energy internal market. Research activities therefore covered: Photovoltaics, Concentrated Solar Power, Wind energy, Ocean Energy, Hydro Power, Geothermal Energy, Renewable Heating and Cooling, Energy Storage, Biofuels and Alternative Fuels, Carbon Capture and Storage. For Smart Cities & Communities the aim was to promote integrated approaches to the development of technologies and services in the areas of energy, transport and ICT. The focus was on developing commercial-scale solutions with a high market potential. The case summarised below provides a concrete example of an illustrative industry-led project.

Box 2.2 Project relating to Alternatives to Fossil Fuels.

| Societal Challenge: Secure, clean and efficient energy |
| Alternatives to Fossil Fuels |
| Demonstrating Advanced Biofuel Technologies (LCE-12-2014) |

In order to achieve the EU targets regarding renewable energy in transport and CO2 abatement, new and advanced biofuels using sustainable feedstock need to reach the market. To this end, the following detailed challenges should be addressed: 1) proving that advanced biofuels and bioenergy carriers technologies are technically viable, environmentally and socially sustainable, and potentially cost-competitive at the commercial stage; 2) developing logistic systems for a sound, safe and sustainable feedstock supply.

In the period 2014-2012, Horizon 2020 has contributed to overcoming these challenges via the Low Carbon Economy calls on topic 12, i.e. demonstrating advanced biofuel technologies. Among others, the programme has financed the STEELANOL project ('Production of sustainable, advanced bio-ethanol through an innovative gas-fermentation process using exhaust gases emitted in the STEEL industry'; IA; EU contribution: EUR 10.2 million). The project is based on producing bioethanol via an innovative gas fermentation process using exhaust gases emitted by the steel industry. The gaseous emissions are an unavoidable residue from the BF/BOF steelmaking process and are currently used for electricity production or are flared. Nevertheless, they can be advantageously used to produce bioethanol, thereby reducing the usage of fossil fuel molecules and significantly reducing GHG emissions compared to oil-derived fuels.

STEELANOL’s main objective is to demonstrate the cost-effective production of sustainable bioethanol, with the purpose of assessing the valorisation of this ethanol biofuel as a fuel derivative for the transport sector. For this purpose, a demonstration flagship pilot plant of approximately 25,000 tons/ethanol per year will be built in Belgium (at ArcelorMittal Europe’s steel plant in Ghent). This is the first of its kind in Europe, and the largest facility built to date utilizing this technology globally. Once the commercial viability of the project is proven, the intention is to construct further plants across ArcelorMittal’s operations. If scaled up to its full potential in Europe, the technology could enable the production of around 500,000 tonnes of bioethanol a year. The project consortium comprises 5 partners from 4 countries. ArcelorMittal is the lead partner of this project. The gas fermentation technology is supplied by LanzaTech, the engineering work will be performed by Primetals, and E4Tech will develop the Life Cycle Assessment of the produced fuels. This is a good example of an industry-led development.
The first Work Programme points out that new technologies and solutions must compete on cost and reliability against energy systems with well-established technologies. Research and innovation are critical to make these new, cleaner, low-carbon, efficient energy sources commercially attractive on the scale needed and must be combined with measures facilitating the market uptake of these energy technologies and services. The focus in the first Work Programme was therefore on "Energy Efficiency", "Competitive Low-Carbon Energy" and "Smart Cities and Communities".

In implementing the challenge-based approach, applicants were given more freedom to come up with innovative solutions in that topics were generally broader, allowed a range of possible approaches and often could encompass more than one action. The Work Programme also called for a number of joint actions between the EU and Member States in order to deliver the necessary scale and scope and achieve greater impact from scarce public and private resources.

Similarly, managing the transition to a more sustainable energy system cannot be achieved without taking into account the societal, economic and environmental context in which the energy system is embedded. Complementary socioeconomic research aiming to increase understanding of the complex energy system, improving the knowledge base for policy development and engaging civil society in transition processes also featured.

In addition, the Energy challenge contributes to ‘Blue Growth’ and to the Public Private Partnership energy-efficient Buildings and Sustainable Process Industries (SPIRE). Moreover, a series of ‘Other Actions’ support policy development and implementation of Directives and regulations relevant to Energy Efficiency, and fund technical support to the Commission on standardisation work on energy related products and innovative financing for sustainable energy through the ELENA Facility.

The second Work Programme (for 2016 – 17) distinguished between the two focus areas "Energy Efficiency" and "Competitive Low-Carbon Energy" on the one hand and "Smart Cities and Communities" on the other. With the first part it enabled participation by consumers in energy transition, and improving the efficiency of the energy system, especially as regards the stock of buildings and also supported the development of the next generation of renewable energy technologies and their integration into the energy system (including energy storage). The Programme also provides support for first-of-a kind, commercial-scale industrial demonstration projects.

With regard to the "Smart and Sustainable Cities" focus area, activities are included in the crosscutting part of the Work Programme, covering the full innovation cycle – from ‘proof of concept’ to applied research, pre-commercial demonstration and market uptake measures.

In general, though, in the second Work Programme, there was a tendency to be more specific in calls, with a greater number of topics listed, with the intention of helping potential participants to see more clearly whether or not calls were relevant for their activities.

**Europe in a changing world - Inclusive, innovative and reflective societies (SC6)**

The specific objective of this Societal Challenge is to foster a greater understanding of Europe, provide solutions and support inclusive, innovative and reflective European
societies in a context of unprecedented transformations and growing global interdependencies.

The H2020 Regulation lists a series of major socio-economic challenges, significantly affecting our common future. These include growing economic and cultural interdependencies, ageing and demographic change, social exclusion and poverty, integration and disintegration, inequalities and migration flows, a growing digital divide, a decreasing sense of trust in democratic institutions and between citizens within and across borders and fostering a culture of innovation and creativity in society and enterprises.

The Societal Challenge ‘Europe in a changing world - Inclusive, Innovative and Reflective Societies’ has a special role in that it makes use of the shared scientific knowledge that the social sciences and humanities (among others) can provide, to develop a common European approach to these issues.

The first Work Programme for 2014-2015 focused on:

- New ideas, strategies and governance structures for overcoming the crisis in Europe (resilient economic and monetary Union, EU growth agenda, EU social policies, the future of European integration).
- The young generation in an innovative, inclusive and sustainable Europe (job insecurity, youth mobility, adult education, social and political engagement of young people).
- Reflective societies: transmission of European cultural heritage, uses of the past.
- Europe as a global actor: cooperation with third countries, the new geopolitical order in the Mediterranean, EU eastern partnership and with other third countries.
- New forms of innovation in the public sector, open government, business model innovation, the social innovation community, ICT for learning and inclusion

Projects were intended to provide insight and potential solutions for a series of complex social and political problems. For instance relating to youth, addressing youth unemployment is a major social concern in many Member States, but so too is engaging young people more effectively in social and political processes. Promoting active citizenship has therefore been a common theme in projects, along with understanding labour market mobility among young people or other aspects of young people’s engagement with the labour market, as in the following example:
Box 2.3 Project relating to Youth policies

<table>
<thead>
<tr>
<th>Societal Challenge: Europe in a changing world</th>
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</thead>
<tbody>
<tr>
<td>Youth Policies</td>
</tr>
<tr>
<td>Negotiating early job-insecurity and labour market exclusion in Europe (NEGOTIATE)</td>
</tr>
</tbody>
</table>

NEGOTIATE is examining the long- and short-term consequences of early job insecurity and the labour market exclusion of young people. It aims to shed new light on the consequences of youth unemployment and influence policy in the area.

The project is taking an innovative approach to these issues, using cross-disciplinary analysis and novel investigation techniques (life course interviews, vignette experiments) to generate primary data. A structured analysis is examining general labour market processes and the impacts of the employment crisis at a macro level, differential access to public and private support within and across countries at an intermediate level and young people’s capacity to influence job prospects at a micro level. Four key concepts (resilience, capability, active agency and negotiation) are applied in this analysis, which has also been designed to be gender-sensitive.

The project is being implemented by a trans-disciplinary consortium of nine higher education and research institutions plus SOLIDAR a European and international network of Civil Society Organisations working to advance social justice, which will help to strengthen the policy impact.

The second Work Programme for 20016 - 2017 tackled four major challenges currently faced by the European Union:

- Economic recovery and inclusive and sustainable long-term growth with a focus on co-creation for growth and inclusion: engaging citizens, users, academia, social partners, public authorities, businesses including SMEs, the creative sector and social entrepreneurs.
- Reversing inequalities in Europe. Coherent visions for more inclusive societies that foster a social and economic framework that promotes fairness and sustainability in Europe.
- The global environment in which the EU operates. Recent developments in changing strategic and geopolitical contexts.
- A better understanding of Europe's cultural and social diversity and of its past to inform the reflection about present problems and help find solutions for shaping Europe's future.

The four calls are supplemented by a set of specific smaller activities supporting in particular the implementation of the Innovation Union, the European Research Area, the strategy for international cooperation in R&I and COST.
II – Research & Industry Involvement in the Societal Challenges Priority

The overall Horizon 2020 Work Programme expenditure in 2014 and 2015 on Societal Challenges and its distribution across the Challenges is shown in the following table:

Table 2.1 Distribution of Signed Grants and EU funding in Horizon 2020 Expenditure on Societal Challenges in 2014 and 2015

<table>
<thead>
<tr>
<th>Societal Challenges</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of signed grants</td>
<td>EU funding to signed grants (EUR million)</td>
<td>Number of signed grants</td>
</tr>
<tr>
<td>Societal Challenges</td>
<td>1 041</td>
<td>2 940.7</td>
<td>1 102</td>
</tr>
<tr>
<td>Health, demographic change and wellbeing (SC1)</td>
<td>219</td>
<td>640.7</td>
<td>198</td>
</tr>
<tr>
<td>Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy (SC2)</td>
<td>123</td>
<td>371.4</td>
<td>145</td>
</tr>
<tr>
<td>Secure, clean and efficient energy (SC3)</td>
<td>251</td>
<td>647.1</td>
<td>219</td>
</tr>
<tr>
<td>Smart, green and integrated transport (SC4)</td>
<td>184</td>
<td>623.5</td>
<td>263</td>
</tr>
<tr>
<td>Climate action, environment, resource efficiency and raw materials (SC5)</td>
<td>139</td>
<td>341.6</td>
<td>121</td>
</tr>
<tr>
<td>Europe in a changing world - inclusive, innovative and reflective societies (SC6)</td>
<td>49</td>
<td>117.8</td>
<td>95</td>
</tr>
<tr>
<td>Secure societies - protecting freedom and security of Europe and its citizens (SC7)</td>
<td>76</td>
<td>198.6</td>
<td>61</td>
</tr>
<tr>
<td>(The SME Instrument*)</td>
<td>(720)</td>
<td>(255.1)</td>
<td>(714)</td>
</tr>
<tr>
<td>TOTAL HORIZON 2020</td>
<td>4 824</td>
<td>8 472.5</td>
<td>4 263</td>
</tr>
<tr>
<td>Societal Challenges share</td>
<td>22%</td>
<td>35%</td>
<td>26%</td>
</tr>
</tbody>
</table>


* Societal Challenges contribute to the SME Instrument although legally it is part of the Innovation in SMEs Programme under Industrial Leadership
Source: Horizon 2020 Monitoring Report 2015

An analysis of the detail of Horizon 2020 expenditure is provided in the parallel briefing on the Financial and Economic aspects of the Societal Challenges. However, it is useful in the current context to have an overview and to be able to see, the share of Societal Challenges in the overall budget, the number of projects funded and, particularly, the
distribution of the funding across the different Challenges. It is clear that main areas of expenditure over the first two years were Secure, clean and efficient energy (SC3 – 23% of total SC EU Work Programme funding), Health, demographic change and wellbeing (SC1 – 22%), and Smart, green and integrated transport (SC4 – 18%), while Europe in a changing world - inclusive, innovative and reflective societies (SC6) accounted for less than 5% of EU funding.

The parallel briefing provides analysis of country distribution, funding success rates, time-to-contract etc. However, for this briefing an issue that is particularly relevant is the extent of participation by different kinds of organisation. The Monitoring Report distinguishes between the following types of organisation:

- Private for profit companies (PRC)
- Public bodies (excluding research and education) (PUB)
- Research organisations (excluding education) (REC)
- Secondary and higher education establishments (HES)
- Other entities (OTH)

On the basis of these distinctions data are provided for the distribution of applications and participations for the Programme as a whole. This shows that 35.2% of the 275,841 applications made in eligible proposals were from private sector for-profit enterprises (PRC). Higher Education accounted for 39.1% and other research organisations for a further 18.4% and other public sector 3.5%. Participations in signed grants were 31.7% (PRC), 34.5% (HES), 22.4% (REC) and 6.1% (PUB) respectively. Overall, therefore Higher Education and research organisations together accounted for just less than 60% of applications and participations, while business involvement provided about one third. The figures also show that research organisations and other public sector organisations were relatively more successful in having their applications taken through to signed grants.

Unfortunately, the information in the Monitoring Report on types of organisation involved in H2020 Work Programme activity is not fully broken down at the level of particular Societal Challenges. However, there is information on the total number of participations in each Challenge, private sector participation and SME participation.

**Table 2.2 Participation in Societal Challenges 2014 &15**

<table>
<thead>
<tr>
<th>Societal Challenges</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health, demographic change and wellbeing (SC1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Number of signed grants</td>
<td>219</td>
<td>198</td>
<td>417</td>
</tr>
<tr>
<td>2. Number of participations</td>
<td>1,550</td>
<td>1,285</td>
<td>2,835</td>
</tr>
<tr>
<td>3. Private sector participation (private/overall)</td>
<td>25.6%</td>
<td>29.0%</td>
<td>27.2%</td>
</tr>
<tr>
<td>4. SMEs participation (SME/overall)</td>
<td>20.5%</td>
<td>22.3%</td>
<td>21.3%</td>
</tr>
<tr>
<td>Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy (SC2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of signed grants</td>
<td>123</td>
<td>145</td>
<td>268</td>
</tr>
<tr>
<td>Number of participations</td>
<td>1,228</td>
<td>1,156</td>
<td>2,384</td>
</tr>
<tr>
<td>Private sector participation (private/overall)</td>
<td>30.9%</td>
<td>37.5%</td>
<td>35.1%</td>
</tr>
<tr>
<td>SMEs participation (SME/overall)</td>
<td>24.3%</td>
<td>29.4%</td>
<td>26.8%</td>
</tr>
<tr>
<td>Secure, clean and efficient energy (SC3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of signed grants</td>
<td>251</td>
<td>219</td>
<td>470</td>
</tr>
<tr>
<td>Number of participations</td>
<td>1,597</td>
<td>1,554</td>
<td>3,151</td>
</tr>
</tbody>
</table>
It can be seen that the number of signed grants and the number of participations broadly reflect the relative budget allocation, as could be expected, with Secure, clean and efficient energy (SC3) having the largest number and Europe in a changing world (SC6) the least. More interesting is the variation in private sector participation. This ranges from 55.3% in Smart, green and integrated transport (SC4) and 44.0% in Secure, clean and efficient energy (SC3), well above the H20220 average to 27.2% in Health, demographic change and wellbeing (SC1) and 17.9% in Europe in a changing world (SC6), in the latter case considerably below the average. Even among the lower private sector participation rates, however, there have been improvements since FP7, where, for instance in the health area, the corresponding rate was 20.7%.

It is also noticeable, that there is considerably less variation in the participation rates of SMEs. These vary from 28.4% in the case of Secure, clean and efficient energy (SC3) to 21.3% for Health, demographic change and wellbeing (SC1) and 16.6% in the case of Europe in a changing world (SC6). All but SC6 exceed the H20220 target of 20% SME participation. Furthermore, there has been some success in attracting both highly successful enterprises and new participants. 195 of the 255 SMEs funded by the SME Instrument in health related projects were new to EU research funding, including among the start-ups, 10 of the 11 most successful spin-off companies in the health sector.

The situation of Europe in a changing world (SC6) is clearly different from that of the other Societal Challenges and it should be noted here that the Monitoring Report also provides information on the involvement of Social Science and Humanities (SSH) partners in other Societal Challenges. Including estimates from the analysis of 2015 projects, € 433 million went to SSH partners in 2014-2015 projects (of which more than € 130 million came from SC6) - almost 22% of the estimated total budget for 2014-2015 SSH flagged topics. SSH partners in this period also accounted for 26% of the total number of consortia partners in

<table>
<thead>
<tr>
<th>Societal Challenges</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private sector participation (private/overall)</td>
<td>44.0%</td>
<td>44.0%</td>
<td>44.0%</td>
</tr>
<tr>
<td>SMEs participation (SME/overall)</td>
<td>27.6%</td>
<td>29.3%</td>
<td>28.4%</td>
</tr>
<tr>
<td>Smart, green and integrated transport (SC4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of signed grants</td>
<td>184</td>
<td>263</td>
<td>447</td>
</tr>
<tr>
<td>Number of participations</td>
<td>1,543</td>
<td>1,109</td>
<td>2,652</td>
</tr>
<tr>
<td>Private sector participation (private/overall)</td>
<td>56.6%</td>
<td>53.7%</td>
<td>55.3%</td>
</tr>
<tr>
<td>SMEs participation (SME/overall)</td>
<td>26.2%</td>
<td>29.2%</td>
<td>27.5%</td>
</tr>
<tr>
<td>Climate action, environment, resource efficiency and raw materials (SC5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of signed grants</td>
<td>139</td>
<td>121</td>
<td>260</td>
</tr>
<tr>
<td>Number of participations</td>
<td>1,126</td>
<td>1,151</td>
<td>2,277</td>
</tr>
<tr>
<td>Private sector participation (private/overall)</td>
<td>32.9%</td>
<td>33.6%</td>
<td>33.3%</td>
</tr>
<tr>
<td>SMEs participation (SME/overall)</td>
<td>23.7%</td>
<td>25.8%</td>
<td>24.8%</td>
</tr>
<tr>
<td>Europe in a changing world - inclusive, innovative and reflective societies (SC6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of signed grants</td>
<td>49</td>
<td>95</td>
<td>144</td>
</tr>
<tr>
<td>Number of participations</td>
<td>499</td>
<td>644</td>
<td>1,143</td>
</tr>
<tr>
<td>Private sector participation (private/overall)</td>
<td>13.2%</td>
<td>21.6%</td>
<td>17.9%</td>
</tr>
<tr>
<td>SMEs participation (SME/overall)</td>
<td>11.6%</td>
<td>20.5%</td>
<td>16.6%</td>
</tr>
<tr>
<td>Secure societies - protecting freedom and security of Europe and its citizens (SC7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of signed grants</td>
<td>76</td>
<td>61</td>
<td>137</td>
</tr>
<tr>
<td>Number of participations</td>
<td>607</td>
<td>564</td>
<td>1,171</td>
</tr>
<tr>
<td>Private sector participation (private/overall)</td>
<td>37.6%</td>
<td>39.1%</td>
<td>38.3%</td>
</tr>
<tr>
<td>SMEs participation (SME/overall)</td>
<td>24.5%</td>
<td>24.8%</td>
<td>24.7%</td>
</tr>
</tbody>
</table>

Source: selection of data by CSES from Monitoring Report 2015
projects funded under SSH flagged topics (20% when excluding SC6). The position of SC6 and Social Science and Humanities more generally will be considered further subsequently.

However, returning to Table 2.2, the figures could very well prompt a question about the differences, between SC1 - Health - and even Climate action, environment, resource efficiency and raw materials (SC5) on the one hand and say SC3 – energy – on the other. Why is it that in the former cases there appears to be noticeably less involvement by businesses in general and SMEs in particular?

Part of the answer may be in the scope afforded to businesses in the calls under the different Societal Challenges and particularly the nature of the instruments available under these calls. Again, the point is illustrated by reference to three particular Societal Challenges.

In general, the following instruments are available under H2020:

- Research and innovation actions (RIA) – actions primarily aiming to establish new knowledge and/or to explore the feasibility of a new or improved technology, product, process, service or solution, including basic and applied research, technology development and integration, testing and validation on a small-scale prototype in a laboratory or simulated environment.
- Innovation actions (IA) - directly aimed at producing plans and arrangements for new, altered or improved products, processes or services, including prototyping, testing, demonstrating, piloting, large-scale product validation and market replication.
- SME instrument (SME).
- ERA-NET Cofund (COFUND) - supporting public-public partnerships and networking structures and joint activities.
- Pre-Commercial Procurement (PCP) Cofund actions.
- Public Procurement of Innovative Solutions (PPI) Cofund actions.
- Coordination and support actions (CSA) - accompanying measures such as standardisation, dissemination, awareness-raising and communication, networking etc.

The relative utilisation of the differing instruments affects the extent of the involvement of the different partners, so Research and Innovation Actions offer more scope to Higher Education and research organisations, whereas Innovation Actions might be expected to be more attractive to private sector businesses and, of course, the SME instrument is designed to encourage SME participation. The table below shows the relative use of the different instruments by the three Societal Challenges that are being examined most closely, as set out in the respective Work Programmes for the first two periods.
Table 2.3 Planned Distribution of Actions Used by Health, demographic change and wellbeing (SC1), Secure, clean and efficient energy (SC3) and Europe in a changing world (SC6), 2014 - 16

| Action/instrument | SC1 | | SC3 | | SC6 | |
|------------------|-----|----------------|-----|----------------|-----|----------------|-----|
| Action/instrument | No. | Funds | % | No. | Funds | % | No. | Funds | % |
| Research and innovation actions (RIA) | 53 | 1543.2 | 83.3% | 26 | 631.9 | 28.7% | 22 | 283.3 | 58.4% |
| Innovation actions (IA) | 1 | 10.0 | 0.5% | 29 | 931.2 | 42.3% | 6 | 43.6 | 9.0% |
| SME instrument (SME) | 2 | 111.0 | 6.0% | 2 | 164.7 | 7.5% | 3 | 37.2 | 7.7% |
| ERA-NET Cofund (COFUND) | 9 | 90.0 | 4.9% | 6 | 175.3 | 8.0% | 4 | 20.0 | 4.1% |
| Pre-Commercial Procurement (PCP) | 2 | 33.0 | 1.8% | - | - | - | - | - |
| Public Procurement of Innovative Solutions (PPI) | 3 | 28.8 | 1.6% | 1 | 4.0 | 0.2% | - | - |
| Coordination and support actions (CSA) | 21 | 35.5 | 1.9% | 26 | 296.3 | 13.5% | 29 | 100.6 | 20.8% |
| | | 1851.5 | | | 2203.4 | | | 484.7 | |

Source: Calculations by CSES on the basis of interpretation of Work Programmes

Note that under 2 SC3 actions a further € 78.2 million was to be split between RIA and IA.
Other actions by the Commission covering studies and evaluations etc. are not included.

There are a number of caveats concerning Table 2.3. The table presents expenditure planned in the Work Programmes. We have yet to see how actual expenditure corresponds to the planned amounts. In addition, a significant consideration as we shall see is that the Table presents a picture of the expenditure over which the Commission has direct control. Other expenditure is channelled via Joint Programming Initiatives or Public-Private Initiatives. Nonetheless the overall picture is an interesting one. It is clear that the Societal Challenges have each made use of the instruments in a distinctive way.

The ‘Health, Demographic Change and Well-being’ Work Programmes for 2014 -2015 and 2016-2017 made use of the whole range of instruments available: collaborative research and innovation actions, an innovation action, the SME instrument, ERA-NET Co-Funds and support for Joint Programming Initiatives (JPIs) and other actions including prizes and innovative financing. However, over 80% of the funding was concentrated in research and innovation actions and there was only one innovation action with a budget of 10 million EUR. This may suggest that SC1 has failed to move in a more applied direction, especially in comparison with SC3 and this may be part of the same picture as the relatively low rate of private sector participation referred to above.

It is important, however, not to jump to conclusions on these issues. Academic research is not necessarily the same as ‘basic research’. Especially in the medical area, research often includes clinical trials and other preparations for applications. In fact, the current estimate by the Commission is that 25% of projects are assessed at Technology Readiness Level (TRL) 7 or above. So the concentration on Research and Innovation Actions does not
directly imply a less applied orientation. Furthermore, it can be seen that SCI has had a bigger allocation to the more experimental instruments, such Pre-Commercial Procurement (PCP) and Public Procurement of Innovative Solutions (PPI), though compared to the other instruments this is still relatively small.

It has also been seen that actions not covered by the Work Programme have also to be taken into account, and these are predominantly of a more applied nature. The Innovative Medicines Initiative (IMI2), based on an association of pharmaceutical companies, is a major instrument for industry involvement in this area of medical research. The Active and Assisted Living Joint Programme (AAL2) is operated by an international not-for-profit association that aims to create better life conditions for older adults and at the same time to create industrial opportunities in Europe through the use of information and communication technology (ICT). It funds projects involving SMEs, research bodies and user’s organisations (representing the older adults), that have a maximum time-to-market perspective of 2 to 3 years after the end of the project. It also co-operates with the European Innovation Partnership on Active and Healthy Ageing (EIP-AHA) to promote best practice dissemination. The European and Developing Countries Clinical Trials Partnership EDCTP2) supports collaborative research to accelerate the clinical development of new or improved interventions to prevent or treat HIV/AIDS, tuberculosis, malaria and other poverty-related infectious diseases prevalent in sub-Saharan Africa. It focuses on phase II and III clinical trials.

SC3 on the other hand clearly has very significant elements supporting moves towards the market and the strong involvement of industry. The activities of both Work Programmes for SC3 covered the full innovation cycle – from 'proof of concept' to applied research, pre-commercial demonstration and market uptake measures, but the relative significance of Innovation Actions (accounting for 42.3% of the planned budget) definitely underlines the point. Synergies were also exploited with other relevant areas, e.g. information and communication technologies. In addition, the Energy Challenge contributed to the Public Private Partnerships Energy-efficient Buildings and Sustainable Process Industries (SPIRE).

There was a notable emphasis too in both Work Programmes on industrial participation in the programme, which has been seen to be crucial for developing new generations of low carbon technologies and rolling them out to the market. Part of this was actions particularly tailored to the needs of SMEs, including but not limited to the SME Instrument. An important part of this orientation towards industry has been the role played by the European Strategic Energy Technology Plan (SET-Plan) in influencing the priorities of energy calls set out in the work programmes. Industry representatives were very involved in shaping the SET-Plan priorities, which therefore have a strong industry dimension and this has been carried through into H2020 implementation.

There was also reference in both Work Programmes to facilitating the market uptake of energy technologies and services, and fostering social innovation and practical measures, such as removing non-technological barriers, promoting standards and accelerating the cost-effective implementation of the Union's energy policies, and indeed featuring a significant social science and humanities input into projects, not least in order to ensure a good understanding of social and political priorities.

A certain emphasis has also been given to promoting new forms of innovation, including new business models and developing an increasingly smart and dynamic system utilizing,
wherever possible, a multi-disciplinary approach, integrating different social sciences and humanities fields.

In general, therefore, the implementation of H2020 under SC3 in particular is seen to be based on the perception, stated explicitly that ‘Industrial participation in the programme is .... crucial’.

Although the complete picture is more complex than the raw figures initially suggest, the contrast between SC1 and SC3 remains. Of course, SC1 and SC3 are significantly different in terms of their relative needs for academic research and this is a major part of the explanation, but further consideration of whether a greater use of Innovation Actions would be appropriate, for instance, should be part of the continuing review of the relationship between research and industry in SC1.

The orientation of SC6 – Europe in a Changing World, encourages social science and humanities research with the intention of giving Europe a cutting edge and/or sufficient resilience to face current and future difficulties affecting the development inclusive, innovative and reflective societies. A basic aim is to gain a greater understanding of societal changes in Europe and of their impact on social cohesion through cutting-edge science and inter-disciplinarity. Higher Education in particular is well-placed to respond to this aim and it is not surprising that a large proportion of the budget should be allocated to RIAs, but there is also an aim to foster the development of innovative societies and policies through the engagement of citizens, civil society organisations, enterprises and users in research and innovation and the promotion of coordinated research and innovation policies. The first Work Programme therefore specifically addressed the development of new forms of innovation, including innovation in the public sector, where new and creative ways of delivering public services can improve efficiency, effectiveness and quality, but also involving enterprises, young entrepreneurs, incubators, universities and innovation centres and other relevant actors through support to open innovation, business model innovation and social innovation.

The second Work Programme followed a similar logic and has included a Fast Track to Innovation pilot and use of the SME Instrument. However, it is probably true to say that the weight of the second Work Programme moved towards more basic research in terms of developing understanding of newly arising concerns in areas such as finding new sources of growth and employment, the need to deliver quality public services and renew the legitimacy of public policy-making, migration, reversing inequalities and promoting fairness.

Examination of the data on research and industry involvement in the societal challenges priority and on the nature of the actions used as instruments for implementing the Work Programme and for supporting other actions has shown a complex picture in which there have clearly been moves towards applications and the market and a greater involvement of industry and SMEs under Horizon 2020, as intended, in all the Societal Challenge priorities examined, but there remains possible scope for further moves in this direction.
III – Analysis of actual expenditure against objectives and targets of the Programme

The Cordis database shows that, up to 1st September 2016, 1,324 projects had been approved under the Societal Challenges pillar since 2014. The majority of projects started in 2015 (699) and were carried out in the area of smart, secure and clean energy efficiency (21%) and in the area of health, demographic changes and well-being (19%). In 2016, one fifth of the projects started in the area of sustainable transport. There were also a number of transversal projects (12 in 2014, 94 in 2015 and 84 in 2016) covering both Industrial Leadership and Societal Challenges, mostly relating to the SME Instrument.

In expenditure terms, the EU contributions committed started at a low level in 2014 (€99 million), but then rose considerably in 2015 (approx. €2.9 billions) and in 2016 (approx. 2.3 billion up to the beginning of September). In 2015 more than 60% of the funds were allocated to projects developed in the area of health, demographic changes and well-being (22%), to support the transition towards a sustainable and competitive energy system (22%) and in the area of smart and green transport (20%). A less concentrated distribution is apparent in 2016, with health and well-being related projects still representing almost one quarter of the overall spending but with a considerable reduction of the EU contribution in the area of green and sustainable transport (-8%).

The overall picture for the Challenges that are particularly under consideration is provided in the following tables, which show the planned expenditure as set out in the Work Programme for 2014 – 15 and the commitments of EU expenditure following the calls published under this Work Programme in 2014 and 2015.

Table 2.4 Planned and Actual Commitments for SC1. Health, demographic change and wellbeing in 2014 & 2015.

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th></th>
<th>2015</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Planned</td>
<td>Outcome</td>
<td>Planned</td>
<td>Outcome</td>
</tr>
<tr>
<td>Personalising Health and Care</td>
<td>549.3</td>
<td>521.6</td>
<td>543.5</td>
<td>545.4</td>
</tr>
<tr>
<td>Co-ordination activities</td>
<td>40.0</td>
<td>48.4</td>
<td>29.0</td>
<td>36.9</td>
</tr>
<tr>
<td>Totals</td>
<td>589.3</td>
<td>570.0</td>
<td>572.5</td>
<td>582.3</td>
</tr>
</tbody>
</table>

Source: CSES analysis of Cordis data
The breakdown of planned and actual commitments under SC1 is not as detailed as in some other areas, but the figures do show a clear contrast between the core Personalising Health and Care programme, where there was a 5% shortfall in actual commitments relating to the 2014 calls (though with a slight catch-up the following year), and Coordination activities, where commitments in both years considerably exceeded the planned expenditure.

Table 2.5 Planned and Actual Commitments for SC3. Secure, clean and efficient energy in 2014 & 2015

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Planned</td>
<td>Outcome</td>
</tr>
<tr>
<td>Energy efficiency</td>
<td>92.5</td>
<td>103.6</td>
</tr>
<tr>
<td>Competitive Low-Carbon Energy</td>
<td>359.3</td>
<td>402.4</td>
</tr>
<tr>
<td>Smart Cities and Communities</td>
<td>73.8</td>
<td>72.7</td>
</tr>
<tr>
<td>SMEs and fast track to innovation for energy</td>
<td>34.0</td>
<td>n/a</td>
</tr>
<tr>
<td>Totals</td>
<td>559.6</td>
<td>604.8</td>
</tr>
</tbody>
</table>

Source: CSES analysis of Cordis data

For SC3, unfortunately the overall situation cannot be discussed, since it has not been possible to identify ‘SMEs and fast track to innovation for energy’ commitments attributable to this Societal Challenge in the Cordis data. Nonetheless it is clear that in the three main energy areas, commitments relating to calls in the first two years were ahead of the planned sums by 7%.

In terms of the nature of the participation, the total number of participants for 2014 and 2015 is 3,151, of which 12.7% are from EU-13 Member States, thus well above the Horizon 2020 average of 8%. Organisations from Spain and Germany had the highest number of participations with respectively 405 and 396. Organisations from Germany also received the largest EU contribution of EUR 225.9 million.

Table 2.6 Planned and Actual Commitments for SC6. Europe in a changing world - inclusive, innovative and reflective societies in 2014 & 2015

<table>
<thead>
<tr>
<th></th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Planned</td>
<td>Outcome</td>
</tr>
<tr>
<td>Overcoming the crisis</td>
<td>36.0</td>
<td>43.5</td>
</tr>
<tr>
<td>YG in an innovative, inclusive and sustainable EU</td>
<td>20.0</td>
<td>19.5</td>
</tr>
<tr>
<td>Reflective Societies</td>
<td>23.0</td>
<td>21.4</td>
</tr>
<tr>
<td>EU as a Global Actor</td>
<td>8.6</td>
<td>6.4</td>
</tr>
<tr>
<td>New Forms of Innovation</td>
<td>26.9</td>
<td>24.8</td>
</tr>
<tr>
<td>Totals</td>
<td>114.5</td>
<td>115.6</td>
</tr>
</tbody>
</table>

Source: CSES analysis of Cordis data

In relation to SC6, a good start was made in 2014 in the area of ‘Overcoming the crisis’, meaning that overall commitments for this Challenge were roughly in line with those planned, but for the 2015 calls, there was a significant shortfall, especially in the areas of EU as a Global Actor and New Forms of Innovation.
IV – Assessment of budget allocation

In general, the allocation of the budget for the Societal Challenges is proceeding as expected. At a more detailed level, however, it is clear that there are differences between the Challenges in the extent to which they involve the different kinds of organisation that can contribute to the overall objectives. SC3 – energy is proceeding faster and with a more balanced representation of the different players than some of the other areas, including SC1 – health. Again, it should be remembered that this is driven largely by the differing nature of the issues being addressed in each of the Challenges. Some intrinsically require a greater interaction between the different contributors than others. However, as will be seen subsequently, those involved believe that this is not the complete story and further consideration needs to be given to the balance between the different partners.

Another issue that will also need to be given further consideration is the integration of the Social Sciences and the Humanities into the work being carried out under the Societal Challenges pillar of H2020. This is not simply a matter of the work being undertaken as part of SC6 – Europe in a Changing World, but also the extent to which the other challenges are addressing these issues. It was seen, in fact that of the € 433 million that went to SSH partners in 2014-2015 projects only around € 130 million was allocated under SC6. Whether this is being allocated effectively will be considered below.
Chapter 3. Effectiveness & Efficiency of implementation

Key findings

- Interviewees’ comments on the efficiency of implementation are reported.
- There have been improvements since FR7 in procedures, but further progress is needed.
- It is important to have staff with the appropriate knowledge and experience in place in the relevant units of the Commission and the agencies. These are critical to the whole Programme.
- H2020 is a highly competitive Programme, which ensures high quality, but also low success rates, which can be very discouraging, especially for newcomers.
- There is a tendency to concentration of funding in elite institutions, but some Member States that have not been involved in the past are being successful.
- Possible responses to the problem of oversubscription are considered, but there is no consensus on this matter.
- Some concerns are reported relating to the quality of proposal evaluation and consequently a potential bias against certain forms of energy technology.
- Consideration of the interaction of this pillar of H2020 and other EU and national programmes points to differences in the objectives of the respective programmes (for example ‘smart specialisation’) that need managing, if conflicting developments are to be avoided. The extent of interaction with third countries in the Societal Challenges is found to be relatively low.
- Finally, some project examples and early indications of results are presented.

I – Efficiency of programme management and implementation – views of participants and implementation bodies

Interviewees have expressed the view that the efficiency of programme management and implementation very much depends on having staff with the appropriate knowledge and experience in place in the relevant units of the Commission and the agencies. These people are central both to the effective management of the processes that lead to a definition of the objectives and detail of the Programme and to the Programme’s subsequent implementation. Some of the interviewees have been very complimentary about the qualities of the staff with whom they have to deal, but others have raised concerns about the effects of the policy of rotation on institutional memory and the under-resourcing of certain areas as a result of staffing reductions.

The situation is thought to have become more acute, as a result of the growing number of applications and the falling success rate. The 2015 Monitoring Report shows that for both years together (2014 and 2015), the overall H2020 success rate was 11.8% and the EU financial contribution as a proportion of funds requested by eligible proposals was 12.3%.
For SC1 the respective figures were 9.5% and 8.6%; for SC3 they were 11.4% and 15.2%, while for SC6, they were 5.1% and 5.9%. Interestingly, for Smart, green and integrated transport (SC4), the figures were among the highest for the whole of H2020 – 16.3% and 26.0%, while the situation for SC6 is particularly acute.

H2020 in general is seen to be a highly competitive Programme. On the one hand, this has led to very high quality in the projects adopted. One comment was that the programme for a particular Societal Challenge was ‘the best research programme in the world’. But equally, the competition means that some perfectly good proposals are rejected and this leads to a disillusionment and an unwillingness to engage in research at a European level, especially given the amount of work needed to prepare a project proposal.

Oversubscription results from a combination of factors. In the post-crisis macroeconomic environment, declining national budgets mean less resources are available for supporting R&I and credit to enterprises in still rationed. Secondly, the new approach of H2020 has brought a greater use of less prescriptive calls and a considerable increase in the number of potential beneficiaries. Broader topics, however, make it more difficult for participants to judge if their own projects meet the submission criteria, leading to a large number of unsuccessful applications. Participation in SC3, for instance, resulted in 2,013 eligible proposals in 2015 but after the evaluation process only 495 proposals scored above threshold (and only 212 proposals were finally retained).

It is also believed by some industry and research associations that oversubscription has negatively affected the quality of proposal evaluation. According to EUREC, the Association of European Renewable Energy Research Centres, for instance, this is partially explained by the rules limiting the number of hours that an evaluator has to complete the work have led to evaluators with less experience being hired to deal with the large numbers of proposals. Another factor explaining the low quality is the significant time constraints. Applicants, from both industry and research, are said to be dissatisfied with the evaluation feedback, because evaluation reports do not always provide sufficient detail to allow the reasons for exclusion to be understood. It seems that the overall perception of the evaluator, which is a rather subjective criterion, weighs too heavily in determining the final score. Prescription in fact implies choices, and in the absence of systems to make these choices in a non-arbitrary way, the risk is to leave the evaluator with the freedom to decide and prioritise and can lead, for instance to a bias in favour of particular technologies, leaving them starved of funding and more generally leading to an unnecessary and counterproductive competition between technologies. The box below illustrates the problem.

**Box 3.1 Difference in average score and competition across technologies**

The EUREC position paper (‘Feedback on two years of Horizon 2020’) reports that EUREC has seen data for the scores given to proposals under the topic LCE 3.12 (Innovation Actions, one-stage evaluation) with the deadline of 5/5/2015. This shows that the 14 ocean proposals scored on average 3.3 points higher than the 16 RHC (renewable heating and cooling) proposals, with the other technologies somewhere in between. Only for wind and PV are the average scores virtually the same, appearing as one line. Sample size ranged from 6 proposals (Geo) to 17 (Bio).

It is surprising that RHC proposals should score so systematically poorly relative to ocean ones. Nothing from the Panel Report of the evaluation, EUREC has been told, suggests that the panel queried this result. The report only says that the standard methodology for tie-breaking was applied, detailed in Annex H of Part 18 of the General Annexes to the Work Programme.
Various suggestions have been made in order to address the problems of oversubscription. However, there are few that command universal agreement.

Views on the usefulness of two-stage submissions, for instance, seem to vary considerably. Some see this approach as a way of reducing the waste of time and resources in developing proposals that are not going to be adopted and also leads to an increased success rate for more mature projects. Others say that in practice, this often does not apply, since much of the work for stage two is already undertaken for stage one and often it is necessary to begin preparing the second stage proposal before the results of the first stage are known. In this view, the two-stage submission process only lengthens the time to grant.

Others, for example EARTO, have suggested having a narrower focus in the topics covered by calls, thus reducing the number of potentially eligible applicants, while still keeping the best parties involved. This approach in practice may account for the relatively high success rates for SC 4.

A further issue, associated with the growing competitiveness of Horizon 2020, is the concentration of funding in elite institutions. In terms of global competition, it may be important to keep standards high and indeed to strengthen the position of our most successful researchers and innovators. But at the same time, it appears to be becoming increasingly difficult for those not in elite institutions to become involved and especially for institutions in Member States that do not have a tradition of globally orientated research. Again the situation is not entirely straightforward. Latvia and Slovakia, for instance, have the highest success rates among the applications for SCI funding of any Member State. What appears to make a difference in this case is the amount of support that is available nationally for promising potential participants. The provisions in Horizon 2020 under ‘Spreading Excellence and Widening Participation’ (SEWP) are also intended to address this problem, but the total EU contribution to signed grants in calls under SEWP in 2014 and 2015 was € 117.4 million and the success rate was 13.4%, again suggesting unmet demand.

Overall, while oversubscription is an indicator of the attractiveness of H2020, it also means that there is a substantial highly innovative unfunded potential to be found in Europe.

Two final issues on slightly different topics. First, there was also a comment that the role of the National Contact Points (NCPs) is becoming more important now that Commission staff no longer have the capacity to provide advice directly to proposal makers. This means that further attention is required in order to strengthen the service provided.

Secondly, it was said that problems can arise in the relationship between industry and research organisations, because of the reluctance of industry participants to involve research institutions in proposals and also to share project results. More attention might usefully be given to managing and improving these relationships.

II – Effects of changes in grant procedures and rules

There is widespread support for the view that the changes and simplifications introduced for Horizon 2020 have definitely improved application procedures and project management. The simplified funding model and streamlined ex-ante checks, together with the accelerated granting processes and the paperless proposal and grant management, have made making applications easier, while other improvements, such as the introduction
of the annotated version of the Model Grant Agreement and reduced requirements for time recording, have also assisted in making project management less onerous.

Equally, however, the common view is that this was a good start, but that more effort is required in the same direction, especially now that applications have become so much more competitive. It is still felt that it is not possible to make a successful application without the assistance of experts in writing and submitting EU proposals.

Another perspective was that in many respects, H2020 as a whole is still orientated to the research practices and business models of academic institutions and still needs to adjust to those of the other participants in the Programme. Again, the message has been that, in spite of recent improvements, there is still some way to go.

III – Research and Industry and their interaction

In some respects, the interaction of research and industry and even the relationship between Higher Education and other research institutions is easier to manage under the Societal Challenges than it is in other parts of H2020. The conceptual orientation of a challenge-based programme encourages a practical orientation and integration of the activities of the principal partners. Furthermore, the nature of the challenges chosen for the Programme also helps. The health sector, for instance, has a long history of integrating basic research into the development of treatments and the pharmaceutical industry has one of the highest levels of investment in research of any sector in a modern economy. Similarly, the energy sector, especially in its more dynamic parts, requires an integrated approach to developing cost-effective forms of energy generation and distribution. Even in relation to Europe in a Changing World, with its orientation towards understanding the critical issues facing Europe and hence requiring academic research, areas of investigation such as new forms of innovation aim to have a significant input from businesses, public authorities and communities.

Nonetheless, as will be seen in the next chapter, there are calls for more to be done in addressing particular aspects of the integration of the activities of the different parties and some particular problems have been raised. One of these concerns the integration of social sciences and the humanities into the Programme. It has been suggested in interviews that since this element entered into the design of the Programme at a relatively late stage, there were problems in the basic programme design and, in particular, a tendency to assume that the nature of the Societal Challenges being addressed were well-understood and that the main challenge therefore was to find appropriate solutions. A better integration of SSH contributions into the research carried out under all the Societal Challenges was required, it was said, as well as a dedicated programme under SC6. Comments in the Monitoring Report seem to agree that while progress was made in 2015, there is still more to be done in achieving this integration.

IV – Health, energy & Europe in a changing world; real projects at an EU & national levels

The examples of projects and actions presented in section 2.1 and in this section of the briefing provide snapshots of particular developments. These are inevitably partial pictures, but have the merit of providing concrete illustrations of the work that is being undertaken.
The three projects described in boxes in section 2.1 on rare diseases, alternatives to fossil fuels and early job-insecurity are typical of projects supported in terms of the subject matter addressed by SC1, SC3 and SC6 respectively - in as far as it is possible to talk of ‘typical projects’. Three other projects are summarised in this section, but they are slightly different in that they illustrate more the involvement of a range of organisations in some of the wider aspects of the Programme, including the use of different support instruments.

The first relates to a COFUND action supported under SC1 that in turn contributed to the work of the Joint Programming Initiative on Antimicrobial Resistance Research. In this case, the organisations supported were mainly academic research institutions, though with some hospital involvement.

Box 3.2 COFUND action relating to Antimicrobial Resistance

<table>
<thead>
<tr>
<th>Societal Challenge: Health, Demographic Change and Wellbeing</th>
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</thead>
<tbody>
<tr>
<td>Antimicrobial Resistance</td>
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</table>

Support to the Joint Programming Initiative on Antimicrobial Resistance Research

Antimicrobial resistance (AMR) is resistance of a microorganism to an antimicrobial medicine to which it was originally sensitive. It is predicted that by 2050, 10 million people a year will die as a result of drug resistant infections and the World Health Organisation considers antibiotic resistance to be one of the three greatest threats to human health over the next few decades. Antimicrobial resistance therefore constitutes a major societal challenge, but it is also an area where international co-operation is crucial for slowing its spread and finding effective alternatives.

Since 2014, EU Member States and others (currently 15 Member States and 7 others) have co-operated in the Joint Programming Initiative on Antimicrobial Resistance Research (JPI-AMR), principally through national research funding agencies. JPI-AMR, in turn, collaborates closely with the World Health Organisation’s AMR Global Research Agenda and the WHO AMR Global Action Plan. Four joint transnational calls for research proposals were made by JPI-AMR during the 2014–2016 period, making up to €55 million of funding available.

Horizon 2020 has contributed financially to these developments solely through an ERA-Net Cofund action, which topped up a major call in 2016 on the Transmission and Selection of Resistance in Humans, Animals, and the Environment. Projects funded will provide a better, quantitative understanding of the dynamics of transmission and selection of antimicrobial resistance (AMR) at genetic, bacterial, animal, human, societal, and environmental levels and consequently will help in the design and evaluation of preventive and intervening measures for controlling resistance.

The contribution to the direct funding of projects under the ERA-Net Cofund action contrasts with the indirect support in the form of the promotion of networking through ERA-Nets in earlier programmes (FP7 and FP6). In fact, ERA-NETs based on a Coordination and Support Action (CSA) are no longer possible.

The call was launched in January and closed in July 2016. Of the 83 initial proposals, it was announced in November last year, 19 project consortia with a total of 96 research groups from 16 countries were selected and awarded 28.3 M EUR for projects of 3 years duration. 6 projects addressed human transmission and 13 ‘One Health’ transmission, involving a wider range of health environments.
In terms of the nature of the participants, the predominant type of institution involved was university departments or specialised research institutes, though from a variety of disciples. The projects addressing human transmission were more likely to include hospitals in the research team.

The next case illustrates the use of the SME Instrument to support a single Estonian SME in developing and marketing ultracapacitors and thus make a contribution to addressing a key innovation bottleneck in the energy field.

Box 3.3 SME Instrument Project relating to Addressing Key Innovation Bottlenecks in the Energy Field

<table>
<thead>
<tr>
<th>Societal Challenge: Secure, Clean and Efficient Energy</th>
<th>Addressing Key Innovation Bottlenecks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulating the innovation potential of SMEs for a low carbon energy system</td>
<td></td>
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</tbody>
</table>

The creation of better energy storage capacity is one of the significant bottlenecks in the overall development of efficient alternative energy sources. SMEs play a crucial role in developing resource-efficient, cost-effective and affordable technology solutions which can help decarbonise the energy system and make it more efficient in a sustainable way. They are expected to contribute significantly via the SME Instrument to meeting many aspects of the Societal Challenge ‘Secure, Clean and Efficient Energy’, but in this case to an issue of strategic importance.

Under the SME Instrument phase 1 call (2014), among others, the project the SKLCarbon project (EU contribution EUR 50,000) addresses the European and global challenge of developing low carbon and efficient energy systems. Ultracapacitors212 are playing an increasingly important role as efficient high power energy storage devices. In this context, the nanoporous carbide-derived carbon (CDC) ultracapacitor technology, developed and patented by Skeleton Technologies, will facilitate advanced energy efficiency and energy recapturing systems, and will support renewable energy production and smart grids.

The project beneficiary is an Estonian enterprise, Skeleton Technologies, which is a developer and manufacturer of high performance ultracapacitors, devices which store and deliver energy much more rapidly than conventional batteries. Their specialist technology, based on in-house-manufactured nanoporous carbide-derived carbon (CDC) electrodes, produces 2.5 times the power to weight ratio, subsequently a 40% reduction in costs, compared to the state of the art.

The company aims to build on successful sales in niche space and motorsport markets, by up-scaling CDC production, reducing costs, allowing a more ubiquitous adoption of their products for energy-saving applications in price-sensitive markets. The Phase I feasibility study is comprised of two consecutive parts: 1) completion of the planning for the up-scaled CDC production facility (to be implemented in the 24 month Phase II project), and 2) conduct of collaborative consultation with other ultracapacitor manufacturers, who will be early adopters of the CDC. In November 2015 Skeleton Technologies were also selected for a SME Instrument Phase 2 grant (EU contribution 2,489 million). The project that is financed under this second grant is geared towards the

212 Ultracapacitors are high-power energy storage devices with more than 100 times increased power density across more than a million life-cycles, compared to the best battery technologies.
scale-up of the graphene-like carbon production, which involves the development of a next generation larger reactors.

Initially, Skeleton Technologies will fulfil explicit demand in the automotive industry for high current, high power/weight ultracapacitors, facilitating advances in stop-start, regenerative braking and cold starting technologies. Applications have also been identified in smart grids, supporting renewable energy sources and circumventing power outages. Actually, Skeleton plans to market its specially treated CDC materials to manufacturers of ultracapacitors and Li-ion capacitors, and to investigate further identified uses, such as in advanced batteries, gas adsorption, water desalination and as a catalyst in fuel cells.

The final example is an Innovation Action project, funded under SC6 illustrating how support can be provided to a SSH project, involving a wide range of actors, with the intention of directly generating change in policy processes, in this case with the support of an ICT platform.

Box 3.4 SC6 Project Promoting the Engagement of Young People

<table>
<thead>
<tr>
<th>Societal Challenge: Europe in a Changing World</th>
<th>Young People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Societal and political engagement of young people in environmental issues (STEP)</td>
<td></td>
</tr>
<tr>
<td>Young people have to live with the consequences of current decisions and over a longer period. Their participation, therefore, in decision-making processes on environmental issues is perceived to be particularly relevant. Despite that, research has highlighted that young people often distrust the European Union and traditional channels of representative democracy only partially stimulate young people’s interest in active participation. In this context, the STEP project aims to motivate young people to participate in decision-making processes on environmental issues, by developing and pilot testing a cloud eParticipation platform.</td>
<td></td>
</tr>
<tr>
<td>The platform is provided through a web/mobile dialogue where local government representatives and young citizens identify, discuss and find solutions on problems related to local environmental issues. Young people can highlight their local problems and create campaigns; they can also organise and join local petitions as well as being involved in round-table dialogues with other stakeholders. An innovative aspect of the platform is the incorporation of gamification and visualisation features aiming to increase the attractiveness of involvement. At the same time the eParticipation platform enables policy makers to analyse and develop new insights based on innovative social media analytics and monitoring tools.</td>
<td></td>
</tr>
<tr>
<td>The project operates from June 2015 to November 2017. The complex nature of the project has required the involvement of a wide range of partners, including private companies (7), higher education organisations (1), public bodies (5), research organisations (1) and an EU organisation platform active in the area of environmental protection. Project partners initially conducted in-depth research and analysis to define the target groups and understand the potential uses of the platform as well as user requirements, supported by the technical requirement analysis, which defined customer and functional requirements and system requirements (including software and hardware). The platform was then integrated and five “real context pilots” were</td>
<td></td>
</tr>
</tbody>
</table>

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implemented with the support of regional authorities and municipalities. The “real context pilots” have been organised in 4 countries (Italy, Spain, Greece and Turkey).

Horizon 2020 has contributed more than 80% of the total cost through an Innovation Action. The support allowed public authorities to open up their decision-making processes to young people and to encourage their social and political engagement in a relatively short time span. The project complements earlier eParticipation projects and research activities focusing on the use of ICT for engaging citizens in politics that were funded through previous framework programmes. The objectives are also in line with the overall goals defined in major EU policy initiatives related to young people, such as “Youth on the Move”, the “Youth Employment Package” and the “Youth Guarantee”.

It is difficult to say that these cases are representative in any way, but they do provide concrete illustrations of the type of activities supported under the Societal Challenges pillar.

V – Synergy and complementarity with other EU and national programmes and with third countries

The emphasis placed on research and innovation by the European Structural and Investment Funds (ESIF), plus the support envisaged for the pursuit of energy and environmental objectives, make them a very significant parallel instrument to Horizon 2020, especially in addressing Societal Challenges, which are often echoed in the concerns addressed in the Operational Programmes at national and regional level, through which the ESIF are largely implemented. The European Regional Development Fund (ERDF), for instance, will invest an estimated € 100 billion in R&I in the period 2014-2020 and there will be an estimated € 38 billion invested in the low carbon economy over the same period, through funding actions such as the take-up of energy efficiency and renewable solutions.

Other programmes, such as COSME and Erasmus+, can also be very complementary to actions undertaken under H2020 or their further development, by providing further access for SMEs to finance and advice and assistance or by helping to develop capacities, especially of staff and young people. However, interviewees commented that often H2020 participants are not aware of the support available from these other sources or find it difficult to make use of them.

Nevertheless, the main issues are with the integration of the addressing of Societal Challenges and the parallel activities being pursued by the ESIF. Here there are a number of considerations. First, it must be remembered that H2020 and the ESIF have different (though overlapping) objectives. This then leads to other differences, such as the territorial distribution of funds. Whereas H2020 has a tendency to concentrate funding in countries and regions that are already relatively developed, the ESIF, and especially the ERDF, specifically set out to allocate funds to regions that are less developed. To an important extent, these processes compensate each other. A large part of R&I funding in newer Member States, for instance, has come from ESIF or their equivalents in earlier programming periods. There are though also more direct complementarities. The 2nd SC3 Work Programme, for instance, encourages synergies between Horizon 2020 and other European Union funds, such as European Structural and Investment Funds (ESIF) in order to increase ‘the impact of both funds in terms of scientific excellence and place-based socio-economic development’.
Possible tensions do arise from the respective emphases of the two Programmes. H2020, for instance encourages development of the ‘knowledge triangle’, consisting of the interaction of research, innovation and education, while the ESIF and particularly the ERDF refer frequently to the ‘triple or quadruple helix’, where the emphasis is on the interaction of the main actors promoting regional development: government, industry, academia and civil participants. Similarly, there are possible tensions between addressing societal challenges and pursuing the smart specialisation promoted by the ESIF in that the former encourages a focus on issues that are common to all European societies, whereas the latter approach is based on the perceived need for regions to concentrate their R&I effort on a restricted number of areas where they enjoy relative competitive advantages.

The two approaches are not necessarily in contradiction, but there are possible incompatibilities, in the choice of a focus for national strategies, for instance. Some countries, such as France, have identified their own list of societal challenges, which overlap with those identified at an EU level. Others, such as the UK and Ireland, have identified R&I priorities, in an approach more influenced by smart specialisation. The danger is that one approach might divert attention away from the need for the other.

More generally, in terms of the relationship between EU and national support for R & I, there are very significant differences between Member States, especially in relation to the relative importance of funding sources. Larger countries tend to have their own well-established research programmes, whereas in smaller countries, there is more often a greater reliance on EU funding. This partially explains the differences in the extent to which encouraging participation in H2020 figures in national research strategy. Smaller countries, for instance, see H2020 as a way to establish world-class research institutions that it would be difficult to support from national resources alone. However, in all cases, the internationalisation of research has tended to underline the importance of international programmes such as H2020 and has also tended to encourage a convergence around similar research objectives.

The position of third countries in R&I under the Societal Challenges varies considerably. The Monitoring Report shows that the largest EU Contribution in absolute terms in 2014 - 2015 went to third country participants under SC1 – health. This amounted to €17.1 million or 1.3% of the total. Under SC3 - energy, by contrast, third countries only accounted for €4.9 million or 0.4%. The highest share in relative terms was in fact under SC6 (3.2%), with another relatively large absolute contribution of €15.5 million or 2.1% being allocated under SC5 - Climate action, environment, resource efficiency and raw materials. Overall therefore, although involvement of participants from third countries has not been major under the Societal Challenges (in contrast say to Leadership in Enabling and Industrial Technologies, where 10.2% went to third countries) they have been making use of the possibility to work with researchers and other partners from around the world.

VI – Assessment of achievements and outstanding challenges

It is still early days to make an assessment of the results and impacts from projects supported under the Societal Challenges pillar. However, there are some initial indications given in the Monitoring Report, especially from projects that began in 2014.
Table 3.1 Societal Challenges – Performance indicators 2015

<table>
<thead>
<tr>
<th>Performance indicators</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health, demographic change and wellbeing (SC1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of publications in peer-reviewed high impact journals</td>
<td>112</td>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>Number of patent applications</td>
<td>14</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Number of patents awarded</td>
<td>9</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy (SC2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of publications in peer-reviewed high impact journals</td>
<td>81</td>
<td>0</td>
<td>81</td>
</tr>
<tr>
<td>Number of patent applications</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Number of patents awarded</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Secure, clean and efficient energy (SC3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of publications in peer-reviewed high impact journals</td>
<td>38</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>Number of patent applications</td>
<td>17</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Number of patents awarded</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Share of the overall Energy challenge funds allocated to market-uptake of sustainable energy solutions</td>
<td>13.9%</td>
<td>14.5%</td>
<td>14.2%</td>
</tr>
<tr>
<td>Primary energy savings triggered by the market uptake project (GWh/year per EUR million, projected)</td>
<td>20</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>Total amount invested by stakeholders in sustainable energy as direct or indirect result of the measures developed by the market uptake project (EUR million, projected)</td>
<td>450</td>
<td>400</td>
<td>850</td>
</tr>
<tr>
<td>Smart, green and integrated transport (SC4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of publications in peer-reviewed high impact journals</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Number of patent applications</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Number of patents awarded</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Climate action, environment, resource efficiency and raw materials (SC5)</td>
<td></td>
<td></td>
<td></td>
</tr>
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It is apparent that SC1 and SC2 have generated a relatively large number of publications in peer-reviewed high impact journals and all challenges other than SC6 have generated patent applications and some patent awards. For SC3, there are already some other indications of impacts on energy efficiency. In 2015, 14.5% of the budget in the Energy Challenge has been dedicated to market uptake of sustainable energy solutions, in line with the Commission’s commitment. In addition, while final results will only be available after projects finish, the values of indicators at the proposal stage suggest that for the funded market uptake projects resulting from the Energy Efficiency call 2015 are expected to trigger around 30 GWh/EUR million in energy savings and more than EUR 400 million of investment in sustainable energy.
Chapter 4. The Design of Horizon 2020 – Societal Challenges

Key findings

- Views about the future development of the Programme are presented, especially from the reports of the Expert Advisory Groups in relation to the three Challenges in focus.
- Key issues for the future are set out. ICT developments and especially big data are highlighted, the latter as an area where Europe has competitive advantages.
- The ‘valley of death’ between research results and commercialisation is still an important issue, though some Challenges are doing better than others in addressing it.
- The contribution of the Social Sciences and Humanities to H2020 is a matter for further consideration.

I – Societal Challenges in relation to the overall Horizon 2020 programme

As a distinctive and new element in Horizon 2020, the Societal Challenges have epitomised the new orientation of the whole programme towards addressing issues set out in the EU’s strategy document Europe 2020. They have been implemented according to plan, in broad terms, but more detailed consideration has revealed differences in approach between the different Challenges that serve to provide lessons for the others, especially in the area that is of particular interest for this briefing – the involvement of a range of research and industry actors and the relationships between them.

II – Potential improvements in the mechanisms for addressing societal challenges

An important focus for improvements in the implementation of the Societal Challenges pillar of H2020 is the reports of the Expert Advisory Groups (EAGs) on priorities for the 2018-20 period. Each Challenge has its own report.

The EAG Report on SCI built on the work of 15 sub-groups and listed the main research priorities it advocated under 7 vertical themes (Personalised medicine, Rare diseases, Infectious diseases, Non-communicable diseases, Paediatrics, Public health and prevention including migration and Active and healthy ageing), 4 horizontal themes (including Big data and eHealth, mHealth & ICT) and four Cross-Cutting issues (including SSH integration, Sex and gender differences, Commercialisation and Encouraging stronger and successful involvement of EU-13.

In the programme set out, there is an emphasis on areas where European co-operation can add most value and also on strategic considerations. For instance, the inclusion of Paediatrics is justified in that many diseases starting in childhood persist throughout life.
(e.g. allergies, autoimmune diseases, neuropsychiatric disorders, obesity). Their early diagnosis and treatment will impact on health throughout life. There is also an emphasis on areas where European co-operation can add most value and also on strategic considerations. Other priorities are explained as a reaction to current challenges. For instance, the inclusion of public health and prevention including migration was motivated by the challenges of increasing migrant populations in the form of different genetic patterns and different childhood immunisation levels, as well as the strategic consideration that public health data will form a major science base for improving health in Europe. There is also considerable emphasis on big data as an issue that affects most areas of medicine and health. This is an area where Europe enjoys considerable competitive advantages, through the widespread operation of public services. Efficient use of big data requires interoperability and standardisation of different datasets, and requires public acceptance based on assurance of the protection of the privacy of individuals. Big data is therefore highlighted as the overarching theme for health research (and it is also relevant for the other societal challenges), though important developments are proposed in the eHealth area too, with a significant role for the public sector in stimulating public confidence about health data governance.

Commercialisation is also identified as a major theme to be addressed. A significant issue is moving from research to commercialisation and especially in navigating the ‘valley of death’ encountered when enterprises seek to exploit the results of research. Practical suggestions included addressing barriers in the form of finance, facilities, such as science parks, strengthening assistance for IPR management and interaction with corporate decision makers. Over the longer term there needs to be an increased use of truly innovative open-innovation and R&D models.

For SC3, the Advisory Group on Energy pointed to the energy ‘trilemma’, which is to secure sustainable, affordable and safe generation with reliable supply and the need for more effort, increased R&D Budgets and critical mass, not least by a better integration of business, political and social aspects with the development of technology. As part of a broader industrial strategy for energy, RTD efforts should be focussed on Smart Grids, storage technologies and their implementation, market design, a new system analysis and design and management improvements. Increasing the interconnection between the energy subsectors (e.g. electricity and heat) is key to further development.

Engagement with cities and urban development is also of increasing importance. The complexity of urban transition processes leads to a growing demand for policy support for a holistic integrated approach and this includes the understanding of actual and future citizen needs. Consumer behaviour is of utmost importance for Energy Efficiency.

AGE members pointed to the limitations of the PRIMES model set out in the Energy 2050 Roadmap. Open source software is missing to enable stakeholders to access reliable, easily adaptable data and guidance on which climate and energy policies will reduce GHG emissions most effectively and at the lowest cost. AGE suggests setting up an EU wide modelling Forum.

Digitalisation enables radically new business models to be developed and more generally, it was stated that ‘the energy (and transport) sector will go through fundamental changes in the forthcoming decade due to digitalisation. Horizon 2020 should embrace this ICT-based revolution, utilise it and support European society and companies to grasp these new market opportunities.’
Finally, reducing investment costs in order to become more competitive was said to be an important policy aim, not least through the use of new planning tools.

The EAG for SC 6 - Europe in a changing world recalled that the rationale and objective of this Societal Challenge is to foster greater understanding of a culturally and socially rich and diverse Europe and how it needs to adopt new paradigms for change in a context of unprecedented transformations and growing global interdependence. In spite of the range of potential issues to be addressed, it proposed a focus on three major themes: migration; the human and social dynamics of the Fourth Industrial Revolution; and governance for the future.

The nature of SSH requires a strong prioritisation of systematic, inclusive, interdisciplinary, cross-national and rigorous comparative analyses. In addition, there is the need for a continuing focus on ICT as the critical infrastructure, especially to handle the increasingly large data sets in both SSH research and innovation. Supplementary research and innovation approaches are recommended where appropriate, including Participatory research and innovation, Rapid reaction research and innovation, Modelling and improving the relationship between research, innovation and policy and Use-inspired basic research. It is also important to understand the nature and potential of ‘radical innovations’ (in contrast to incremental innovation) as unanticipated, game-changing answers addressing complex and interdisciplinary societal challenges.

The three main challenges identified for the final period are seen to have major implications for all of the other challenges and an important role for SC6 is precisely in helping to develop a clear understanding of their implications for the other activities carried out in this part of H2020. The 2015 Monitoring Report claimed progress in this respect since the beginning of the Programme, but acknowledged that further progress was required.

**III – Main achievements and main challenges (research and industry perspective)**

The Societal Challenges have already made a good start in pursuing their established objectives and have generally succeeded in involving the expected mix of partners, with important inputs from higher education, research organisations and industry. The priorities for the final period of the Programme (2018-2020) therefore build on those decided for the first two Work Programmes, though with differences in emphasis and in the case of SC6 a greater focus on just three major challenges.

A common theme for all the Challenges is the need for ICT developments to support their work, but, in particular for more support to be devoted to big data, where it is thought that Europe often has competitive advantages.

The Challenges have been seen to have differed in the extent to which they have encouraged the participation of businesses. The EAG for SC1 – Health, in particular, saw a need to have better support for moving from research to commercialisation especially in navigating the ‘valley of death’ encountered when enterprises seek to exploit the results of research.
Chapter 5. Conclusions & Recommendations

Key findings
- Conclusions are summarised, though they are still provisional.
- Recommendations are made reflecting the main findings.

I – Conclusions

Any conclusions of this stage of the Programme are necessarily provisional. Nonetheless there are some clear indications emerging from the experience of the first three years of the Programme.

The implementation of the Societal Challenges part of H2020 can largely be said to be proceeding according to plan, although also building on the achievements of earlier Framework Programmes. There have been clear advances, for instance, in terms of involving more SMEs and in engaging with a significant number of newcomers to the Programme. Debates about the priorities for the final period of the Programme have been assisted by the work of a series of Expert Advisory Groups, whose detailed recommendations need to be followed up.

There do appear to be differences between Challenges in the pace of implementation and especially in the ways that private sector organisations and SMEs are engaged in exploiting the results of research. To an important extent this reflects the nature of the challenge under consideration, but there are lessons that some Challenges could learn from the others about encouraging greater industry participation, possibly through the greater use of the full range of the instruments or actions that are available under the Programme.

There are some complex issues in the interaction of H2020 with other EU and national programmes, especially in relation to the relative distributions of the budgets and the need to align the differing objectives of the respective Programmes on the ground.

The contribution of the Social Sciences and the Humanities to addressing Societal Challenges can be still further developed, building on the progress already made.

II – Recommendations

Recommendations arising from the examination of the implementation of the Societal Challenges pillar of Horizon 2020, from the research and industry perspective are:

- There could be greater cross-fertilisation and learning from the experience of the different Societal Challenges, especially in terms of the experience of using the full range of actions or instruments available and of engaging industry input into research and innovation.

- ICT support and especially big data are issues that affect all of the Challenges and that need further consideration and work.
Further progress is needed in the integration of Social Sciences and Humanities elements into mainstream research and innovation processes. In many areas, including health and energy, these considerations are critical, not least for defining the development path of the relevant technologies.

- Oversubscription is a major problem in the Societal Challenges area, as much as in other parts of H2020, and suggests that there are considerable innovation opportunities in the form of good projects that are seeking funding, but which are unable to access it from H2020.

- The possibility that evaluation processes are introducing a bias in favour of certain alternative energy technologies needs to be investigated.

- Further definition is required of the issues affecting enterprises seeking to exploit initial research results and facing the ‘valley of death’ and the remedies suggested (especially by the EAG SC1) need to be examined in greater detail.

- The interaction between the implementation of the Societal Challenges and that of other EU programmes, especially the European Structural and Investment Funds, needs to be examined more closely on the ground in order to ensure that the differing approaches are consistent or rather positively reinforce each other. Smart specialisation, for instance, should not detract from tackling broad societal challenges.

- Efforts should continue to present an overall picture of EU expenditure in the annual Monitoring Reports and not only expenditure covered by the Work Programme. This will require more data on Joint Programming Initiatives and on public-private partnerships that are not covered by the Work Programme, for which currently there is only partial information, mostly presented in annexes.
ANNEX A - REFERENCES:


EUREC (2016) Feedback on two years of Horizon 2020


http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=23042&no=1

http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=25452&no=1


ScienceBusiness, (2015c). SME instrument is popular but 90 per cent of projects do not make the grade. Article by Florin Zubascu, published on line Science Business 09 April 2015


### ANNEX B - LIST OF PEOPLE INTERVIEWED

Interviewed directly or with written responses.

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<th>Category of stakeholder</th>
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<td>European Commission</td>
<td>Olivier Le Dour</td>
<td>DG Research &amp; Innovation E1 - Health Research - Strategy</td>
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<td>European Commission</td>
<td>Gwennaël Joliff-Botrel (Head of Unit) and Thomas Schubert (Policy officer)</td>
<td>DG Research &amp; Innovation G1 Energy - Strategy Unit</td>
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<td>European Commission</td>
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<td>DG Research &amp; Innovation B5 - Spreading of excellence and widening participation</td>
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<td>Expert Advisory Group</td>
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ANNEX VI

THE IMPLEMENTATION OF HORIZON 2020

- SOCIETAL CHALLENGES -

Economic and financial perspective

Briefing paper
by Europe Economics

Abstract

This report is an evaluation of H2020 funding, from an economic and financial perspective, of the Societal Challenges pillar. The pillar is designed to respond to societal priorities identified in the Europe 2020 Strategy. In this report we focus on three specific sub-areas: Health, demographic change and wellbeing; Secure, clean and efficient energy; and Europe in a changing world - inclusive, innovative and reflective societies.

Horizon 2020 is received very positively by the different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions by some of our interviewees. There is a good cooperation between institutions to get funding (88% of total spending is on projects involving 5 or more institutions) and across EU Member States (68% of total spending is on projects with more than 5 EU Member States).

Our main conclusions show some concerning issues around the problem definition, envisaged impacts of the interventions, ex-post monitoring and evaluation of the projects, budgets and the problem of oversubscription, and evaluation of proposals. We also show our conclusions in relation to cross-country cooperation, the synergies with other programmes and the simplification of the regulations. Recommendations are provided to correct for such problems.
AUTHOR
This study has been written by Dr Pau Salsas, Kareen El Beyrouty, Summayah Leghari, Simona Castellini (Europe Economics) and Jacqueline Snijders (Panteia) at the request of the Impact Assessment Unit of the Directorate for Impact Assessment and European Added Value, within the Directorate General for Parliamentary Research Services (DG EPRS) of the General Secretariat of the European Parliament.

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Executive summary

This report is an evaluation of H2020 funding, from an economic and financial perspective, of the Societal Challenges pillar. The pillar is designed to respond to societal priorities identified in the Europe 2020 Strategy. In this report we focus on three specific sub-areas: Health, demographic change and wellbeing; Secure, clean and efficient energy; and Europe in a changing world - inclusive, innovative and reflective societies.

Methodology

We have used the following tools of analysis throughout the study: Data analysis using financial and programmatic data from CORDIS; Information and budgetary data from H2020 Work Programmes; Stakeholder interviews; Case studies; and Desk research.

The current study has been undertaken with limited time and resources and does not aim at a comprehensive evaluation. Our findings have been based on the judgement to inform a high level opinion of the implementation of the programme.

Main Findings and Conclusions

Horizon 2020 - Societal Challenges is positively perceived by stakeholders. Budgets have been spent as envisaged and we have received favourable opinions from stakeholders.

There is a good cooperation between institutions to get funding and across EU Member States, although the participation of non-EU countries is low.

The impacts of the programme are difficult to be assessed at this very early stage, especially with respect to the economic growth and boosting job effects.

Societal Challenges calls and workplans are designed to take into account specific problems within the different sub-areas of the programme. However, it is difficult to identify an association between the rationale for each funding and the tools and types of action needed to overcome market failures. This results in stakeholders not having a clear vision of the need for each type of intervention and believing that the design of the programme is unbalanced towards certain type of actions (more applied innovation).

There is some lack of understanding on how impact indicators can be translated into additional benefits for society. Indicators tracked across all H2020 projects can be suitable for measuring some of the expected outputs, but they cannot measure the expected impacts in all areas. Although it may not be feasible to translate the impacts of every call to indicators of growth, employment and improvement of lives, there could be some benefit in developing a methodological approach to assess the success of the different projects.

The high participation in H2020 has increased competition for funding with respect to FP7. The high participation can be interpreted as a good achievement for the programme in reaching a broad audience and increasing competition. But, on the other hand, stakeholders have stressed some adverse effects this has on the motivation of excellent researchers. There may be arguments for increasing or reallocating some of the budgets. If this is the case, this may be done by selecting those areas where impacts are expected to be higher.
The evaluation process is the object of some critiques. Stakeholders raised concerns about a lack of transparency in the evaluation. In particular, the evaluation process comes across as a lottery to applicants in calls with very high participation rate.

There is low involvement of countries belonging to the EU-13 group and non-EU countries. The pursuit of excellence leads to a situation where research tends to be focused around centres where this is carried out more efficiently. This can be seen as a positive result because it pursues allocation efficiency and selection of the best research centres, but it can also exclude participation from countries less advanced in those areas. However, one of the objectives of the Societal Challenge pillar is to create inclusive societies and improve lives. At times this may be in contradiction with the objective of Excellence Science so it would be advisable to establish the circumstances under which one or other (or both) objectives can be achieved.

We have identified a number of synergies and existing complementarities between EU and national programmes and in many cases these seem to work well. However, we found that the large number of existing programmes and satellite initiatives resulted in a landscape that is not simple for participants. This happens because of the existence of overlaps.

Significant steps towards simplifications have been taken in H2020 as compared to FP7. The participant portal and its integrated use for the whole process from proposal submission to final reporting is one of the most visible examples. However, some bureaucratic barriers are identified in the legal and financial implementation of H2020 in areas such as internally invoiced costs and personnel costs.

**Recommendations**

To correct for the identified problems we would recommend the following:

**Recommendation 1:** The strategy for each of the calls under the programme should be more developed. This should take into account issues such as the problem definition (market failure to be corrected for, social impact, externalities and “spill-overs”, as identified in the impact assessment), envisaged impacts of the call and expected ex-post metrics for measurement of outcomes and impacts.

**Recommendation 2:** Assess size and scope of the calls using the evidence provided in Recommendation 1. Given the assessment it may be possible to rank the different calls and prioritise the funding for those that yield higher return to society.

**Recommendation 3:** There should be a close monitoring of project outputs. The outputs should take into account metrics developed as part of Recommendation 1 but should also design a strategy for dissemination of results.

**Recommendation 4:** Improve quality control mechanisms for the evaluation process of applications. Options could include establishing consensus for the approach to be used in the evaluation of calls or train the evaluators. Another option could be to develop further a two-stage approach to evaluation.

**Recommendation 5:** Clarify the policy objectives of H2020 such that it is focussed on excellence and leadership at the European level. It may help to delimit the scope of the
programme such that it is easy to link to other programmes without overlapping in the objectives.

Recommendation 6: The Commission may think about further improving the process of cost reporting and reducing burdens for SME. This could be done by strengthening the interaction and coordination between NCPs and applicants.
Chapter 1 – Introduction

The objective of this briefing paper is to assess, from an economic and financial perspective, the implementation of the Horizon 2020 framework programme as regards the priority “Societal Challenges”. The paper is part of three evaluation studies (the other two being the assessment of “Excellent science” and “Industrial Leadership” priorities) which have been undertaken in parallel to this research.

In this chapter, we present a brief introduction to Horizon 2020 (H2020) and describe the Societal Challenges section of Horizon 2020, along with the methodological tools we have employed in our investigation on the progress of Horizon 2020 from a financial and economic perspective.

I – Introduction to the programme

The general purpose of Horizon 2020 is to “take great ideas from the lab to the market”. It is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe’s global competitiveness.213 Horizon 2020 has broken down its focus into three main pillars:

- excellent science to strengthen the Union’s world-class scientific excellence and make the Union’s research and innovation system more competitive;
- fostering industrial leadership to speed up the development of technologies that will support businesses and innovation, including for small companies; and
- tackling societal challenges to respond to the priorities identified in the Europe 2020 strategy.

In addition, there are three horizontal programmes (“Spreading excellence and widening participation”, “Science with and for society”, and “Fast Track to Innovation Pilot”) and three smaller blocks (“EIT - European Institute of Innovation and Technology”, “Euratom”, and “Smart Cyber-Physical Systems”). There are also three separate cross-cutting calls: Industry 2020 in the Circular Economy, Internet of Things, and Smart and Sustainable Cities.

The objectives of Horizon 2020 can be summarised in the following high-level goals:

- More breakthroughs, discoveries and world-firsts: The programme aims to deliver radical technological change, not changes by small increments.
- Driving economic growth and creating jobs: Economic impacts of the project are expected to affect two areas — GDP growth and job creation.

213 FP7 was the European Union’s Research and Innovation funding programme for projects which started in the time period 2007-2013. Horizon 2020 is the sequel of this programme and covers projects initiated between 2014 and 2020. The focus and the budget of FP7 and Horizon 2020, however, differ. FP7 focused on research only, while Horizon 2020 focuses on both research and innovation. Moreover, FP7 had a budget of €55 billion compared to around €79 billion for Horizon 2020.
Smart, sustainable and inclusive growth and jobs: The programme is expected to produce a certain type of GDP growth and jobs.

Produce world-class science: research produced should rank in the top internationally.

Remove barriers to innovation: Projects funded should have positive externalities for other potential innovations.

Facilitate public-private cooperation in delivering innovation: it should create partnerships or lead to innovations that are beneficial to both the public and private sectors.

In this briefing paper we focus specifically on the Societal Challenges section of Horizon 2020. It seeks to support policy priorities from the Europe 2020 strategy, addressing the main concerns of the citizens of Europe and other regions. The section funds a diverse range of activities across the spectrum of research to market, and it contains a new focus on innovation-related activities. The section contains seven sub-topics:

- Health, demographic change and wellbeing;
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy;
- Secure, clean and efficient energy;
- Smart, green and integrated transport;
- Climate action, environment, resource efficiency and raw materials;
- Europe in a changing world - inclusive, innovative and reflective societies;
- Secure societies - protecting freedom and security of Europe and its citizens.

Following the terms of reference, this paper focuses on three areas of Societal Challenges: Health, demographic change and wellbeing; Secure, clean and efficient energy; and Europe in a changing world - inclusive, innovative and reflective societies.

II – Methodology

We have used the following tools of analysis throughout the study:

- Data analysis using financial and programmatic data from CORDIS;
- Information and budgetary data from H2020 Work Programmes;
- Stakeholder interviews;
- Case studies; and
- Desk research.

Details on the methodology are provided in the annex.
III – Structure of the document

The current study has been undertaken together with a parallel evaluation of two other priorities (“Excellent Science” and “Industrial Leadership”), but this report represents a complete evaluation of the Societal Challenges pillar, presenting the evidence from data, desk research, interviews and case studies, and our recommendations for potential improvements that could be made for the Societal Challenges pillar.

The structure of the study is the following:

- Chapter 2: Implementation of the programme (contains the progress made in the spending against the budgets and analysis of the partnerships and cross-border cooperation of the different projects);
- Chapter 3: Evidence from Societal Challenges covering desk research, interviews and case studies;
- Chapter 4: Conclusions and recommendations based on a review of the evidence in previous chapters and our economic analysis and judgement of the different results.

IV – Limitations of the study

The extension and complexities of H2020 make its evaluation a challenging task. The current study has been undertaken with limited time and resources and does not aim at a comprehensive evaluation of all the aspects of the programme.

The scope of the study is to provide a briefing paper assessing, from an economic and financial perspective, the implementation of H2020. We have used evidence from desk research, case studies, and in-depth interviews. Our findings have been based on the judgement of what we consider most relevant to inform a high level opinion of the implementation of the programme. Our conclusions exclude views and arguments which are hard to prove or contain minor details on its functions which would not allow a high-level critical review of the programme.
Chapter 2 – Implementation of the programme

In this chapter we analyse indicators which compare the indicative and realised budget (by Call, Topic and type of actions and type of funding). We also analyse the partnerships and cross-border cooperation of the different projects.

I – Comparison of indicative and realised budgets

To assess the progress in the implementation of the programme, we analyse the spending in comparison with the actual budgets allocated in the Work Programmes. This is shown using the metrics of total spending, total allocated budget, and the share of the budget spent. For description purposes we also report the number of projects and average size in the three different focus areas of “Health”, “Energy” and “Inclusive, innovative and reflective societies” (IIRS).

The initial budgets (as reported in the Work Programmes) were allocated unevenly across the different focus areas: Energy had an allocation of around €1.2 billion (for both 2014 and 2015), Health had about one half of this amount (around €0.5 billion) and IIRS around one fifth (€0.2 billion), see Table 1.

The spending however, is similar for both Energy and Health (at slightly under €0.7 billion). In IIRS, it is around one third the spending in the other areas. This implies that projects in Energy have been underfunded (only a 54% and 52% of the budgets have been achieved in 2014 and 2015 respectively), whereas the funding in Health has gone slightly beyond 100% (for both 2014 and 2015). There is also some underfunding of projects in IIRS (80% and 48% of the original budgets for both 2014 and 2015, respectively).

More than 1,000 projects have been funded in 2014 and 2015 (see Table 1). Most of these projects were in the areas of Energy and Health (less than 150 were in IIRS across both the years). The average size of the projects has been slightly under €3 million but there are some differences across areas and years. The size was quite similar for Health and Energy (slightly under €3 million in 2014 and slightly above €3 million in 2014), but very different for IIRS (the average size was €4 million in 2014 and dropped to €1.5 in 2015).

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214 The budget values do not match with the ones in the Monitoring report. We are reporting the total budget presented in the Work Programme including the budget for other actions which includes subscription fees, expert evaluation etc. (not reported in the Monitoring report). Also, the Monitoring report provides budgets from other sources. For instance, budget is provided for Call JTI-FCH in 2015 which is not present in the Work Programme.
Table 1: Details of projects granted under Societal Challenges (2014-2015)

<table>
<thead>
<tr>
<th>Area</th>
<th>Spending, €m</th>
<th>Budget, €m</th>
<th>Share, %</th>
<th>Number of projects</th>
<th>Average size, €m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>662</td>
<td>626</td>
<td>571</td>
<td>546</td>
<td>116%</td>
</tr>
<tr>
<td>Energy</td>
<td>655</td>
<td>672</td>
<td>1,222</td>
<td>1,297</td>
<td>54%</td>
</tr>
<tr>
<td>IIRS</td>
<td>210</td>
<td>136</td>
<td>264</td>
<td>285</td>
<td>80%</td>
</tr>
<tr>
<td>Total</td>
<td>1,528</td>
<td>1,435</td>
<td>2,123</td>
<td>2,173</td>
<td>72%</td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Health, demographic change and well being. CORDIS data refers to data added on 2015-07-29 and updated on 2016-09-01.

In the next tables, we further breakdown the budgets and funding in these three focus areas by Call type and Topics.

Calls refer to the different programmes being undertaken in the main focus areas.

Topics describe the different projects (within Calls) being undertaken to achieve the main objectives of the focus areas.

The analysis of expenditure and budgets has been done using CORDIS data (aggregated at Call and Topic levels) and compared with the budgets provided in the Work Programmes. When doing so, we found that some of the Calls referred to in CORDIS did not match any of the Calls in the Work Programmes (for example, projects referred to as “Adhoc” in CORDIS). In some instances, we also found that some of the budgets contained in the Work Programme were not matched by projects from CORDIS (this refers to the “Other actions” in the Work Programmes). For the remaining Calls, it was possible to establish a link between the spending and the allocated budgets in the Work Programmes.

The results are presented in Table 2.

**Table** For most of the Calls, there is a good balance between the spending and budget amounts (reaching a share of 100%). However, there are some exceptions:

Some Calls are over-spent by more than 20% or very close to 20%: HCO (121% and 127% in 2014 and 2015 respectively), EURO (121% in 2014) and REFLECTIVE (119% in 2014).

Some Calls are being under-spent by more than 20%: SCC (80% in 2014) and INT (75% in 2014).

It is also worth mentioning that the highest spending is in Call PHC (€0.5 billion or around 34% and 37% of total budget in 2014 and 2015 respectively). This is followed by LCE (26% and 27% of total budget in 2014 and 2015 respectively). PHC referes to Personalised Health Care and LCE refers to Low-Carbon Energy.
Table 2: Spending, budgets and shares by Call (2014-2015)

<table>
<thead>
<tr>
<th>Area</th>
<th>Call</th>
<th>Spending, €m</th>
<th>Budget, €m</th>
<th>Share, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>Adhoc</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>HCO</td>
<td>48</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>Health</td>
<td>PHC</td>
<td>522</td>
<td>545</td>
<td>488</td>
</tr>
<tr>
<td>Health</td>
<td>HOA*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health</td>
<td>Innovation in SMEs**</td>
<td>66</td>
<td>44</td>
<td>66</td>
</tr>
<tr>
<td>Energy</td>
<td>Adhoc</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>EE</td>
<td>104</td>
<td>104</td>
<td>98</td>
</tr>
<tr>
<td>Energy</td>
<td>FCH</td>
<td>37</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>LCE</td>
<td>402</td>
<td>368</td>
<td>359</td>
</tr>
<tr>
<td>Energy</td>
<td>SCC</td>
<td>73</td>
<td>103</td>
<td>91</td>
</tr>
<tr>
<td>Energy</td>
<td>OA*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>Innovation in SMEs**</td>
<td>36</td>
<td>31</td>
<td>34</td>
</tr>
<tr>
<td>IIRS</td>
<td>Adhoc</td>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIRS</td>
<td>EURO</td>
<td>43</td>
<td>16</td>
<td>36</td>
</tr>
<tr>
<td>IIRS</td>
<td>INSO</td>
<td>25</td>
<td>24</td>
<td>26</td>
</tr>
<tr>
<td>IIRS</td>
<td>INT</td>
<td>6</td>
<td>37</td>
<td>9</td>
</tr>
<tr>
<td>IIRS</td>
<td>REFLECTIVE</td>
<td>21</td>
<td>33</td>
<td>23</td>
</tr>
<tr>
<td>IIRS</td>
<td>YOUNG</td>
<td>20</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>IIRS</td>
<td>OA*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIRS</td>
<td>Innovation in SMEs**</td>
<td>16</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>**Total</td>
<td></td>
<td>1,528</td>
<td>1,435</td>
<td>2,123</td>
</tr>
</tbody>
</table>

Note: * Other actions include budgets in the Work Programme that could not be matched to the projects in the CORDIS database. These primarily consist of public procurement, expert evaluation, subscription etc. **Innovation in SMEs refers to projects that are funded by Societal Challenges but awarded and managed under Work Programme Industrial Leadership: Innovation in SMEs.

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Health, demographic change and well being. CORDIS data refers to data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.
All the Calls under the three focus areas are funded by different funding schemes. In the table below, we breakdown the spending on projects in Societal Challenges by different types of actions (funding schemes). Around 75% of the funding is provided under the IA (Innovation Action) and RIA (Research and Innovation Action) funding schemes as can be seen from the shares of total spending. This is followed by CSA (Coordination and Support Action) which consists of around 15% and 7% of total funding in 2014 and 2015 respectively.

Funding schemes categorised as others consist of ERA-NET-Cofund, Cofund-PCP and Cofund-PPI. ERA-NET refers to the funding of costs related to the coordination of national research programmes, 100% reimbursement rate for coordination and management costs. COFUND-PCP refers to pre-commercial procurement funded through programme COFUND grant. Cofund-PPI refers to public procurement of innovative solutions funded through programme COFUND grant.

As seen from the table, very small percentage (only 4% in 2014 and 5% in 2015) of funds is coming from these three type of actions (funding schemes).

Table 3: Spending by type of action (2014-2015)

<table>
<thead>
<tr>
<th>Funding scheme</th>
<th>Spending 2014, % of total</th>
<th>Spending 2015, % of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSA</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>IA</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>RIA</td>
<td>51</td>
<td>59</td>
</tr>
<tr>
<td>SME</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Other*</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: Other includes ERA-NET-Cofund, COFUND-PCP and COFUND-PPI.

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Health, demographic change and well being. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.

Cofund means an action funded through a grant whose main purpose is to supplement the funding of individual calls or programmes which are funded by entities managing research and innovation programmes, not including the Union funding bodies.
II – Partnerships and Cross-border cooperation

Transnational co-operation between Member States and/or between Member States and non-European countries is a condition for participating in the programme, and this is reflected in the analysis for country participation.

In the table below, we show the spending on different focus areas between different groups of participating institutions. We constructed the groups based on the number of participating institutions in each project such that projects consisting of between 1 and 4 participating institutions were grouped together under one group. Similarly, projects between 5 and 9 participating institutions were grouped together under group 5-9 and so on.

We then summed the total spending on projects within these groups and calculated the share of total spending as shown in Table 1 below. For instance, projects consisting of between 1 and 4 participating institutions in Health have a total spending of €146m which is 5% of total spending in Societal Challenges in 2014 and 2015.

The highest amount of money is spent on projects which have between 5 to 9 participating institutions (68%). Overall, 87% of total spending is on projects with 5 or more institutions.

Table 4: Spending by groups of institutions, €m, and % of total spending (2014-2015)

<table>
<thead>
<tr>
<th>Focus area</th>
<th>1-4</th>
<th>5-9</th>
<th>&gt;=10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>146 (5%)</td>
<td>964 (32%)</td>
<td>179 (6%)</td>
<td>1,288 (43%)</td>
</tr>
<tr>
<td>Energy</td>
<td>95 (3%)</td>
<td>876 (29%)</td>
<td>356 (12%)</td>
<td>1,347 (45%)</td>
</tr>
<tr>
<td>IIRS</td>
<td>115 (4%)</td>
<td>197 (7%)</td>
<td>35 (1%)</td>
<td>347 (12%)</td>
</tr>
<tr>
<td>Total</td>
<td>355 (12%)</td>
<td>2,037 (68%)</td>
<td>570 (19%)</td>
<td>2,983 (100%)</td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Health, demographic change and well being. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.

In Table 5, Table, we show the spending by number of participating countries. For each project, we calculated the number of different countries participating in the project. The projects are then divided into groups consisting of 1-4, 5-9 and 10 or more EU participating countries (a separate group is used to contain projects with any partner from outside the EU).

The total spending on projects in these groups is calculated, together with the share of the total Societal Challenges spending. For instance, projects in Health which consist of 1-4 EU
participating States had a spending of £371m in 2014 and 2015, which was 12% of total spending in Societal Challenges (Table 5).

The data shows significant cross-country cooperation in the projects: 54% of the spending is on projects with 5-9 participating EU Member (overall, 67% of total spending is on projects with more than 5 EU Member States). The share of non-EU participating countries is low: non-EU participation amounts to less than 6 million Euros (a 0.2% of total Societal Challenges amount spent).

Table 5: Spending by Non EU and different group of EU countries, €m, and % of total spending (2014-2015)

<table>
<thead>
<tr>
<th>Focus area</th>
<th>Non EU</th>
<th>EU</th>
<th>1-4</th>
<th>5-9</th>
<th>&gt;=10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>4 (0%)</td>
<td>371 (12%)</td>
<td>712 (24%)</td>
<td>201 (7%)</td>
<td>1,288 (43%)</td>
<td></td>
</tr>
<tr>
<td>Energy</td>
<td>2 (0%)</td>
<td>428 (14%)</td>
<td>738 (25%)</td>
<td>158 (5%)</td>
<td>1,347 (45%)</td>
<td></td>
</tr>
<tr>
<td>IIRS</td>
<td>0 (0%)</td>
<td>146 (5%)</td>
<td>162 (5%)</td>
<td>38 (1%)</td>
<td>347 (12%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>6 (0%)</td>
<td>946 (32%)</td>
<td>1,613 (54%)</td>
<td>398 (13%)</td>
<td>2,983 (100%)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Europe Economics calculations based on CORDIS database of signed grants and Work Programme 2014-2015: Health, demographic change and well being. Data added on 2015-07-29 and updated on 2016-09-01. Note that the numbers may not add up to the totals due to rounding to whole numbers.
Chapter 3 – Evidence from Societal Challenges: interviews and case study

This chapter discusses the specific evidence gathered on the Societal Challenges pillar of Horizon 2020 via interviews, case studies, and reviews of stakeholder documents. We describe some of the distinctive features of Societal Challenges and how these relate to objectives and impacts of the programme, participation and success rates, regulation and simplification as well as synergies with other programmes.

I – Objectives

The Societal Challenges pillar aims at bringing together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities. This covers activities from research to market with a focus on innovation-related activities and support for public procurement and market uptake.

Interviews note that a great added value of the programme is especially represented by this approach that covers the full innovation spectrum – from innovation and research to market – in order to find solutions for societal challenges such as public health, clean transport and affordable energy.

However, they also point out that there are some issues that can affect the expected achievements. This relates to:

- Need for more social dimension in the different topics.
- Need to get the right balance between research-based and applied innovation.
- Need for more social dimension

In order to accomplish the broad objectives included in Societal Challenges, interviewees stress that greater effort should be put in integrating the social dimension into the different topics. Some of them highlight that the insufficient integration of the social sciences and humanities (SSH) in the Societal Challenges priority exemplifies the rather limited notion of societal value adopted by Horizon 2020 in general. A strong science base is needed in all scientific fields, including SSH, while it seems “it has been an add-on aspect so far”.

The SSH dimension is also related to a recurrent recommendation for a greater degree of interdisciplinary research carried out under Societal Challenges. It is important to acknowledge that SSH is a broad and multidisciplinary field in itself; however, some disciplines have been widely represented so far, while others, particularly within the arts and humanities, have been almost absent.

- The Advisory Group for Health, Demographic Change and Well-being, for instance, underlines how health care research is strengthened when it is integrated with research from other fields such as anthropology, economics, psychology, political science and sociology.
- One of the interviewee also suggests that “transdisciplinary research is key for developing transformation literacy of our society, which is a prerequisite for decarbonisation”.

- Need for more social dimension
Balance between research-based and applied innovation

A significant focus is posed on incremental innovation and projects with high technology readiness levels (TRL) in Societal Challenges. For some stakeholders, this results in an increasing gap between fundamental research and closer-to-market activities with an increasing trend towards more applied innovation (higher TRL). This tendency is exacerbated by increasing participation from public-private partnerships.

Research university organizations and advisory groups express concerns about the unbalanced allocation of funding for collaborative research across the stages of the innovation pipeline (although this is a finding common across the three pillars, it seems to be particularly significant in the Societal Challenges one). As a result, there is the perception of limited connection between the technologies that bring solutions to the market, and the ground-braking research that is needed as a pre-requisite for such solutions. By focusing more strongly on the ‘market readiness’ with high TRL projects (and less on the early, critical part of the innovation pipeline) there is a risk that market innovations run dry.

II – Impacts

The impacts of the programme should be achieved by turning innovative ideas and breakthroughs into new products and services that can help European competitiveness, growth and jobs. However, these impacts are difficult to be assessed at this very early stage, especially with respect to the growth and boosting job effect.

In the area of energy, outputs may be easy to obtain as they need to be included as part of the proposals (one interviewee explained how the “expected impact” or “savings” are one of the criteria used for the selection and award of projects). However, measuring the output does not correspond to the measurement of impacts (e.g. jobs and growth). Interviews note that projections and forecasts of job creation would require the quantification of investments (especially related to energy efficiency) and it would be a very difficult assessment at this stage.

However, there are other impacts that may be considered. Stakeholders view positively the progress made in bringing together top researchers in the EU and, more generally, in helping the creation of a critical mass in different topics. This has been achieved also thanks to the greater engagement of the industry. In the Health area, for instance, positive spill-overs are expected given the very diverse types of stakeholders involved in the programme, ranging from academia and industry experts to patients.

216 Technology Readiness Levels, or TRL, are indicators of the maturity level of particular technologies. This measurement system provides a common understanding of technology status and addresses the entire innovation chain. There are nine technology readiness levels; TRL 1 being the lowest (“basic principles observed”) and TRL 9 the highest (“actual system proven in operational environment – competitive manufacturing in the case of key enabling technologies; or in space”).
III – Structure of the programme

As already anticipated, particular appreciation has been expressed on the organisation and structure of the programme, in particular in relation to the efforts to embrace the whole innovation chain: from basic to applied research (including pilot actions) and from single technology development to an integrated and complex system approach, including all relevant actors in the innovation chain (from industry to research and public bodies).

However, similarly to the other two pillars, oversubscription and low success rates remain a core issues that undermine the positive achievements of the programme.

Stakeholders stress that oversubscription leads to a waste of invested resources and, more dramatically, to losing occasionally very good evaluated projects as well as demotivating excellent researchers.

A two-stage evaluation procedure has been used by the EC in some cases to reduce the resources spent on proposals that would not receive funding. But the effectiveness of this procedure remains to be demonstrated, as the two stages can increase time-to-grant, according to one interviewee. The NCP Academy, on the other hand, comments that the way in which the two-stage evaluation procedure was implemented in calls in the programme “Health” 2014 and 2015, led to very low Stage 2 success rates negating any positive effects of the two stage procedure.

Oversubscription together with additional priorities derived from Mission Innovation challenges (following commitments to take action on increasing public clean energy R&D investment over five years) create the need for additional budget in the area of Energy, according to one of the interviewed stakeholders.

A minor point made by a stakeholder is that there are few instruments where less than three very good research centres can work together due to current programme rules.oversubscription 

Thus exceptions in the participation rules for specialised work within Health, Demographic Change and Well-being may allow participants to do better quality work.

IV – Synergies with other programmes

The European Commission and the Member States are mandated to ensure coordination, synergies and complementarities of the different EU funds. In order to achieve this goal, the Commission specifically set up a website and handbook to provide guidance in the creation of synergies between European Structural and Investment Funds (ESIF), Horizon 2020 and other related EU programmes, presenting examples of good practices. In their guidance, the EC identified five different typologies of synergies.

Our review of evidence suggests that there is some consensus on the synergies generated by H2020 with national programmes. For instance, a EC-commissioned survey of National Contact Points (NCPs) found that more than three-quarters of respondents either agreed

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217 Interviewee [S4].

or strongly agreed that H2020 adds value to national programmes in supporting cross-border R&I.\textsuperscript{219}

Within Societal Challenges, many stakeholders stressed the importance of synergies with other funding programmes. In particular, the H2020 Advisory Group on Secure, Clean and Efficient energy believes the coordination between the national and EU programmes could be increased and also between the regional/local level. For its part, the H2020 Advisory Group on Energy highlighted the importance of the coordination between H2020 and the Strategic Energy Technology (SET) Plan, the fifth section of the Commission’s Energy Union strategy, which serves as the framework for all European energy research.\textsuperscript{220}

Interviews noted that the SET plan, which sets up a communication process between the EC, Member States, the research community and industry stakeholders, is perceived as working very well and is creating a trustful cooperation between the actors. Other examples of creating synergies with national programmes in the Energy area include ERA-Nets, Joint Programming Initiatives, ECRIA projects and the EERA (European Energy Research Alliance).

In 2014, the H2020 Advisory Group for Europe in a Changing World, in its reports, recommended that Structural Funds be explored to leverage unused place-based knowledge and assets. Aside from the use of Structural Funds, it also recommended coordination with the Social Investment Package and the education programme of the European Union (Erasmus+) to support synergies in spatial and workplace development and in enhancing the skills and competences of Europeans for both vocational and non-vocational settings.

Interviewees noted that there are significant synergies and complementarities between H2020 and the EU programmes, in particular LIFE and COSME for Energy Efficiency.\textsuperscript{221} However, in areas linked to health and medicine, it is particularly complicated to develop synergies that avoid duplication effects. Recent examples of synergies between Horizon 2020 and other programmes include: IMI (Innovative Medicines Initiative) and EIT Health (European Institute of Innovation and Technology).\textsuperscript{222}

\section*{V – Cross-country cooperation}

Interviewed stakeholders are placing great emphasis on the cross-border cooperation but they see some obstacles on this objective due to the very diverse economic conditions and legislative frameworks across the Member States.\textsuperscript{223} Moreover, stakeholders witness with some concerns the decline of third country participation.


\textsuperscript{221} Interviewee [S1].

\textsuperscript{222} Interviewee [S4].

\textsuperscript{223} Interviewee [S5], Interviewee [S4].
In the **Secure, Clean and Efficient Energy** section, our interviews point out that there is great variety across countries in terms of energy efficiency standards because Member States adopted them at different points in time (e.g. Denmark has adopted building energy performance certification a long time ago while other Member States have adopted it only recently). Differences in the maturities of energy efficiency policies might in turn create difficulty in finding cross-border partners. In addition, a more strategic use from an economic point of view of the INCO (International Cooperation) instrument is recommended.

Similarly, in the **Health, Demographic Change and Wellbeing** section, it often occurs that new Member States (e.g. within the EU-13 group) end up not being highly engaged because the focus on excellence in Horizon 2020 limits the participation of the less advanced countries. These aspects pose limitations in Horizon 2020 cross-border cooperation.

Along these lines, the Advisory Group on Energy states that it is very important to align with international non-European leading research groups and emerging markets making large investments in energy infrastructure. Therefore, they recommend the development of a coherent strategy of international cooperation.

### VI – Regulation and simplification

Horizon 2020 introduced significant simplifications of the architecture, rules, procedures and control strategy of the programme with respect to previous EU funding programmes. The objective was to make the programme easier to navigate as well as more attractive to top researchers and innovative enterprises. Three specific dimensions were at the core of simplification: structure, funding rules and strategy for control.

The evidence we reviewed showed that these initiatives made were a very positive step forward especially in relation to FP7. Specifically, an online survey undertaken after the first 20 months of Horizon 2020 found broad agreement among H2020 project participants that the simplification measures introduced were helpful. Most participants (75%) believed that processes in H2020 were simpler than in FP7.

The majority of stakeholders highlighted the improvements made in the IT system, now that the entire application process takes place electronically. They also suggest that simplification in the award of grants has sped up the process to sign a grant agreement, but one downside is that no changes of substance can be requested before grant signing (elimination of negotiation).

Although the entire process is now perceived as much more user-friendly, the entire application is still significantly time-consuming and requires too much bureaucracy, especially in filling timesheets. A more “trust-based approach” is recommended by some interviewees, with rigid rules for monitoring (e.g. a sort of “black list” to punish who abuses the trust). Other recommend, a better quality of the peer-review process. An interviewee suggests taking inspiration from the National Institutes of Health (NIH) in the US where researchers who are awarded with funds are automatically engaged also as peer-

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reviewers. This approach would allow involving first-class researchers also in the peer-reviewing process.

VII – Evidence from case studies

The case studies are helpful to visualise the range of projects funded and the views of respondents on different aspects of the programme.

**Responsive Engagement of the Elderly promoting Activity and Customized Healthcare (REACH)**

REACH aims to develop a service system that is able to turn clinical and care environments into personalisable modular sensing, prevention, and intervention systems that encourage the elderly to become healthy via activity (physical, cognitive, mobility, personalized food, etc.). The four EuroTech Universities (DTU, EPFL, TU/e and TUM) manage the core of this project, which in total consists of 17 partners from higher education institutions and industry. The total grant amounts to around €6 million (€4.5 million from the EU and €1.5 million from the Swiss government).

The project coordinator found the broad collaboration with cross-border partners very fruitful in terms of knowledge transfer. Participants from the industry were particularly involved and highly engaged also at the proposal stage. The synergies between H2020 funding and national funding are viewed as working well.

Expected impacts of the project include increased competitiveness of industry partners as well as positive effects on the health care and social system (in the longer run). While the proposal already included an estimate of time predicted to obtain such results (i.e. three to seven years), there are no standardized tools and best practices available that could be used to effectively monitor, evaluate, and report the impact of the experimental results of the project on society in the long run.

Oversubscription and low success rates remain a core issue and might discourage applicants due to the huge efforts and time spent in putting together a good proposal. The consortium spent a year preparing the proposal and some consortium partners felt that this may not be sustainable in future collaborations. A move to a two-stage evaluation process could improve the situation. Aside from this, the researchers felt the evaluation process was detailed and very rapid.

For comprehensive projects that involve a large number of collaborators such as REACH, the project coordinator suggests to consider the possibility of having a longer time horizon to finalize the project (instead of a maximum of four years). Limited budget and time constraints pose a clear limitation on the number of competencies (partners) one can involve. However, the nature of today’s technological development points to the need to integrate an increasing number of backgrounds/competencies to do innovation. A recommendation points towards the creation of guidelines provided by the EC indicating an ideal number of partners for projects given the available budget.
ERA-NET for establishing synergies between the Joint Programming on Neurodegenerative Diseases Research and Horizon 2020

This project is a joint programming initiative dedicated to neurodegenerative diseases. These are very large research programming actions led by Member States, associated countries and third-countries. The project aims to tackle the grand challenges identified by the European Commission, European Parliament and the Member States. They are preparing from a common strategy view, common actions, including transnational calls, directly funded by the national budgets of the different Member States. In this context they applied for the co-fund option in H2020. The second one applied for was the CSA. This was more about the joint programming initiatives to prepare the evolution and sustainability of their actions.

For the co-funding of the project it was complex to prepare the budget, although some people in their organisation have the relevant training. Some parts of the financing were difficult. In order to determine the amount of money that they could ask from the Commission, they needed to identify the financial input that each of the partners in the countries was able to make, and consequently how also the budget from H2020 would be distributed among the partners. For instance, the mechanism of the “so-called” black box was difficult to understand for some partners and generated a lot of discussions and confusion. In addition, the unit costs and their impact on the overall budgets were difficult to integrate in the global budget; it is unclear what they can be used for, and how they will have to be reported to the EC. To solve issues they contacted the Commission. Due to the fact that the co-fund option was a new instrument, some answers they got differed from one contact to another. Fortunately, one contact at the Commission who precisely knew this instrument helped them to better understand the ERA-NET co-fund mechanism. Overall, the co-fund is a very great idea and a great tool, but the preparation of the budget could be simplified.

Despite the complexity, they are very happy with the co-fund instrument as this top-up funding was an excellent incentive and leveraging tool to increase the commitment of each participating countries and offered some flexibility in the funding of the proposals. Indeed, this instrument put them in a position to cover more than double the number of projects (21 instead of 11 projects without this instrument). Compared to FP7, the CSA indirect costs are for H2020 25%, whereas for FP7 it was only 7%, so this increase is also very positive.

However, simplification of the preparation of the budget, with clear definitions and guidelines would simplify the process. Also, the project coordinator noted that last year the reporting was difficult since the reporting module on the portal of the Commission was not ready, and there were bugs in the system. This led to the postponing the submitting of the reports, which although the Commission accepted, took a lot of effort and time which could be better spent on other activities.
European Regulatory Science on Tobacco: Policy implementation to reduce lung diseases (EUREST-PLUS)

The main objective of EUREST-PLUS is to monitor and evaluate the impact of the Tobacco Products Directives (TPD) within the context of WHO Framework Convention on Tobacco Control (FCTC) ratification at a European level. This main objective is addressed through several integrated research-oriented work packages (WP) in EUREST-PLUS.

This is the coordinator’s first experience as a coordinator under Horizon 2020, although he has experience as a researcher in FP6 and FP7. The particular call under Horizon 2020 related directly to their relevant experience and provided a unique opportunity to carry out this research. The project consists of 13 partners, containing 11 based in the EU and 2 from outside the EU (Canada and Switzerland). The inclusion of 2 partners from outside the EU added extra financial and administrative burden but they provided significant expertise which would have made the project more difficult without. Original data collection is carried out in 6 Member States while secondary data (Eurobarometer) are used on all 28 Member States.

The application process was complex due to the nature of working with so many partners, particularly when working out the financial aspect. This was intensified due to dealing with non-EU partners. Some of the EU partners had prior experience with framework programmes, for others it was the first time. The writing of the proposal was intensive and took several weeks. The submission system was very easy to use. Overall, the administrative aspects were tedious but the result was satisfactory.

The proposal was structured around the budget limit, so is therefore sufficient to meet the work as planned. As a recommendation, the coordinator felt that from an academic perspective increasing the budget for each project is not as important as increasing the budget for the entire call, thereby creating the opportunity for more projects to be funded. This would result in a larger success rate. Organising such a project using only national funding would not have been possible due to the scope and uniqueness of the project, with Horizon 2020 allowing for sufficient cross country analysis and evaluation of European regulation.

In the application, the impacts were included in detail. The project puts emphasis on specific measurable impacts with regards to public policy.

The coordinator finds that the reporting system is appropriate in regards to the flexibility. There is enough time to report and there are not too many administrative issues. There is flexibility for the coordinator to monitor the partners at a frequency that he wishes, based upon trust and the experience of working with the partners. Where teams are familiar, there is the flexibility to not have such a rigorous and frequent reporting system. This can differ in cases where there is less familiarity.

Although the reporting and budget submission process is simple and allows for some flexibility, the coordinator recommends including the option to have a ‘buffer budget of 2 to 5%’ to be used for unforeseen aspects that may develop throughout the project. It is hard to know when drafting the application what to expect several years down the road and now even very small budget redistributions requires a contract amendment.
Chapter 4 – Conclusions and Recommendations

In this chapter we show the main findings of the evaluation undertaken and recommendations for its improvement. Our findings summarise the desk-based research, interviews and case studies described in the previous chapter. Our conclusions and recommendations are based on these findings as well as our economic analysis and judgement of the different results.

I – Findings

The main findings evolve around the following topics: take up and evolution of expenditures, cross-border objectives, outcomes, impacts, synergies with other programmes and processes of regulation and simplification.

1. Take up (evolution of expenditures)

Programmes are progressing towards their envisaged aggregated budgets. However there are disparities when viewed at the Section or Call level:

In Societal Challenges, Energy and IIRS have been underfunded (only 54% and 52% of the budgets have been achieved for Energy, and only 80% and 48% of the original IIRS budgets have been achieved, for both 2014 and 2015 respectively). Funding in Health has gone slightly beyond 100% (for both 2014 and 2015).

For most of the Calls, there is a good balance between the spending and budget amounts (reaching a share of 100%). However, there are some exceptions of calls spending more than 20% of the budget and calls spending 20% less than the budget.

All the Calls under the three focus areas are funded by different funding schemes but IA (Innovation Action) and RIA (Research and Innovation Action) predominate (75% of the funding is in those schemes).

2. Cross-border objectives

There is a good cooperation between institutions to get funding (88% of total spending is on projects involving 5 or more institutions) and across EU Member States (68% of total spending is on projects with more than 5 EU Member States). The participation of non-EU countries is low, reaching 0.2% of total Societal Challenges amount spent.

The presence in Europe of a great variety of energy efficiency standards, maturity of energy efficiency policies as well as very high targets of excellence in health in certain Member States often create difficulties in finding cross-border partners.

3. Outcomes

Similarly to the Industrial Leadership pillar, Societal Challenges pose an emphasis on research and innovation activities complemented with activities which operate close to the end-users and the market, such as demonstrating or piloting. Stakeholders note that this coverage of the full innovation spectrum – from innovation and research to market – represent a great added value of the programme.
However, stakeholders also point out some issues that might affect the achievements of the expected outcomes of the programme. These specifically include a limited inclusion of the social sciences and humanities (SSH) dimension and an unbalanced allocation of funds towards projects with high TRL. A higher contribution of the former is particularly envisaged for its intrinsic multidisciplinarity, with SSH disciplines ranging from anthropology to economics. As for the latter, major funding towards high TRL projects make stakeholders raise concerns about a possibly limited connection between fundamental research and closer-to-market activities.

The extent to which the outcomes of the programme can be measured is linked to each specific priority. Some projects in Energy, for instance, already include the expected outputs at the proposal stage and are evaluated accordingly (e.g. quantification of expected savings). For other priorities this is less straightforward. On top of that, oversubscription and low success rates are perceived as undermining the positive achievements of the programme and raised concerns about the quality of the evaluation process.

4. Impact

The impacts of the programme are difficult to be assessed at this very early stage, especially with respect to the economic growth and boosting job effects.

While measuring the output of projects is often feasible, e.g. through the number of patent applications or publications, it does not correspond to the measurement of impacts (i.e. creation of jobs and growth). Interviews note that projections and forecasts of jobs creation would require the quantification of investments (especially related to buildings renovation and energy efficiency) and it would be a very difficult assessment at this stage.

Other important impacts that can be considered are qualitative and relate to the progress made in bringing together top researchers in the EU and, more generally, in fostering the creation of a critical mass across different topics. This has been achieved especially thanks to a greater engagement of the industry.

5. Synergies with other programmes

There is some general support to the fact that H2020 generates synergies with other EU and national funding programmes. In this respect, the broader spectrum of topics that seems to increase participation is seen at the same time as a positive feature able to generate more synergies. Still, some stakeholders believe the coordination between the national and EU programmes could be further increased as well as between the regional/local level. In some cases it is difficult to develop synergies because of programme overlaps (this was mentioned linked to health and medicine).

Within Societal Challenges, stakeholders highlighted the importance of the coordination between H2020 and the Strategic Energy Technology (SET) Plan, the fifth section of the Commission’s Energy Union strategy, which serves as the framework for all European energy research. Other examples of synergies with national programmes in the Energy area include ERA-Nets, Joint Programming Initiatives, ECRIA projects and the EERA (European Energy Research Alliance). Significant synergies and complementarities between H2020 and other EU programmes are also represented by programmes such as LIFE, COSME, IMI and EIT.
Better coordination is also recommended with respect to Structural Funds and coordination with the Social Investment Package and the education programme of the European Union (Erasmus+) to support synergies in spatial and workplace development. One respondent recommended that the procedures, forms etc. for all EU funded programmes should be better coordinated and preferable similar, as it takes a lot of time to learn the requirements of the different systems.

6. Regulation and simplification

The simplifications made in H2020 have been commonly referred to as a very positive step forward with respect to FP7. Significant improvements include an improved understanding of the application process, a reduction in time-to-grant (no negotiation) and a speed-up in the payments made.

According to some interviewees, simplifications can be further improved, especially in relation to unit costs reporting. In this respect, our case studies pointed out that in the budget preparation it was very unclear how unit costs had to be determined (e.g. at country/participant level). This is reported as being particularly burdensome for SMEs that generally need to hire external consultants to take care of this aspect of the application process. Some stakeholders view this as an unnecessary diversion of resources away from research (and towards the consultants).

Therefore, although the entire process is now perceived as much more user-friendly, it is still viewed as significantly time-consuming by some, in particular for filling timesheets.

II – Conclusions

Horizon 2020 is received very positively by the different stakeholders. The budgets have been spent as envisaged and we have received favourable opinions by some of our interviewees.

Our main conclusions show some concerning issues around the problem definition, envisaged impacts of the interventions, ex-post monitoring and evaluation of the projects, budgets and the problem of oversubscription, and evaluation of proposals. We also show our conclusions in relation to cross-country cooperation, the synergies with other programmes and the simplification of the regulations.

Problem definition

The Work Programmes (WPs) set out the funding opportunities under the different WP parts through calls for proposals and other actions such as public procurement. Each call for proposals contains topics and each topic describes the challenge to be addressed as well as the scope of the activities to be carried out and the expected impact. Horizon 2020 proposals are accompanied by appropriate impact assessments (SEC(2011) 1427 and SEC(2011) 1428) which provide the intervention logic of the programme. The needs for

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One of the organisation interviewed had a lot of problems and had to contact many different persons (this is despite having previous experience in the process). They mentioned that the national contact points were not able to provide answers to their questions.
intervention as well as market failures to be addressed are also extensively described in the impact assessment.

The need for public intervention in the Societal Challenges pillar is justified by the presence of important market and systemic failures that are magnified in times of shifts in basic technologies. At high-level, the impact assessment identifies these failures as locked-in investments, high risks and the need for significant investments in less profitable alternatives. All of these should be understood as investments that may not be profitable from a private point of view but can potentially bring high returns to society.

Specific barriers and failures also characterise each individual priority:

In Energy, there are additional barriers for eco-innovations that slow down its development such as the failure to price environmental externalities, the lack of appropriate and credible information on the performance of some eco-innovative solutions or the additional difficulties in accessing and providing finance to these types of businesses.

In Health, there are barriers for the dissemination of data and scientific results to limited knowledge exchange and mobility between stakeholders. These imperfections make the translation of research results into clinical applications more difficult.

In Inclusive, innovative and reflective societies, market imperfections include the ineffective mechanisms of fiscal policy coordination and supervision, lack of a coherent regulatory framework in various industries as well as the existence of welfare gaps.

Overall, the existence of these identified problems means that change might be slow without a major “public push”.

Within the Societal Challenges pillar, the Work Programme for Secure, clean and efficient energy priority is quite detailed in specifying how calls and topics are designed to advance in low-carbon energy technologies. Similar considerations hold for the Health, Demographic Change and Wellbeing section, where a clear focus is put on the necessity to increasingly rely on integration of large datasets to provide the evidence base for realisation of personalised medicine and future health policies.

However, it is difficult to identify an association between the rationale for each funding and the tools and types of action needed to overcome market failures and achieve the corresponding societal benefits. This results in stakeholders not having a clear vision of the need for each type of intervention and believing that the design of the programme is unbalanced towards certain type of actions (more applied innovation).

In other instances, they advocate for more contribution of SSH which should appear alongside many disciplines: it is believed that proposals under Societal Challenges are expected to take into account the social, economic, behavioural, institutional, historical and/or cultural dimensions, as appropriate, of a societal issue. But the way the problems and expected solutions are defined prevent a straightforward identification of the role played by the social disciplines in solving the market failures envisaged in the research programmes.

A clearer definition of challenges and objectives to be achieved by each of the financial instruments would improve the understanding by researchers and stakeholders. It would
also make it possible to compare the rationales for using the different instruments. This would clarify the need (or not) of funding in certain areas and the way this should be done. This need for clarification is particularly relevant in the Societal Challenges pillar because of the huge diversity in the topics covered.

**Ex-ante impact**

The Work Programmes provide some guidelines on the expected impact of the different calls. However, impacts envisaged happen to be specific for each call and different to the homogenous Key Performance Indicators (KPIs) used for monitoring and evaluating the objectives across the programme.

The Societal Challenges pillar include priorities that are very different one from another ranging from highly technical and specific ones (Health and Energy) to much broader ones (Inclusive, innovative and reflective societies). Despite these intrinsic differences, the range of KPIs used to measure output is the same across all priorities.

The adopted KPIs include:

- Number of publications in peer-reviewed high impact journals;
- Number of patent applications;
- Number of patents awarded;
- Number of prototypes and testing activities;
- Number of joint public-private publications; and
- New products, processes, and methods launched into the market.

Although these KPIs can be suitable for measuring some of the expected outputs, they are unsuitable to measure the expected impacts in all areas.

Because of this, other indicators are required to be reported by Horizon 2020 beneficiaries after the end of a project. In the Energy priority, for instance, these include: primary energy savings triggered by the market uptake project (GWh/year per EUR million) and total amount of money invested by the stakeholders in sustainable energy as direct or indirect result from the measures developed by the market uptake project (amount in EUR million). In this case, the combination of KPIs and other specific indicators allows good complementarities in the evaluation and monitoring process. In other priorities, this is less well-designed.

In addition, there are a number of different expected impacts in the WPs as well as indicators recommended to be used to measure them. While some of them explicitly tackle social benefits (e.g. reduction of energy consumption of space and water heating by 30 to 50 per cent), some others seem to be more related to private benefits of the industry (e.g. larger market share of energy-efficient products). So clarification on the social impact would reassure the scientific community of the reasons for intervention and market failure being tackled.

Overall, there is some lack of understanding on how such indicators can be translated into additional benefits for society. In this respect, there is a need to properly consider the contributions that such impacts may materialise as effects to other market players,
consumers or the public sector so as to improve the social value of the investments being made.

The ultimate objective would be to provide clarity around the EU added value provided by the different priorities and calls. This could be done following the Commission’s principles for better regulation and identifying market imperfections and sub-optimal investment situations, so to be able to assess investment needs and demonstrate that the market needs cannot be addressed with market-led activities or other types of intervention. This would help in turn establishing agreement on the priorities of the different calls and their objectives. This sort of approach is particularly relevant in a context with oversubscription and stakeholders declaring a need for inclusion of certain topics or expanding funding in others. In particular, it will help determine where and how this should be done.

Establishing clear expected impacts may be difficult to achieve. In this respect, it may be useful to include selected stakeholders in the challenge formulation phase and design of topics as to agree around a common strategic vision. The impact assessment (SEC(2011) 1427) used consultation and extensive analysis but it may be worth to expand the consultation to other stakeholders (especially in the SSH disciplines) to clarify the scientific needs and expected impacts of some of the actions.

Ex-post monitoring and evaluation of the projects

The impacts of the programme are difficult to measure for a number of reasons. In the first place, H2020 is still at a very early stage of implementation, hence the impacts may not be material yet. More importantly, difficulties are also encountered in trying to quantify the outcomes of different projects, especially if these have to be assessed in terms of economic growth, jobs and improvement of lives.

This is particularly relevant in the Societal Challenges pillar because of the relevance of the social dimension. A proper assessment would require a methodological approach that is able to account for impacts that go beyond the economic dimension and include the contributions that science makes to the environment, public health, societal well-being, and culture.

It may be unfeasible to translate the impacts of every call in terms of indicators of growth, employment and improvement of lives, especially because it is difficult to establish a link between the monitored data and such final objectives. Because of this, in some instances it has been argued that the impacts should be assessed qualitatively, using narrative to show the causal links with the objectives they aim to achieve.

The task will be difficult but the Commission could try to develop a methodological approach to assess the successfulness (or not) of the different projects. These would need to be proportional to the sizes and efforts of every project but should stand scrutiny by the scientific community (as to avoid discrepancies in opinions).

We would suggest using consensual solutions such as establishing an independent board of experts/evaluators that assess and judge the outcomes and impacts of the different projects awarded (this could be done in close cooperation with the manager of each project). There could also be higher involvement of different stakeholders when assessing the results of the different projects. This analysis should go beyond the assessment
currently being done by the Commission and would help in establishing the outcomes of the programmes to be disseminated across relevant stakeholders. This would provide reassurance to the scientific community that consensual and transparent approaches are being used for the evaluation of the projects.

**Budget and oversubscription**

The high participation in H2020 has increased competition for funding with respect to FP7. The reasons for higher participation are different, ranging from the provision of broader topics to the sometimes tougher national availability of funding budgets. The result has been extensive oversubscription (especially in some calls) and low success rates of proposals.

The high participation can be interpreted as a good achievement for the programme in reaching a broad audience and increasing competition. But, on the other hand, it makes stakeholders stress possible adverse effects on the motivation of excellent researchers. Oversubscription leads to a situation in which projects evaluated even with high or top scores are not funded. As a consequence, low success rates have encouraged views that advocate increases in budgets, especially for over-crowded calls.

If there is an intention of increasing the budget, this may be done by selecting those areas where impacts are expected to be higher. As anticipated in the previous section, the achievement of strategic priorities and the proper measurement of the expected impacts represent a core issue for the assessment of H2020. Although many stakeholders stress the need for more funding, the allocation of resources should not be demand-driven but determined on the basis of the expected social impact of the envisaged action. Another possibility could be to make calls more demanding in terms of the required expected outputs, and in particular, outputs that relate to social impacts (the market failures and diffusion of knowledge expected in the different actions). This would reduce the number of proposals and would select those that are more focused on reverting back to society the obtained results.

Another possible solution to deal with oversubscription relates to be possibility of making the calls narrower in scope. This would attract less people and would possibly support a better understanding of the specific aims of all the initiatives by potential participants. Despite the difficulties and competition involved in winning a project, once it is awarded, the budget provided is always perceived as suitable and appropriate to deliver the expected output.

**Evaluation of proposals**

The evaluation process is object of some critiques. When competition and participation is high it is particularly important to adopt well-established and trusted evaluation procedures that are able to reassure the applicant community about the quality of the evaluation.

In this respect, stakeholders raised concerns about a lack of transparency in the evaluation. In particular, the evaluation process comes across as a lottery to applicants in calls with

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very high participation rate. Enhanced quality control mechanisms in the evaluation and peer-review processes are therefore recommended. One recommendation from one stakeholder suggested developing a peer-review mechanism that is able to automatically engage researchers who received funds as reviewers or proposals. Such an approach to evaluation would allow always including first-class researchers but it has to be done in a way that it keeps a “double-blind” evaluation process (in some very specialised areas the amount of researchers may know each other and evaluators could decide to favour some of their colleagues rather than use strict and objective evaluation criteria).

**Cross-country cooperation**

The most recurrent type of cross-country cooperation within H2020 takes the form of collaboration amongst EU-15 Member States. Conversely, there is low involvement of countries belonging to the EU-13 group and non-EU countries. The reasons for this exclusion are diverse and include countries’ different “levels of excellence” in producing research and also difficulties in joining existing collaborative research networks due to existing national (legal) constraints.

The pursuit of excellence leads to a situation where research tends to be focused around centres (“clusters” or “networks”) where this is carried more efficiently. This can be seen as a positive result because it pursues allocation efficiency and selection of the best research centres.

However, one of the objectives of the Societal Challenge pillar is to create inclusive societies and improve lives. At times this may be in contradiction with the objective of Excellence Science so it would be advisable to establish the circumstances under which one or other (or both) objectives can be achieved. One possibility could be to improve the role of disseminating and sharing the obtained findings and discoveries. It may be more efficient to do so in those Member States that are still developing their research capabilities (in situations with economies of scale in research and innovation transformations it will mean that it would be more efficient to invest in low- not high-developed industries). This would help promoting the catching up process of less developed countries and help reduce (in the long run) the disparities in knowledge across countries.

We have also seen that there are some participation barriers and these are due to differences in the development of certain policies (for example, different level of energy efficient standards). When this is the case, the Work Programmes should design ways for not discriminating unfairly Member States on the basis of such constraints. One option could be to restrict the calls to situations where there is no such discrimination (research topics would be in areas where policies are homogeneous across countries). Another option could be to allow the inclusion of partners as “observers” basis so that they can develop any improvements at a later stage (when policies have converged with those of more advanced countries).

Stakeholders have reported that so far there has been no specific funding priority (topic) expressed by the European Commission to favour R&I collaboration with given third countries outside the EU. Member States and the European Commission are therefore encouraged to improve the legal and regulatory conditions that currently generate burdens in the participation of third countries as well as design calls and topics that are attractive
and incentivise the creation of networks and consortia with partners that deliver excellent research also outside the EU borders.

**Synergies with other programmes**

We have identified a number of synergies and existing complementarities between EU and national programmes and in many cases these seem to work well. However, we found that the large number of existing programmes and satellite initiatives resulted in a landscape that is not simple for participants. This happens because of the existence of overlaps.

In this respect, we would like to stress that synergies should not be an objective in itself and drive future research and innovation policies but rather support such policies. This is particularly important in cases where the rationale behind the different funding schemes is not the same. For example, H2020 rationale differs significantly from Structural Funds: while H2020 supports excellence and competitiveness, ESIF focuses on regional cohesion.

As a result, the Commission may want to push for synergies that have a common rationale both at a programme and strategic level, and further develop guidelines and recommendations on how this should be achieved. This seems to be already the case for most of the programmes already in place. For instance, stakeholders reported positive views on synergies between programmes that are managed and/or monitored by the same agencies, e.g. the fact that the Energy Efficiency part of the Energy Challenge is managed by EASME, which is also managing LIFE and COSME programmes, is seen as a positive asset to develop synergies between programmes and projects.

**Simplifications and regulations**

Significant steps towards simplifications have been taken in H2020. 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. However, relevant bureaucratic barriers are identified in the legal and financial implementation of H2020 in areas such as internally invoiced costs and personnel costs.

In this respect, we would suggest a better engagement with NCPs, for example through the use of workshops, so to provide clear guidelines to applicants, especially SMEs that are not familiar with procurement procedures). This is particularly important because some stakeholders reported that responses given by NCPs and the Commission were sometimes divergent and contradictory in the way they recommended to address budget issues.

Some concerns were raised with respect to the complexity of the Cofund financing instrument. Conversely, the CSA instrument was well received (probably because Cofund has been introduced in H2020, while CSA already existed in FP7). Moreover, the process of filling time sheets is still perceived as significantly bureaucratic and time-consuming. Further improvements in this direction would be beneficial.
III - Recommendations

To correct for the identified problems we would recommend the following.

Recommendation 1: The strategy for each of the calls under the programme should be more developed. This should take into account issues such as the problem definition (market failure to be corrected for, social impact, investment risks, computation of market values, externalities and “spill-overs”, as identified in the impact assessment), envisaged impacts of the call and expected ex-post metrics for measurement of outcomes and impacts (the principles and tools for better regulation established by the Commission could be used when defining the guidelines).

The design of a clear strategy should also envisage some clear objectives for each of the calls. This should allow for inclusion of research from other disciplines (SSH) as long as they are helpful in solving one of the identified market failures or improving some of the envisaged impacts.

The envisaged project impacts of the calls should take into account the principles of additionality and potential market distortions (“crowding-out” of private funding). Where possible, impacts should be estimated in relation to a counterfactual (control group or situation without the intervention).

Given that data may be scarce or unavailable a methodology or consensus approach should be developed to assess the relevance or expected value added in the different topics. The findings from the impact assessment and data from previous research framework programmes could be used to inform this analysis. Industry stakeholders or external experts could be involved at this stage to reach a consensual view. This would provide reassurance to the scientific community that the design of the funds is done according to principles of better regulation (in particular, it could provide reasoning for situations where it may be beneficial to include research from SSH disciplines).

In some situations the pursuit of an “excellence” objective may be difficult to achieve in conjunction to the social dimension objectives (“create inclusive societies and improve lives”). There is therefore a need to clarify how different calls should address (or prioritise) such objectives. Because of the importance of the “excellence” objective, we have argued that the best way to make the programme inclusive could be by including additional partners (as is already being done) but also in being more active in the dissemination of results (if done on Member States which are still developing their research capabilities this would be efficient and would help reduce the disparities in knowledge across countries).

Recommendation 2: Assess size and scope of the calls using the evidence provided in Recommendation 1. Given the assessment it may be possible to rank the different calls and prioritise the funding for those that yield higher return to society. This may imply reducing the number of topics, or making the topics more general. Given the different priorities it may imply rethinking the grant amounts in each call. If the rational in the different calls is guided by evaluation principles (market failures) it could leave room for including other disciplines (SSH) as long as value added is proved or at least expected.

Recommendation 3: There should be a close monitoring of project outputs. The outputs should take into account metrics developed as part of Recommendation 1 but should also
design a strategy for dissemination of results. This could include external advisors as part of the consortia or advisory panel for the project. The role of the project managers could be considered for contributing to such monitoring tasks.

The dissemination objectives of H2020 should be a priority in order to include potential stakeholders that can benefit from the outcomes of the funded research.

Recommendation 4: Improve quality control mechanisms for the evaluation process of applications. Options could include establishing consensus for the approach to be used in the evaluation of calls or train the evaluators. Another option could be to develop further a two-stage approach to evaluation. The ultimate objective is to provide reassurance in the expertise of the evaluators.

Because of the complexity of projects, it may be difficult to find capable evaluators, so selection criteria for evaluators (and their rewards) may need to be considered. Using researchers who received funds as reviewers could be an option, but if so, this should be done in a way that it keeps a “double-blind” process (so that evaluators cannot identify the partners in the calls so that only strict and objective evaluation criteria are used).

Recommendation 5: Clarify the policy objectives of H2020 such that it is focussed on excellence and leadership at the European level. Although not a major issue, in some cases it may help to delimit the scope of the programme such that it is easy to link to other programmes without overlapping in the objectives. There could be benefits in providing further guidance on how should synergies between programmes be achieved.

Recommendation 6: The Commission may think about further improving the process of cost reporting and reducing burdens for SME. This could be done by strengthening the interaction and coordination between NCPs and applicants.
Annex – Methodological approach

We have used the following tools of analysis throughout the study:

1. Data from CORDIS

The Community Research and Development Information Service (CORDIS) database contains information on all EU-funded research projects and their results. In addition to data on H2020 projects funded, it also has data on FP7, FP6, FP5 and earlier research programmes since 1990.

We have used the latest available CORDIS data (data added on 2015-07-29 and updated on 2016-09-01). Our data analysis concentrates on the Programme, Topic, Call Id, Funding Scheme, Coordinator Country and Participant Country fields to assess the financial progress of the programmes.

2. H2020 Work Programmes

All funding available under Horizon 2020 is set out in multi-annual work programmes formulated by the European Commission in accordance with the Horizon 2020 legislation and EU policy objectives. In the period of our evaluation, there have been two rounds of Work Programmes formulated, 2014-2015 and 2016-2017.

The Work Programme describes the various funding opportunities available in each section of H2020 via calls for proposals that have various topics specified within each call for proposals. In addition, there are some additional funding opportunities via other mechanisms such as public procurements, opportunities where demand for innovative products is first created by governments to bring solutions earlier to the market. Every topic in the Work Programme sets out the challenge the topic intends to address, the range of activities the Commission intends to be carried out under each topic, and the impacts expected from projects. The Work Programme is formulated in consultation with stakeholders, including the Horizon 2020 Advisory Groups for each area.

We have used the Work Programmes to provide background and budgetary information on the range of activities planned. This is in order to compare the expected activity under H2020 as set out in the Work Programme and make a comparison with the actual activity funded as recorded in CORDIS.

3. Stakeholder interviews

We have supplemented our data analysis with stakeholder interviews to qualitatively understand the reasons behind our programme implementation findings and to explore other qualitative questions on the programme’s implementation. These questions cover some measures of success of H2020 (boost the economy, provide jobs, cross-border cooperation, and synergies/complementation with national and EU programmes and policies). They also explore the financial envelope of the programme, the financial incentives provided and monitoring mechanisms, along with the strengths, weaknesses, opportunities and threats of the programme. Persons interviewed broadly fall under four categories:

- DG RTD
- Organisations responsible for H2020 implementation
• Horizon 2020 Advisory Groups
• National Contact Points

For this briefing paper, we have interviewed eight stakeholders. Four have responsibilities in different advisory groups. Another four are from RTD (combined into two interviews). Their details are in the table below:

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Agency for Small and Medium-sized Enterprises (EASME)</td>
<td>Vincent Berrutto</td>
<td>Head of Unit B1 - H2020 Energy</td>
</tr>
<tr>
<td>Horizon 2020 Advisory group on Europe in a changing world - inclusive, innovative and reflective societies</td>
<td>Kerstin Sahlin</td>
<td>Chair, and Professor</td>
</tr>
<tr>
<td>Horizon 2020 Advisory group for Health, demographic change and wellbeing</td>
<td>Liselotte Højgaard</td>
<td>Chair, and Professor</td>
</tr>
<tr>
<td>Horizon 2020 Advisory Group on Energy</td>
<td>Brigitte Bach</td>
<td>Chair</td>
</tr>
<tr>
<td>DG RTD. Directorate A - Policy Development and Coordination</td>
<td>Kurt Vandenberghe</td>
<td>Director</td>
</tr>
<tr>
<td>DG RTD. Directorate A, Unit A5 - Evaluation</td>
<td>Nelly Bruno</td>
<td>Policy Analyst</td>
</tr>
<tr>
<td>DG RTD. Directorate B - Open innovation and science</td>
<td>Doris Schroecker</td>
<td>Head of Strategy Unit</td>
</tr>
<tr>
<td>DG RTD. Directorate B - Open innovation and science</td>
<td>Nicholas Deliyanakis</td>
<td>Deputy Head of Unit</td>
</tr>
</tbody>
</table>

We thank interviewees for their time and for the contributions made for the study. All contributions have been anonymised.

4. Case studies

The paper provides three case studies to illustrate some of our findings. The initial selection of the projects studied here have been made after obtaining initial results from our data analysis showing which topics have achieved higher or lower funding rates from that planned in the Work Programmes. Within each of the areas of Societal Challenges we focus our evaluation on, we selected a topic and a particular project funded within the topic. Our selection was guided by the following principals:

• The project has already started;
• Multiple countries are involved in the project;
• The identity of the coordinator and partners of the project and their experience;
• The project funded is substantial (based on the EU contribution); and
• Sufficient information about the project is available on the website.

Due to time limitations for conducting the study, we complemented our planned selection process with a random selection of some projects. We interviewed project coordinators on
the objectives of the projects and H2020, regulations and simplifications introduced in the
programme, financial mechanisms and monitoring, strengths and weaknesses of the
programme, and recommendations for future programmes and/or future work
programmes.

5. Desk research

Finally, we undertook a review of materials available on the background and
implementation of H2020 to inform our analysis. The three main types of documents
reviewed include previous reports on H2020 and FP7, its predecessor, reports from
Horizon 2020 Expert Advisory Groups, reports from stakeholders who have publically
responded to the Commission’s ongoing interim H2020 evaluation online questionnaire,
and project specific documentation stored on CORDIS.227 These sources include the

227 The questionnaire closes in January 2017, but some of the respondents have made public their
general response to the questions. The link to the questionnaire can be accessed at
Horizon 2020, the EU framework programme for research and innovation (2014-2020) is aimed at building a society and an economy based on knowledge and innovation across the Union, while contributing to sustainable development. The programme supports the implementation of the Europe 2020 strategy and other Union policies, as well as the achievement and functioning of the European Research Area (ERA).

The introduction to this European implementation assessment (EIA) presents basic information on the implementation of Horizon 2020, including policy on gender equality and international cooperation.

In addition, the annexes contain the input to the EIA received from external experts, who prepared analyses of the implementation of the three Horizon 2020 priorities: excellent science, industrial leadership, and societal challenges. The implementation of each priority was analysed from two perspectives:

a) a research and industry perspective prepared by experts from the Centre for Strategy and Evaluation Services (CSES) and the Centre for Industrial Studies (CSIL);

b) economic and financial perspective prepared by experts from the Europe Economics consortium.