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REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

Annual Report on Research and Technological Development Activities of the European Union and Monitoring of Horizon 2020 in 2016

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1. BACKGROUND TO THE ANNUAL REPORT ON RTD ACTIVITIES

The Annual Report on the European Union's (EU) Research and Technological Development Activities, and on the dissemination of results, is prepared pursuant to Article 190 of the Treaty on the Functioning of the European Union (TFEU). The purpose of this report is to provide a concise and non-exhaustive overview of key measures undertaken in the reporting year.

Following a call from the Council on 30 May 2017 to the Commission to streamline its reporting strategy, this report includes annual monitoring data of Horizon 2020 in relation to Horizon 2020 calls closed in 2016. Since 9 November 2017, further detailed monitoring data for Horizon 2020 is made publicly available at the Horizon 2020 Dashboard.[1]

2. THE BROADER POLITICAL CONTEXT IN 2016

The year 2016 marked the second year of the Commission's work under President Juncker's leadership. At the beginning of his mandate, President Juncker announced a new start for Europe and introduced his Agenda for Jobs, Growth, Fairness and Democratic Change, focused on ten political priorities.

The Commission's €315 billion Investment Plan for Europe, with the European Fund for Strategic Investments (EFSI), brought further results. The Fund was operational and delivered high quality investments to further boost the European economy, including in R&I and for innovative SMEs and small mid-caps.

Throughout the year, some of the crucial initiatives of the Commission, such as the Energy Union, the Digital Single Market, the Capital Markets Union, the European Agenda on Security, the European Agenda on Migration, reached new stages. The EU needs more than ever to be both relevant and connected to its citizens. According to President Juncker we need a stronger connection between policies, decisions and strategies.

As a follow-up to the Paris Climate Conference (COP21), the European Commission started implementing the EU's energy and climate commitments by adopting the ambitious "Clean Energy for all Europeans" package including a Communication on "Accelerating Clean Energy Innovation" (ACEI). The latter outlines wide-reaching policy measures to accelerate Europe's transition to a competitive low-carbon economy by boosting investment in clean energy research and innovation (R&I) and mobilising actors at all levels to facilitate the market uptake of innovative clean energy technologies and services. It also adhered, on behalf of the EU as a whole, to the Mission Innovation, launched at COP21, an international initiative that endeavours to accelerate public and private clean energy innovation and spending to address climate change.

[1] http://ec.europa.eu/research/participants/portal/desktop/en/projectresults/index.html.

3. POLICY FRAMEWORK

During this reporting year, the strategic priorities of Commissioner for Research, Science and Innovation Carlos Moedas 'Open Innovation, Open Science and Open to the World' were further developed.

One of the main components of 'Open Science' is the establishment of a European Science Cloud. In 2016, the European Commission launched different components of this initiative to capitalise on the data revolution. The science cloud will provide European science, industry and public authorities with world-class digital infrastructure that brings state-of-the-art computing and data storage capacity to the fingertips of any scientist and engineer in the European Union.

During 2016, the Scientific Advice Mechanism's High Level Group of Scientific Advisors adopted their scientific opinion on "Closing the gap between light-duty vehicle real-world CO2 emissions and laboratory testing"; made significant progress on the development of a scientific opinion on "Cybersecurity in the European Digital Single Market"; and on an Explanatory Note on "New techniques in Agricultural Biotechnology"; the group also started work on a scientific opinion on "Food from the Oceans". Over 2016, the HLG worked increasingly closely with the newly established "Science Advice for Policy by European Academies" consortium (SAPEA – funded through Horizon 2020) which brings together the outstanding knowledge and expertise of fellows from over 100 Academies and Learned Societies in over 40 countries across Europe.

In order to increase Europe's capacity to generate and scale up breakthrough, market-creating innovations, a Call for Ideas on the possible establishment of a European Innovation Council was run from 16 February to 29 April 2016. The Commission also launched a Special announcement for the setting-up of a High Level Group of Innovators to provide expert advice to the European Commission in designing and developing a European Innovation Council (EIC), to boost the capacity of the EU in the field of breakthrough, market-creating innovation. Following the announcement, a group of 15 members were selected out of almost 500 submissions, forming a group that started operating on 1 January 2017. The European Innovation Council is a key measure in the Start-up and Scale-up Initiative launched by the Commission to give Europe's many innovative entrepreneurs every opportunity to become world leading companies. The pilot measures taking effect under Horizon 2020 were developed already over the course of 2016 with engagement of external stakeholders and relevant Commission services.

In 2016, the European Institute of Innovation and Technology (EIT) designated a new Knowledge and Innovation Community (KIC), the EIT Food, which supports innovative and economically sustainable initiatives with the aim to transform European food system, drive consumer confidence and improve global health.

A pilot action on the Circular Economy started in 2016 to help different kinds of innovators facing regulatory obstacles by setting up agreements with stakeholders and public authorities[2]. Innovation Deals were launched as a new pilot scheme by the European Commission to help innovators with promising solutions to environmental issues to navigate regulatory challenges to bringing their ideas to market.

In February 2016, the Commission launched a public consultation on a new R&I initiative for sustainable food production and improved water management in the Mediterranean area, to be called PRIMA, the Partnership for Research and Innovation in the Mediterranean Area.

[2] http://ec.europa.eu/priorities/jobs-growth-investment/circular-economy/docs/communication-action-plan-forcircular-economy_en.pdf.

In October 2016, the Commission adopted the legislative proposal for the PRIMA Initiative based on Article 185 of the Treaty (TFEU), which was approved by the legislator in 2017. This was an important milestone as well in view of recent events in this neighbouring area of the EU.

In June 2016, the Commission joined, on behalf of the EU, the global 'Mission Innovation' initiative that was initiated during the COP21 conference. This initiative unites major global economies with the aim of stepping up coordination on R&I projects in the area of clean energy technologies. All members pledged to double government investment in clean energy R&I over the next five years. In November 2016 the Strategic Energy Technology Plan released its' 2016 progress report[3] in the margins of the SET Plan Conference in Bratislava. The report presented the targets for key technologies that are prepared in cooperation with and endorsed by all Member States and other EU countries involved in the SET Plan, as well as the R&I stakeholder community. The targets focus on reducing the cost and improving the performance of key low carbon technologies. The way forward is the compilation of Implementation Plans for the respective technology areas, which will identify concrete activities/projects contributing to the realisation of the targets for the interested SET Plan actors to take forward, under preparation in the course of 2017.

The European Commission continued its 'science4refugees' initiative for asylum-seeking and refugee scientists and researchers, which entails a match-making process between refugees and asylum seekers with a scientific background and scientific institutions that voluntarily declare themselves to be "refugee-welcoming organisations".

In 2016, one more ERC Grantee received a Nobel Prize. Professor Ben Ferringa from the University of Groningen in the Netherlands was awarded the 2016 Nobel Prize in Chemistry, together with Sir J. Fraser Stoddart and Jean-Pierre Sauvage, who supervised two individual MSCA fellowships "*for the design and synthesis of molecular machines*". Professor Ferringa received his first ERC Advanced Grant in 2008 and a second one in 2015 to push forward the frontiers of the field of molecular motors. He is the 6th ERC Grantee to receive a Nobel Prize. He was also formerly a scientist in charge of an MSCA COFUND project. In addition, 7 grantees were already Nobel laureates at the moment that they received an ERC grant, bringing to 13 the total number of Nobel Laureates funded by the ERC since its beginning 10 years ago.

In October 2016, the Commission proposed a new Space Strategy for Europe. This initiative was among 10 main initiatives of the recent Commission. This strategy will be closely connected with the Horizon 2020 programme via different calls.

[4]In 2016, a set of country-specific recommendations[4] addressing R&I issues was adopted in the context of the European Semester of economic policy coordination. The ERAC (European Research and Innovation Committee), the SFIC (The Strategic Forum for International Scientific and Technological Cooperation) and the GPC (the High Level Group on Joint Programming) were preparing their positions on the Interim Evaluation of Horizon 2020 and the next R&I Framework Programme.

The Horizon 2020 Policy Support Facility (PSF), which was launched in March 2015, successfully continued as a new instrument that gives Member states and countries associated to Horizon 2020 practical support to design, implement and evaluate reforms that

[3] https://ec.europa.eu/energy/sites/ener/files/documents/set-plan_progress_2016.pdf
[4]https://ec.europa.eu/info/european-semester/european-semester-timeline/eu-country-specific-recommendations/2016-european_en

enhance the quality of their R&I investments. Finally, work was undertaken to strengthen evaluation methods to measure the impact of R&I investments, especially in view of the new R&I Framework Programme.

4. IMPLEMENTATION OF HORIZON 2020

Through its second biennial work programme covering 2016-2017, Horizon 2020 is aligned with the Commission's policy agenda and in particular such priorities as the Digital Single Market, the Energy Union, the Circular Economy and the European Fund for Strategic Investments (EFSI). During the year, calls for proposals were launched worth € 7.7 billion.

The second wave of Simplification of Horizon 2020 was delivered in 2016, including the preparation of the "lump sum pilot". The pilot will test lump sum funding of large collaborative projects as part of the Horizon 2020 work programme 2018-2020, in view of drawing lessons for FP9.

The other major priority in implementation terms for 2016 was the strategic programming exercise to prepare the final work programme under Horizon 2020, in this case three years and covering 2018-20. This major exercise brought together a wide range of different types of information coming from stakeholders across the board and open consultations, as well as the work of expert groups from all the research and innovation and policy areas under Horizon 2020. Supporting this were many studies and evaluations of progress with the programme so far.

While the Horizon 2020 work programmes cover the large majority of the funding available under the Programme, they are complemented by the separate work programmes for the European Research Council, the Euratom Research and Training Programme (2014-2018), and the Joint Research Centre, as well as by the Strategic Innovation Agenda for the European Institute of Innovation and Technology (EIT).

Also in 2016, synergies (like CleanSky 2 JU, ECSEL JU) with European Structural and Investment Funds (ESIF) and preparatory action like Stairway to Excellence continued to be promoted. As part of this, Commissioner Carlos Moedas announced a further extension of the Seal of Excellence under Horizon 2020. Applicants were invited to identify the smart specialisation fields of their EU Member State or region and explore the potential for synergies with the relevant Managing Authorities in charge of the ESIF in their territory[5]. A 'Seal of Excellence' is provided to proposals meeting evaluation thresholds but not funded due to budget constraints under the SME instrument (and possibly other mono-beneficiary instruments). The 'Seal of Excellence' allows countries / regions to recognise the quality label awarded to promising proposals submitted under Horizon 2020 and promote their access to different funding sources like the ESIF and other national or regional investment programmes. This action has been complemented by a 'mobilisation' campaign towards regions/countries to include SME-instrument friendly funding schemes in the context of implementation of their ESIF Operational Programmes.

4.1 Key monitoring data – Horizon 2020 three years on

By the end of 2016, 329 Horizon 2020 calls were concluded, with 115 235 eligible proposals submitted, requesting a total EU financial contribution of €182.4 billion. Of these, only 14 549 proposals were retained for funding, bringing the overall success rate of eligible full proposals in the first three years to 12.6%. A total of 13 903 grant agreements were signed by 1 September 2017, with a budget allocation of €24.8 billion in EU funding. Just in 2016,

[5] http://ec.europa.eu/regional_policy/indexes/in_your_country_en.cfm

a total of 4 594 grant agreements were signed with an EU financial contribution of €8.3 billion.[6]

A total of 399 927 eligible **applications** were received over the three years. In 2016, the number of retained applications and the financial contribution allocated to them increased significantly (respectively by 23.8% and 17.1% compared to 2015). Since Horizon 2020 began, 38.4% of all applications came from universities, 36.1% from the private sector and 18.2% from research organisations. Although public bodies had the lowest application rate (3.5%), they had the highest success rate.

In 2016, Germany has the highest share of **participations** in signed grants per EU Member State, followed by the United Kingdom and Spain. Twelve EU Member States experienced an increase in participation, with Sweden and Spain experiencing the largest increase. Member States received a total of 92.8% of funding in the first three years of Horizon 2020. The remaining funding went to Associated[7] and Third Countries.

Third Countries had a 1.94% share of participations in signed grants across the three years, with signed grant agreements of participants from 94 different countries. The top five participating countries (United States, China, South Africa, Canada and Brazil) accounted for more than 40% of the overall Third Country participation.

Universities remain in first place in terms of funding received, whereas the private sector has almost overtaken them in terms of participation.

The share of private sector participation in the calls since the beginning of the programme and until the end of the reporting year amounts to 32.8%. In pillars 2 and 3, excluding "Access to risk finance", 63.9% of all beneficiaries in the signed grant agreements are from the private sector.

Both public bodies and other entities have increased their share of participation and financial contribution.

There were almost 35 000 applications to the **SME Instrument** across the three years, with an increase from year to year (9 061 in 2014, 12 713 in 2015 and 13 186 in 2016). The average success rate of full proposals in the SME instrument in the first three years was 7.5% (9.1% in 2014, 6.4% in 2015 and 7.4% in 2016), which is lower than the Horizon 2020 average of 14.8% in terms of overall applications. In 2016, 23.6% (EUR 1.17 billion) of the combined budgets for Leadership in Enabling and Industrial Technologies (LEIT) and Societal Challenges was allocated to SMEs, surpassing the 20% budget target.

Around 54% of the total participants in Horizon 2020 are **newcomers**, while the rest also participated in FP7. In the first three years of Horizon 2020, 73% of the newcomers were from the private sector, showing the attractiveness of Horizon 2020 for private companies. Out of these, 48.9% were SMEs.

On average over the three years, 90.5% of all grant agreements were signed within the legal target (which does not cover the ERC) of eight months, increasing from 90.9% in 2015 to 93.7% in 2016. In the first three years of Horizon 2020, the average **time-to-grant** period was 192.5 days (208.4 in 2014, decreasing to 189.7 in 2015 and to 180.9 in 2016).

[6] This dataset includes calls closed on 31st December 2016, therefore it does not include calls launched in 2016 but closed in 2017, which will be in the scope of the next Horizon 2020 annual monitoring report

[7] The countries associated to Horizon 2020 are: Albania, Armenia, Bosnia and Herzegovina, Faroe Islands, Former Yugoslavian Republic of Macedonia, Georgia, Iceland, Israel, Republic of Moldova, Montenegro, Norway, Serbia, Switzerland, Tunisia, Turkey and Ukraine.

Furthermore, 2016 saw a continuation of the **Fast Track to Innovation (FTI)** pilot initiative, with the underlying objective of promoting innovation by reducing the time it takes to bring innovative ideas to market. Out of 1 096 proposals received, 48 received more than €100.9 million in funding in 2016, with 51.7% of the project participants being SMEs.

During this period the **expert evaluators** of eligible proposals came from 107 different countries[8]. The majority of evaluators was affiliated to a university or research organisation (combined figure of 68%), whereas 17% came from the private sector. Public bodies and other entities accounted for about 15% of the evaluators. 71% came from the EU-15, 16% from the EU-13, 6% from Third Countries and 6% from Associated Countries.

In 2016, efforts were stepped up to strengthen the interdisciplinary relevance of the calls for proposals, with particular attention being paid to **social sciences and humanities (SSH)** research. There were 183 topics in 2016 with SSH relevance. Moreover, SSH experts took part in the respective evaluation panels - and targeted guidelines were given to experts and moderators. In addition, SSH played a major role in Societal Challenge 6 'Europe in a changing world - Inclusive, Innovative and Reflective Societies', where topics with SSH relevance reached 94%.

Work progressed for a better integration of the **gender dimension** in Horizon 2020 and in the work programme 2016-2017 the visibility of gender has again been improved. Gender equality now has its own page on the Horizon 2020 website[9] and greater efforts have been made to ensure that gender is taken into account. In addition, the share of contracts signed with women experts participating in evaluation panels for Horizon 2020 was 41%, an increase from the previous year's figure of 37%.

The monitoring of **climate action and sustainable development** expenditure across Horizon 2020 against the respective 35% and 60% spending targets set out in the Horizon 2020 Regulation is ongoing. The figures for 2016 show that the target for sustainable development is well on track, while the one for climate action is not yet met. The figures for Horizon 2020 expenditure tracked in 2016 (corresponding to €8.3 billion) are 28% for climate action and 65 % for sustainable development. Still, in comparison to the preceding years, both contributions have increased. Additional efforts by the whole of the Commission are needed to ensure that the climate action mainstreaming target will be met in Horizon 2020. The constant mainstreaming of climate action within the DGs responsible for Horizon 2020 implementation will be further supported.

The **Euratom Programme** continued to support nuclear safety and energy development. In fission research, 48 projects involving 1200 researchers were addressing the three key areas: nuclear safety, waste management and radiation protection. In fusion research, the programme achieved, by the end of 2016, 47% of the research milestones set for 2014-2018 and is delivering key information and data for the future operation of ITER, the ground-breaking global research facility under construction in France.

On the issue of **widening participation**, alongside the Policy Support Facility (PSF) and the Seal of excellence, 10 projects were selected in 2016 under the second phase of the Teaming instrument to help improve research performance and increase investment in countries with lower research excellence rankings. The projects received between 10 and 14 million Euro

[8] Assessment made using available data

[9] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/promoting-gender-equality-research-and-innovation

each, amounting to almost €140 million in total. In 2016, a Teaming phase one call was also launched with almost €14 million of EU financial contribution, which resulted in 30 funded projects. In addition, support continued to be provided for COST (European Cooperation in Science and Technology).

International participation in Horizon 2020 in 2016 has improved compared to the beginning of the programme but still remains well below the FP7 level. Corrective actions have been taken to improve the international dimension of Horizon 2020. In particular, the number of topics in the work programme 2016-17 that are specifically relevant for international cooperation has increased compared to the work programme 2014-15. Moreover, the Commission has continued to encourage and assist industrialised countries and emerging economies in setting up mechanisms to fund the participation of their researchers in Horizon 2020 actions and efforts have continued in 2016 to broaden their scope of application. Communication activities and targeted partnering events were strengthened in particular through the "Horizon 2020 – Open to the World" campaign. The European Commission has adopted in October 2016 the Progress Report on the Strategy for EU International Cooperation in Research and Innovation. Science diplomacy is becoming an increasingly important part of the EU strategy for international R&I cooperation. For example, the Joint Communication on 'An integrated EU policy for the Arctic', published in April 2016, emphasises the key role of R&I in developing international cooperation on Arctic issues. The EU has also mobilised substantial political, financial and scientific resources to help the people affected by the Zika virus and to contain, control, treat and ultimately defeat it (with a specific call for 30 million euro). That included funding from Member States and the European Commission.

In 2016, Tunisia, Georgia and Armenia became associated to Horizon 2020, raising the number of associated countries to 16.

5. JOINT RESEARCH CENTRE (JRC)

In 2016, the JRC continued to provide scientific support to key policy initiatives such as regional development, digital single market, energy union, circular economy, standardisation, Economic and Monetary Union and migration.

A new JRC Strategy 2030 was approved in April 2016 by Commissioner Navracsics. The strategy prepares the JRC to better serve current and future priorities of the Commission. It focusses i.a. on knowledge management and cooperation with leading partners. JRC actively contributed to the implementation of the Commission's new corporate data, information and knowledge management policy. The Modelling Inventory and Knowledge Management System has been scaled up from a JRC tool to a Commission-wide tool. A collaborative online space was launched in October 2016, with the objective of enhancing collaborative working, using the 'Connected' platform for the 27 European Semester country teams. Moreover, new knowledge centres (for migration & demography and for territorial policies) and competence centres (on composite indicators & scoreboards and on micro-economic evaluation) were launched. By bringing together experts, competences, tools, skills, data and knowledge and working with DGs across the Commission, these centres can tailor the supply of sound scientific advice and knowledge, by better addressing the political needs.

By sharing knowledge, competences and facilities with over 1 000 partners worldwide, the JRC maintains a high level of expertise, and informs policy-making with the best scientific evidence. In 2016, the JRC concluded arrangements with strategic organisations such as the Central European University, the EIT, Ukraine’s National Academy of Sciences, the US Department of Energy (DoE) and the US Geological Survey. The JRC also strengthened its

relations with African countries, notably through a capacity-building event addressing evidence-based policymaking challenges. Other successful events co-organised by the JRC included the 'Science meets regions' and 'Science meets parliaments' events and the 5th annual forum of the EU strategy for the Danube region as well as the technology-transfer support to the Western Balkan countries.

6. DISSEMINATION, EXPLOITATION AND COMMUNICATION

The Commission implements activities by means of specific calls for proposals, coordination and support actions, and public procurement to provide targeted assistance to projects and consortia to optimise the exploitation and dissemination of results, with a budget in 2016 of around € 6.6 million. A Framework contract 'Common Exploitation Booster' (€ 1.6 million) supports 239 projects, with 40 services completed by the end of 2016. For external stakeholders, CORDIS, the European Commission's primary public repository and portal to disseminate information on all EU-funded research projects and their results, has been supported with € 5 million. CORDIS has been extended and improved with new initiatives. Exploitable research results for targeted audiences are made available, via 'Results Packs' and a. new enhanced 'Results in Brief' service presents the result and impact of projects to a broader public. This was complemented by sustained effort to showcase the successes of EU funded R&I with a focus on Horizon 2020. A new communication action was launched to highlight the longer term impact of sustained EU support for R&I in key areas.

Following Horizon 2020's open access policy, beneficiaries must ensure that peer-reviewed scientific publications resulting from Horizon 2020 funding are deposited in repositories and made open access i.e. involving free of charge online access for the user. Based on the signed grant agreements, by the end of 2016, around 68% of projects in the core areas participate in the Pilot. While this Pilot concerns selected areas of Horizon 2020, progress was made to further strengthen open access to research publications and data so that open access to data becomes the default rule in the work programmes as of 2017.

The importance of monitoring and evaluation in the strategic programming and policy cycle has been strengthened fully in line with the Better Regulation Package.

7. OUTLOOK

The outlook was shaped by both the coming half-way point of Horizon 2020, including the Interim evaluation exercise, as well as early efforts to lay the ground work for the successor framework programme.

The interim evaluations of Horizon 2020 and the Euratom programme were completed in 2017[10]. The results of these exercises fed through into improvements for the 2018-2020 work programme, such as attention to improving success rates for applicants.

A High Level Group, chaired by Pascal Lamy, was set up in September 2016 to formulate a vision for future EU R&I and to draw strategic recommendations on maximising the impact of EU R&I programmes in the future. It delivered its final report in July 2017[11]. The High Level Group's report, together with the lessons learnt in the Horizon 2020 interim evaluation, an on-going foresight exercise and the economic rationale for public R&I funding and its impact will be building blocks that pave the way for the successor Framework Programme, which will be proposed by the Commission in 2018.

[10] http://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020evaluation
[11] http://ec.europa.eu/research/evaluations/index_en.cfm?pg=hlg