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## **Is the EU's investment moving research, innovation and business forward?:**

### **A Mid-term assessment of the cost-effectiveness of Horizon 2020**

**Briefing for CONT Hearing on Horizon 2020 programmes**

**21 June 2017**

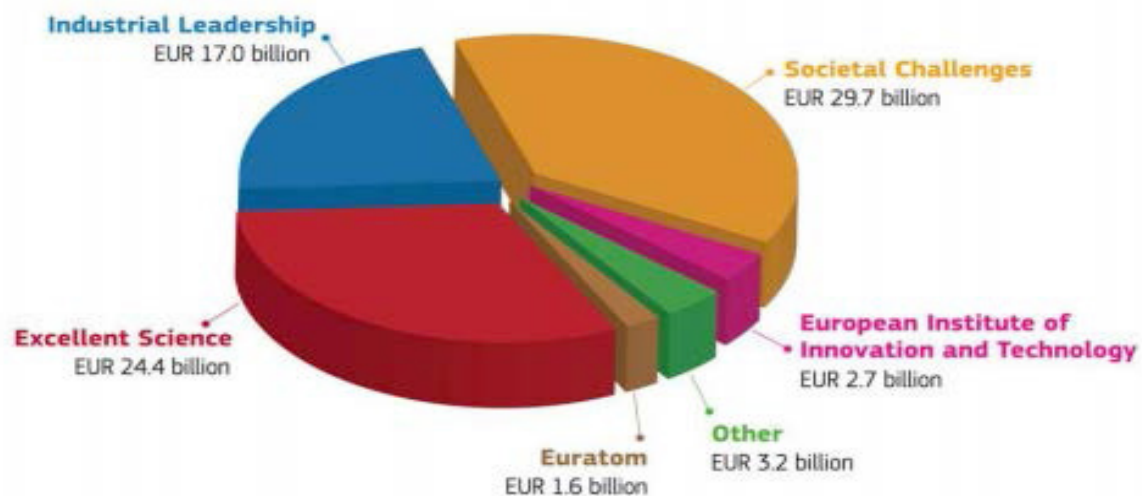
#### **HORIZON 2020: AN OVERVIEW**

Horizon 2020 is the financial instrument for implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness and building a society and an economy based on knowledge and innovation across the Union, while contributing to sustainable development. Running from 2014 to 2020 with a proposed € 80 billion budget, the EU's programme for research and innovation is part of the drive to create new growth and jobs in Europe, as well as the achievement and functioning of the European Research Area (ERA).

The vast scale and scope of this financial instrument will tackle societal challenges by helping to bridge the gap between research and the market by, for example, helping innovative enterprises to develop their technological breakthroughs into viable products with real commercial potential. This market-driven approach includes creating partnerships with the private sector and member states to bring together the necessary resources. The ultimate success of EU budget investment via Horizon 2020 depends on the effective and efficient implementation of available funding with focus on results.

A 'programme of programmes', Horizon 2020 presents two types of complexity. The first is due to the implementation mechanisms it inherited from previous framework programmes. The second is linked to its structure designed to promote a new approach to research and innovation funding and to enlarge the scope of the framework programme. The financing include 26 managing and implementing bodies, 28 member states and hundreds of thousands of potential beneficiaries from different areas and of different sizes.

**Figure 1: Horizon 2020 budget (EUR 78.6bn, i.e. in current prices)**



Source: Factsheet: Horizon 2020 budget

Figure 1 illustrates the Horizon 2020 priorities. The breakdown highlights that the majority of resources are allocated to the three pillars of the programme – Excellent Science (incl the European Research Council and Marie Curie actions), Industrial Leadership and Societal Challenges.

Horizon 2020 should leave all researchers aware of their responsibility for ensuring that every research project aimed at solving the societal challenges has a clear impact of value for society as a whole. In many cases this impact should be visible in terms of economic growth and job creation achieved through commercialisation. Timely collaboration with industry, in particular Small and Medium-sized Enterprises (SMEs), should be enhanced in strategic research. Great value for society, however, can also be gained through the production of state-of-the-art knowledge applicable to the formulation of future roadmaps and topics securing firm evidence for future research and political decision making. Impact in Horizon 2020 should therefore be measured in terms of transferability of knowledge and technologies.

This public hearing aims at assessing the cost-effectiveness of Horizon 2020 by discussing with representatives of all EU institutions involved as well as with stakeholders and beneficiaries, and debating in a Q&A form. The objective is to highlight achievements, identify weaknesses and propose improvements in order to enhance the cost-effectiveness of EU budget investments

## **THE IMPLEMENTATION AND PERFORMANCE OF HORIZON 2020**

The Horizon 2020 programme falls operationally under the European Union's budget Heading 1a for 'Competitiveness for Growth and Jobs' and has a total budget of EUR 19,925.0 million for 2017. The share of Horizon 2020 of this amount is EUR 10,345.9 million. The programme's budget for 2017 constituted an increase of 8.5% compared with 2016. The overall budget is used as a basis for developing the Horizon 2020 WPs. However, the figures provided in the WPs are indicative. Final WP budgets may vary by up to 20%.

Implementation of the Horizon 2020 budget is the responsibility of nine different directorates-general (DGs) of the European Commission. The budget is implemented by 22 different bodies, some of which channel resources from other funding bodies (other EU, national, regional, and/or private funds) and so act as a secondary source of funds. This complex structure of direct and indirect funding is the heritage of the multiplicity of instruments, partnerships and agencies created over past decades. The cascade of funding from the managing DGs to the beneficiaries of the EU funds therefore follows various routes that are not always easy for the final beneficiaries who perform the research and innovation activities (researchers, research institutes, private companies) to identify and track.

The new architecture of Horizon 2020 with its three pillars – 'Excellent Science', 'Industrial Leadership', and 'Societal Challenges' – and two specific objectives – 'Spreading Excellence and Widening Participation' and 'Science with and for Society' is intertwined with this intricate system of funding, adding an extra level of complexity. For example, the funding for a given societal challenge usually falls under the budget responsibility of two DGs and can be implemented in part by executive agencies and in part by public-public or public-private partnerships. Linear situations, where one DG is in charge of one part of the

On the performance side, the overall success rate of eligible full proposals is 11.8% and has declined from 2014 to 2015. It should however be noted that this is mainly due to the strong increase in the number of submitted proposals, rather than less funding. At the same time, there is an increased interest from potential applicants in Horizon 2020, demonstrated by the fact that 49.0% of successful applicants were newcomers and the share is increasing (Box 1).

### Box 1: Selected key performance facts

- Some key performance facts
- So far, over 76,400 eligible proposals were submitted for calls in the first two years of Horizon 2020, requesting a total EU financial contribution of €125.4bn.
- Around 9,200 proposals were retained for funding. The overall success rate of eligible full proposals in the first two years is 14%. Oversubscription is therefore a main concern.
- Over 9,000 grant agreements were signed by 1 September 2016, (528 of which were signed by DG RTD) with a budget allocation of over €15.9bn in EU funding.
- More than 90% of all grant agreements were signed within the legal target of eight months.
- Around 49% of the participants in Horizon 2020 are newcomers.
- The 20% budget target for the funding of small and medium-sized enterprises was achieved.

On financial terms there were EUR 551 million of cost savings in FP7 comparing to FP6. A positive sign is also that the share of Horizon 2020 funds allocated to small and medium-sized enterprises increased from 19.4% in 2014 to 23.4% in 2015. This trend must be

proactively encouraged, in particularly with the Commission's endeavour to further simplify the implementation of Horizon 2020 compared with FP7. All policy areas, including structural funds, benefit from simplification with a view to maintaining equal treatment of beneficiaries of European financial assistance. It is also worth noting that under Horizon 2020, 55 % of the budget will be managed by executive agencies, further reducing overhead costs and promoting cost-effectiveness.

Cost-effectiveness of Horizon 2020 derives also from very practical grounds (Box 2). The creation of a Common Support Centre (CSC) helps to coordinate and deliver the programme in an efficient and harmonised manner across seven Commission directorates-general, four executive agencies and six joint undertakings. Since 1 January 2014 the CSC provides common services in the areas of legal support, ex-post auditing, IT systems and operations, business processes, programme information and data to all research DGs, executive agencies and joint undertakings implementing Horizon 2020. Furthermore, the role of the National Contact Points (NCP) should be increased in order to provide quality technical support on the ground, because annual assessment of results, trainings and stimulation of NCPs that perform effectively will increase the success rate of Horizon 2020 programme.

**Box 2: Selected facts contributing to cost-effectiveness**

**Some facts contributing to cost-effectiveness**

- the programme structure under Horizon 2020 is less complex and provides for interoperability among different parts,
- a single set of rules now applies,
- there is now one funding rate per project,
- indirect costs are covered by a flat rate (25 %),
- only the financial viability of project coordinators is checked,
- a more measurable performance approach was introduced,
- a single audit strategy applies to the R&I family,
- a single participant portal was created for managing grants and experts,
- grants, expert contracts and archiving are managed electronically;

## **HORIZON 2020 ENCOUNTERS SOME DIFFICULTIES**

Despite a very positive uptake the Horizon 2020 programme encountered some difficulties. One of the major problems the Horizon 2020 programme needs to work around is a financial backlog. For almost all projects under Horizon 2020 the level of pre-financing for new projects had to be reduced to 35%. It should be noted that this backlog stems from the EU budget as a whole, and is not unique to the Horizon 2020 programme, as the EU budget is increasingly being put under pressure. Frontloading of appropriations for Horizon 2020 may have helped to tackle payments shortages. A 'hidden backlog', such as the postponement of some calls for proposals, may have at least partially offset the frontloading. A backlog of the EU budget will increasingly pose an obstacle to the implementation of the Horizon 2020 programme

The creation of the EFSI has had a direct negative impact on Horizon 2020 as the programme's budget has been reduced by EUR 2.2 billion to contribute to EFSI funding. As a result, the ERC and the MSCA as well as 'Spreading Excellence and Widening Participation' retain their original budget, i.e. these areas of Horizon 2020 were exempted from budget cuts. The cuts are spread over four years.

### How to measure cost-effectiveness

**Cost-effectiveness analysis (CEA)** is a form of economic analysis that compares the relative costs and outcomes (effects) of different courses of action. Cost-effectiveness analysis is an alternative and distinct from cost-benefit analysis (CBA), which assigns a monetary value to the measure of effect. CEA is useful when analysts face constraints which prevent them from conducting CBA. The most common constraint is the inability or unwillingness of analysts to monetize benefits

Cost-effectiveness analysis is often used in the field of health services, where it may be inappropriate to monetize health effect. Typically the CEA is expressed in terms of a ratio where the denominator is a gain in health from a measure (years of life, premature births averted, sight-years gained) and the numerator is the cost associated with the health gain. The most commonly used outcome measure is quality-adjusted life years (QALY).

While CEA has been widely applied for project analysis, there has been great variation in the way it is applied; consistency is often lacking among CEA analyses. Also, the quality of the CEA studies is often poor. This stands in contrast to CBA which is well-defined both in theory and practice.

The concept of cost effectiveness is applied to the planning and management of many types of organized activity. It is widely used in many aspects of life and it focuses on maximising the average level of an outcome, distributional cost-effectiveness analysis extends the core methods of CEA to incorporate concerns for the distribution of outcomes as well as their average level and make trade-offs between equity and efficiency, these more sophisticated methods are of particular interest when analysing interventions to tackle health inequality.

CEA usually compares a series of mutually exclusive alternative projects. Costs are monetized. Project costs are typically measured as actual expenditures rather than as opportunity costs. For example, costs might include the cost of laborers, but no charge for the opportunity cost of their travel time.

However, benefits are not monetized. Instead, a single, quantified physical measure of the principal project output is made. For example, the output may be the number of lives saved, or the tons of sediment per acre prevented, or the miles of road paved.

CEA measures costs in dollars and effectiveness in physical units. Because the two are incommensurable, they cannot be added or subtracted to obtain a single criterion measure (hence the reason that it is impossible to determine if  $B > C$ ). One can only compute the ratio of costs and effectiveness in the following ways:

$$1) \text{ CE ratio} = C_i/E_i$$

$$2) \text{ EC ratio} = E_i/C_i$$

where:  $C_i$  = the cost of alternative  $i$ , in dollars; and,  $E_i$  = the effectiveness of alternative  $i$ , in physical units

Equation 1 represents the cost per unit of effectiveness (e.g. dollars/ton of soil). Projects can be rank ordered by CE ratio from lowest to highest. The most cost-effective project has the lowest CE ratio.

Equation 2 is the effectiveness per unit of cost (e.g., tons of soil/dollar). Projects should be rank ordered from highest to lowest EC ratios. Both the CE and EC ratios are measures of technical and not economic efficiency. Thus, they are poor or at least questionable measures of allocative efficiency.

*Source: please see references and database*

## HOW SUCCESSFUL THE HORIZON 2020 PROGRAMME HAS BEEN

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.

Implementation of synergies and complementarities between Horizon 2020 and other national or regional programmes in Member States has just started and it is too early to assess the impact on participants and to assess Horizon 2020's performance with reference to employment creation and dealing with the economic crisis. Thus far, national initiatives have been limited to supporting unsuccessful SME applicants, while further progress should be considered in other areas.

What can be concluded with certainty is that there is a very high demand for funds – leading to 100% absorption of resources. In addition there are a number of other promising signs for Horizon 2020's contribution to achievement of the EU2020 strategy, for example that the share of SME participation is in line with ex-ante expectations (20%).

Given the fact that FP7 only accounts for a small proportion of total RTD expenditure in Europe, its economic impacts are quite substantial. Through short-term leverage effects and long-term multiplier effects each euro spent by the European Commission on FP7 generated approximately 11 euro of estimated direct and indirect economic effects through innovations, new technologies and products.

In terms of job creation, the economic impacts into effects on employment, FP7 directly created 1.3 million person/years within the projects funded (over a period of ten years) and indirectly 4 million person/years over a period of 25 years. Again, it is still too early to produce a final assessment of the market impact.

The Horizon 2020 has introduced a number of new programme design elements. These put a stronger emphasis on innovation. Using this reasoning, it can reasonably be expected that Horizon 2020 has the potential to create even greater effects on innovation-led growth in the EU. This would of course partly depend on the continued work of the European Institute for Innovation and Technology (EIT) and its Knowledge and Innovation Community (KICs) which have been designed to support innovation regionally, as well as across EU Member States' borders in key sectors.

The budget is one of the biggest problems of the Horizon 2020. Less than one third of the positively evaluated proposals could be financed. Oversubscription may discourage leading researchers and organisations from applying for Horizon 2020 grants. There is a need to clearly establish research priorities.

The simplifications introduced in the Horizon 2020 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.

## **HORIZON 2020 VS COST-EFFECTIVENESS**

Cost effectiveness should be measured against economy, efficiency and effectiveness (sound financial management) in achieving the policy objectives. The fact that implementation of research framework programmes was shared among different directorates-general, executive agencies, joint undertakings, so-called Article-185 bodies, the European Investment Bank (EIB) and the EIT contributes to cost-effectiveness.

Early signs indicate that overall Horizon 2020 has been managed cost effectively. The programme has improved its efficiency despite the delays and repeated error rates in its implementation. Modernisations introduced under Horizon 2020, such as flat rates for indirect costs, a single audit strategy, single participant portal, etc., should be applied in a similar way in other policy areas, e.g. structural funds and all grant beneficiaries should be treated fairly and equally.

Horizon 2020 rules are at times not sufficiently compatible with general business practices and control systems need to be better balanced between risk and control and beneficiaries require better guidance to cope with complexity of the scheme and reimbursement methods need to be more efficient to increase efficiency. Positive is that indicators such as time-to-grant, time-to-inform and time-to pay showed a positive trend and were considered to be satisfactory (93-100 % compliance).

The fact that projects worth EUR 1.63 billion were still not completed could severely delay the implementation of Horizon 2020. Positive is that due to the fact that the Court's concerns were taken into consideration, by the end of 2016 the amount to be recovered was EUR 68 million, of which EUR 49.7 million was effectively collected

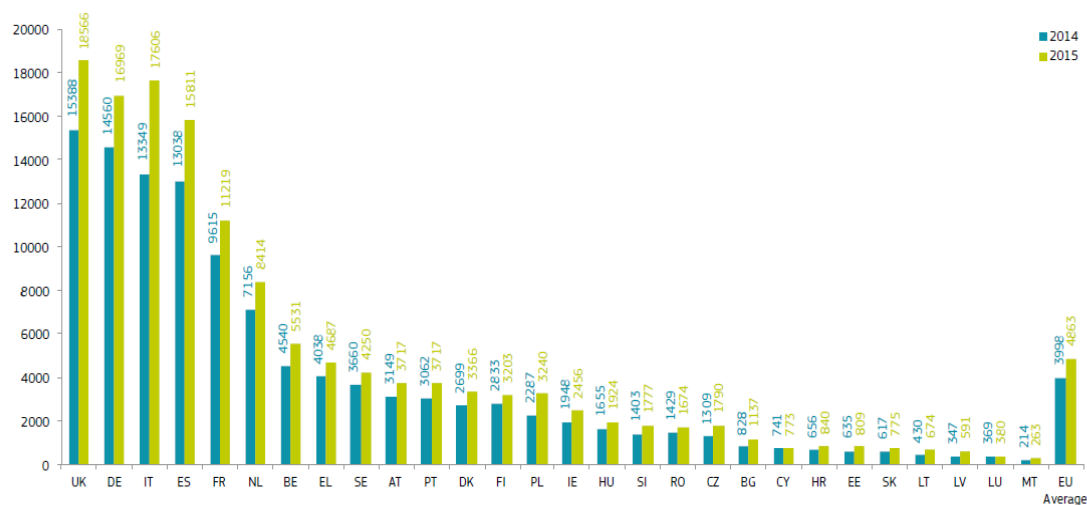
Establishing synergies between the research and innovation sector on the one hand, and the structural funds on the other, is in the European Union's interest. Horizon 2020 and national research funding must be coherent with Common rules on state aid to avoid inconsistencies and duplications of funding and specific national characteristics should be taken into account.

Financial instruments in the area of research and innovation are of high importance to ensure competitiveness within research and that projects with higher Technology Readiness Levels can ensure sufficient return on public investment. To that end it should be noted that 'The Risk-Sharing Finance Facility (RSFF 2007-2013) offer loans and hybrid or mezzanine finance to improve access to risk finance for R&I projects. Horizon 2020 should work closely with EFSI to ensure coordination between EU's Framework Programme and the EFSI.

The need to ensure that Horizon 2020's best practices are used in defining the programme, suggests more funding for innovation, which is economically efficient for the business sector and greater flexibility between budgets of the different sub-programs to avoid lack of funding for those qualified as "excellent";

## ANNEX I: APPLICATION RATE OF MEMBER STATES

### Application rate of Member States



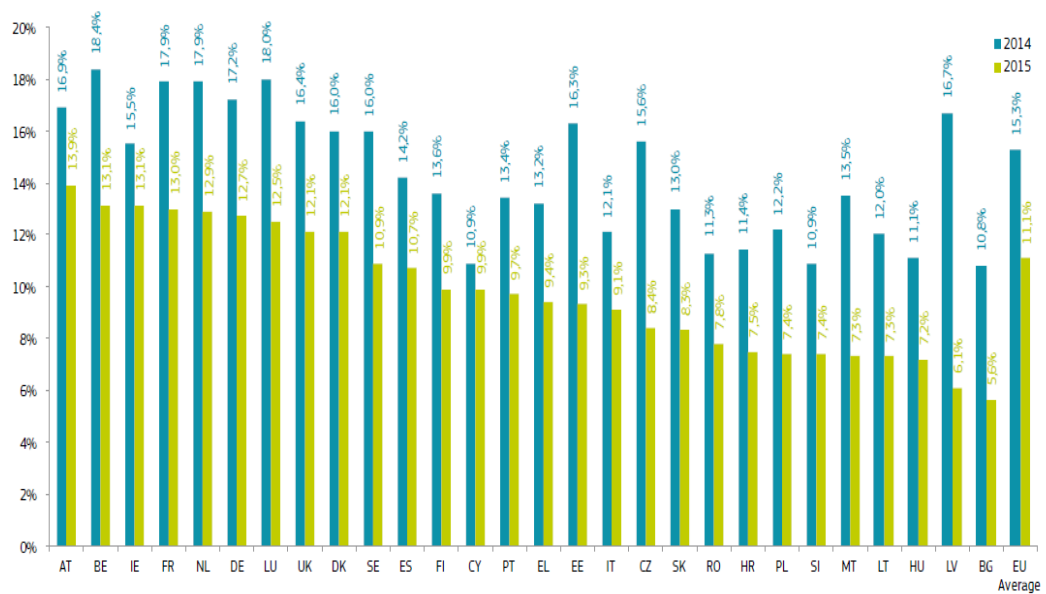
A total of 275,841 applications were received over the two years, with an increase of 23.9% from 2014 to 2015. This chart shows the total number of applications from EU countries.

All Member States have increased the number of applications submitted from 2014 to 2015. The applications from the EU-13 (Member States joining EU since 2004) increased by 29.6% and the EU-15 (Member States joining EU before 2004) by 20.6%.

**Source:** European Commission Directorate-general for Research and Innovation

## ANNEX II: RATE OF SUCCESSFUL APPLICATIONS PER MEMBER STATE

Rate of successful applications per Member State

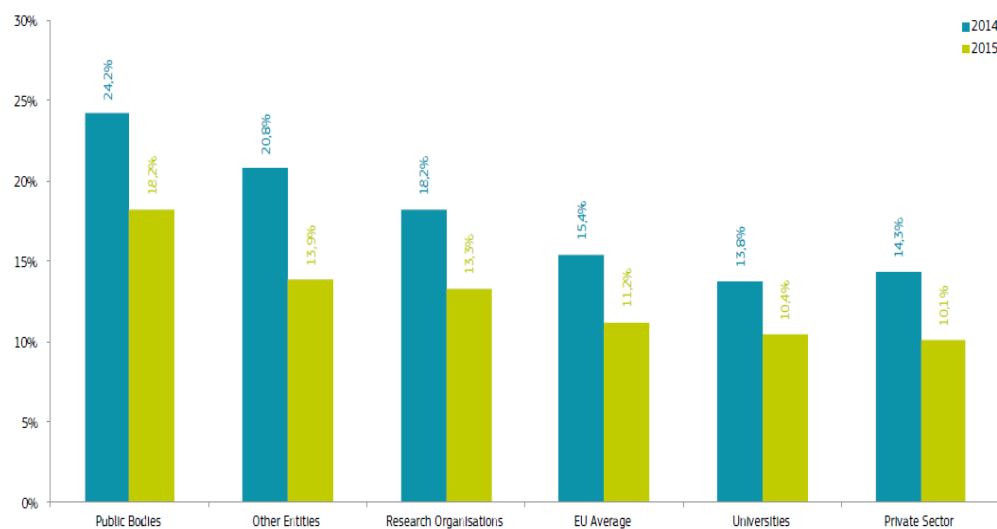


This chart shows the overall success rate per Member State - the EU average for the two years is 13%. The decline in success rates is due to the increase in the number of eligible applications, rather than a decrease in funding available.

**Source:** European Commission Directorate-general for Research and Innovation

### ANNEX III: RATE OF SUCCESSFUL APPLICATIONS FROM DIFFERENT SECTORS

Rate of successful applications from different sectors



Since Horizon 2020 began, more than 39% of all applications came from university candidates, 35.2% from the private sector and 18.4% from research organisations. Although public bodies had the lowest application rate (3.5%), they had the highest success rate. This chart shows the success rate across the sectors.

*Note: Please refer to the section in the Glossary on Evaluation procedure for more information on how proposals are selected, and to Definitions of types of organisations for more information on the above classification.*

**Source:** European Commission Directorate-general for Research and Innovation

## ANNEX IV: A COMPARATIVE ANALYSIS OF HORIZON 2020 AND FP 7

With the introduction of Horizon 2020, the Commission - responsible for research and innovation programming - took a decisive break with the past and engaged into a new approach to implementing research programmes. Before Horizon 2020, EU funding for research, education and innovation was covered by separate EU programmes (FP7, the innovation-related part of the Competitiveness and Innovation Programme (CIP), and the European Institute of Innovation and Technology (EIT)), with different rules and implementation modalities. The strategic programming is the key to Horizon's 2020 work programmes, in order to be forward-looking and to respond to new developments, as well as to cover full research and innovation cycles and to contribute significantly towards the EU's overall policy objectives.

The main changes from FP7 to Horizon 2020 as well as the key expectations resulting from the changes of focus between FP7 and Horizon 2020 are highlighted in Box 1. Where relevant and possible, the performance of FP7 and these expectations are used as a baseline in this evaluation.

### Box 1: From FP 7 to Horizon 2020

Recommendations from FP7 ex-post evaluation <sup>11</sup>	Horizon 2020
<b>Focus on critical challenges and opportunities in the global context</b>	<ul style="list-style-type: none"> <li>➤ focuses on society's major challenges</li> <li>➤ boosts private sector participation, including SMEs</li> <li>➤ maximises synergies between different areas of research and innovation and new digital technologies</li> </ul>
<b>Align research and innovation instruments and agendas in Europe</b>	<ul style="list-style-type: none"> <li>➤ seeks to support the alignment of national research strategies</li> <li>➤ better coordinates with EU regional funding</li> <li>➤ helps EU countries reform their research and innovation strategies</li> <li>➤ identifies obstacles to research and innovation</li> <li>➤ ensures that research proposals support innovation</li> </ul>
<b>Integrate different sections of research funding programmes more effectively</b>	<ul style="list-style-type: none"> <li>➤ focuses on better consistency across the funding programme</li> <li>➤ ensures cross-cutting issues are considered</li> <li>➤ simplifies access to research and innovation funding</li> <li>➤ applies single set of rules consistently</li> <li>➤ coordinates effectively across the Commission in managing funding</li> </ul>
<b>Bring science closer to citizens</b>	<ul style="list-style-type: none"> <li>➤ better communicates to the general public on science issues in general and on Horizon 2020 in particular</li> <li>➤ strengthens open access to research publications and data</li> <li>➤ involves citizens in research strategy and topics</li> </ul>
<b>Establish strategic programme monitoring and evaluation</b>	<ul style="list-style-type: none"> <li>➤ better monitors and evaluates funding and socioeconomic impacts</li> <li>➤ improves feedback loop from project results to policy making</li> </ul>

Source: EU Commission, 2016

Horizon 2020 has a more coherent structure than FP7, largely by consisting out of three pillars, which allows to focus to promote interdisciplinary solutions to multiple societal challenges. It is commonly stated that Horizon 2020 is making progress in spreading excellence and widening participation and is making progress in generating science with and for society compared to FP7. To that end, Horizon 2020 produces demonstrable benefits compared to national and regional support to R&I and FP7 in a variety of terms and hence delivers a higher added value. Box 2 highlights in three sections the main novelties/changes of Horizon 2020 to FP7.

## Box 2: Main changes between FP 7 and Horizon 2020

### Main novelties of Horizon 2020 compared to FP7

- A single programme for all EU managed research and innovation funding, with a single set of participation rules.
- Full integration of innovation in the programme, meaning more support that is closer to market application (e.g. demonstration, support for SMEs, innovation services, venture capital)
- A focus on the major societal challenges Europe and the world face. This means bringing together different technologies, sectors, scientific disciplines, social sciences and humanities, and innovation actors to find new solutions to these challenges.
- Radically simplified access for participants, including a single web portal for all information applications, and fewer controls and audits.
- A more inclusive approach with specific actions to ensure excellent researchers and innovators from all European regions can participate, and reinforced support for partnerships with the private sector and with the public sector in order to pool resources and build more effective programmes.
- At the same time, successful elements from FP7 are being scaled up, such as the European Research Council and trans-national collaborative projects.

### Main elements of continuity/strengthening of successful elements from FP7

- The *European Research Council*, which had in a few years' time become the point of reference for excellent frontier research in Europe and which has therefore been significantly strengthened;
- The *Marie Curie actions* for training, mobility and career development of researchers and the research infra-structure actions;
- The *collaborative research actions* which have been at the heart of the successive Framework Programmes for Research and are under Horizon 2020 extended to innovation aspects such as market-replication, demonstration, involvement of users, design, intellectual property and standardisation issues;
- The *financial instruments* of both FP7 and the CIP which have been met with great demand and which have been shown to be particularly valuable in a time in which debt and equity financing have been severely constrained;
- *Demand side measures* to stimulate innovation (in particular public procurement of innovative solutions), support through clusters, IPR management and exploitation, SME innovation capacity support, stemming from the CIP.
- While aligning with the strategy of Horizon 2020, the *European Institute of Innovation and Technology* maintains its mission: integrating the knowledge triangle and experimenting with new approaches for innovation, notably involving the business community.

### Main expectations from Horizon 2020 compared to a continuation as in FP7

- As under FP7, Horizon 2020 is expected to achieve critical mass at programme and project level. At the same time, it is expected to enhance the promotion of scientific and technological excellence and allow for more flexibility.
- Administrative costs for applicants and participants are expected to reduce drastically, which is expected to significantly improve accessibility, in particular for SMEs, and increase levels of support from all types of stakeholders.
- Knowledge triangle and broader horizontal policy coordination is expected to be enhanced through a single framework integrating, research, innovation, and researcher training and skills development, and explicitly defining links with other policies.
- Scientific, technological and innovation impacts are expected to be enhanced through the provision of seam-less support from scientific idea to marketable product, stronger output orientation, better dissemination of research results, clearer technological

- objectives, enhanced industrial and SME participation and, thus, enhanced leverage, funding of demonstration activities, and provision of innovation financing and support.
- In combination with clarity of focus and high-quality intervention logic, enhanced scientific, technological and innovation impacts are expected to translate into larger downstream economic and competitiveness, social, environmental and EU policy impacts.
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Source: EU Commission, 2016

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