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Commission

# Key findings from the **HORIZON 2020** interim evaluation



Research and  
Innovation

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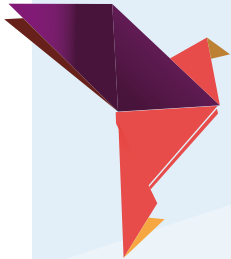
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Key findings  
from the  
**HORIZON 2020**  
interim  
evaluation



# KEY FEATURES OF HORIZON 2020

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- A European research and innovation Framework Programme that is **truly unique** in the world in terms of:
  - ➔ budget (close to EUR 77 billion, the largest Framework Programme budget ever, but still less than 10% of all public expenditure on research and innovation in the EU),
  - ➔ duration (7 years),
  - ➔ budgetary framework stability, and
  - ➔ scope (research plus innovation; grants as well as loans, equity, and procurement; broad top-down focus on grand societal challenges as well as bottom-up frontier research; cross-border, cross-sectoral, inter-disciplinary collaboration, mobility, coordination).
- With an ambitious general objective: *“To contribute to building a society and economy based on knowledge and innovation across the Union”*.
- Pursues a number of focused **specific objectives**, mainly:
  - ➔ to strengthen the EU’s science base;
  - ➔ to boost the technological leadership and innovation capability of the private sector;
  - ➔ and to address the contribution of research and innovation to tackling societal challenges.
- A **simple structure**, aligned with the specific objectives, comprising three pillars:
  - ➔ ‘Excellent science’,
  - ➔ ‘Industrial leadership’ and
  - ➔ ‘Societal challenges’.
- Built-in innovation and **impact orientation** (challenge-based approach; funding all the way from lab to market; enhanced involvement of business, in particular Small and Medium-sized Enterprises (SMEs);
  - ➔ impact-oriented calls for proposals;
  - ➔ expected impact to be spelled out in proposals;
  - ➔ impact examined during proposal evaluation;
  - ➔ regular reporting and monitoring).
- Inclusion of cross-cutting themes in societal challenges (e.g. Blue Growth/maritime, circular economy, Internet of Things, Smart and Sustainable cities, Digital Security).
- **Radical simplification** (e.g. electronic signing of grant agreements, Participant Portal, single reimbursement rate, flat rate for indirect costs).
- Makes a break with past Framework Programmes (through integration of research and innovation, accessibility, harmonisation).
- Allocates funding through a **strategic programming process** and two-year work programmes.
- **Wide range of instruments** and actions.
- **Excellence** as guiding principle and main proposal evaluation and selection criterion (no geographical consideration except in the Spreading Excellence and Widening Participation part).

# WHERE DO WE STAND AFTER THREE YEARS?

In the first three years of programme implementation, **EUR 20.4 billion** – just about one fourth of the total Horizon 2020 budget - has been allocated to **11,108 signed grants**.

Horizon 2020 has so far attracted more than **100,000 applications**, representing a 65% increase in the annual number of applications compared to its predecessor, the 7<sup>th</sup> Framework Programme (FP7).

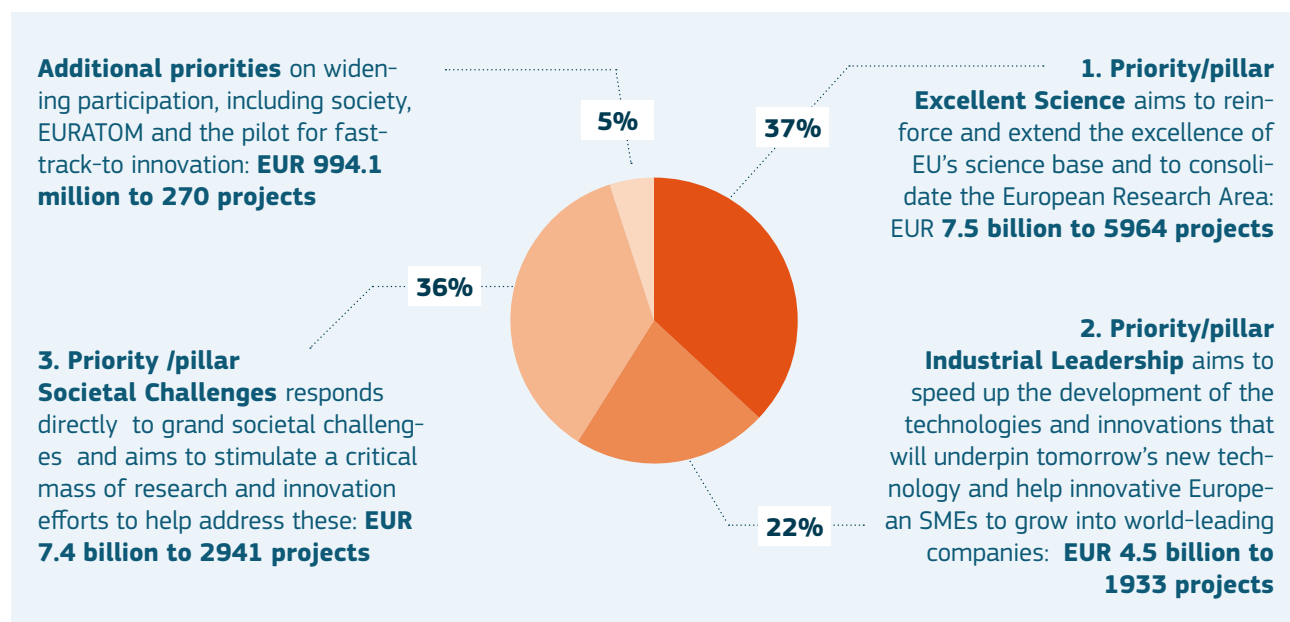
It involves **top level participants** from the higher education, research and private sectors and from a wide range of disciplines and thematic fields. The main beneficiaries of Horizon 2020 are higher education and research organisations, which together received 64.9% of the funding, the private sector receiving 27.7%, and

public authorities and other types of organisations 7.3%. **23.9% of the budget for industrial and enabling technologies and societal challenges goes to SMEs**, far exceeding the legal target (20%). **More than half (52%) of participants are newcomers**.

Participants come from **over 130 countries** (including 87 third countries). Those from EU-28 countries received 92.9% of the funding.

Approximately **75% of all funding so far has gone to instruments supporting collaborative research and innovation**, while the rest went to single beneficiaries e.g. to support excellent science through European Research Council grants, or research and innovation projects for SMEs.

## ALLOCATION OF HORIZON 2020 FUNDING 2014-2016



# THE INTERIM EVALUATION

The purpose of the interim evaluation is to contribute to improving the implementation of Horizon 2020 in its last Work Programme 2018-2020, to provide the evidence-base for the report of the High Level Group on maximizing the impact of EU Research and Innovation programmes and to inform the design of future Framework Programmes. Following the Better Regulation Guidelines, it looks at Horizon 2020 from five different angles:

1. **Relevance:** assessment of whether the original objectives of Horizon 2020 are still relevant and how well they still match the current needs and problems.
2. **Efficiency:** the relationship between the resources used by Horizon 2020 and the changes it is generating.
3. **Effectiveness:** how successful Horizon 2020 has been in achieving or progressing towards its objectives.
4. **Coherence:** how well or not the different actions work together, internally and with other EU interventions/policies.
5. **EU added value:** assessment of the value resulting from Horizon 2020 that is additional to the value that could result from interventions which would be carried out at regional or national levels.

## A WIDE EVIDENCE BASE

### + EVALUATION STRENGTHS

- **Wide evidence base**
- Use of **counterfactual analysis**
- Benchmarking with FP7
- Building **in-house evaluation culture**

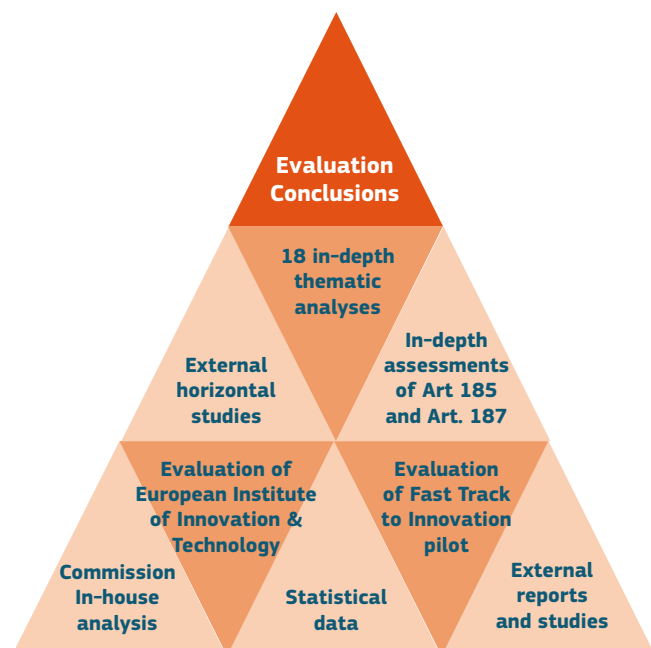
### - EVALUATION CHALLENGES

- Very **few projects completed** (~0.6% of budget committed)
- **Data availability** & quality, lack of impact indicators
- Time-lags for R&I impacts

**DATA SOURCES** → Surveys, interviews, case studies, expert groups, Horizon 2020 monitoring data (e.g. CORDA), Commission administrative data (e.g. budget), existing databases (e.g. OECD, Eurostat, ORBIS) and publications (incl. European Parliament, European Economic and Social Committee, Court of Auditors)

**METHODS** → Macro-economic modelling, counterfactual analysis, Social Network Analysis, descriptive statistics, bibliometric analysis, Text and data mining analysis, document review, case studies, synthesis of thematic assessments

**STAKEHOLDER CONSULTATIONS** → NCP surveys, simplification survey, call for Ideas on the European Innovation Council, Stakeholder consultation on the Interim Evaluation of Horizon 2020



# IS HORIZON 2020 IN LINE WITH EUROPE'S NEEDS?



## KEY MESSAGES

Horizon 2020's original rationale for intervention and objectives remain largely valid.

Closing the innovation gap and maintaining industrial leadership remain valid key objectives for the EU and Horizon 2020, though the importance of supporting breakthrough, market-creating innovation is now more clearly recognised than when designing Horizon 2020.

Further strengthening the EU's science base is as necessary as ever and remains a valid Horizon 2020 objective.

The societal challenges identified when conceiving Horizon 2020 still exist and are valid continued priorities for the EU and Horizon 2020.

The continued relevance of Horizon 2020 also lies in its contribution to the achievement of a wide range of EU and global objectives such as the Sustainable Development Goals.

Horizon 2020 has been flexible enough to support research on urgent new needs (e.g. Ebola and Zika outbreaks, migration) as well as new, promising science and research.

Emerging priorities and new developments still need to be scouted continuously and the right balance has to be found between being too prescriptive or not prescriptive enough.

The strategic programming process improved the intelligence-base underpinning programming choices though stakeholders call for even greater transparency.

The high application rate, including from newcomers, also shows the relevance and attractiveness of Horizon 2020 for stakeholders. The annual number of applications has increased by 65% between FP7 and Horizon 2020 including 78% from new applicants, mainly from the private sector.

Stakeholders' substantial reasons for participating - in particular getting financial support, access to knowledge and expertise, and collaboration with European or international partners - illustrate the importance and relevance of Horizon 2020.

The wider public's understanding of the benefits of publicly supported research and innovation and the involvement of civil society in Horizon 2020 can be further improved.





### THE INITIAL OBJECTIVES OF HORIZON 2020 ARE STILL FULLY VALID



- The EU still underinvests in R&I activities (below the target of **3%** of GDP)
- Strengthening the EU's **science base** is as necessary as ever
- There is still a need to further reinforce **industrial leadership**
- The identified **Societal Challenges** are still present

### HORIZON 2020 IS ATTRACTIVE TO STAKEHOLDERS



- Stakeholders increasingly participate in programme design
- Applications increased to **33,000** per year (vs. **20,000** in FP7)
- **78%** from new applicants, mainly from the private sector

### HORIZON 2020 HAS PROVEN TO BE FLEXIBLE



- Responds to **emerging needs** (e.g. emergency Ebola call, more funds to deal with migration)
- Supports recent **technology advances**
- Addresses renewed **political priorities**

### MORE NEEDS TO BE DONE

➤ There remains an innovation gap. EU lags behind in **breakthrough, market-creating innovation**

➤ Low involvement of civil society but improving from FP7: room for improvement in **bringing research closer to the general public**

➤ The strategic challenges and objectives are **not always clearly translated in specific calls and topics.**

# THE EFFICIENCY AND IMPLEMENTATION OF HORIZON 2020



## KEY MESSAGES

Horizon 2020 is generally expected to be at least as cost-effective as FP7 if the most recent macro-economic projections materialise (internal rate of return of 30%).

Compared to FP7, Horizon 2020's efficiency is positively influenced by the extensive externalisation of programme implementation to new management modes including Executive Agencies (implementing 60% of the budget).

Horizon 2020's efficiency has been enhanced compared to FP7 through the creation of a Common Support Centre ensuring the harmonised implementation of Horizon 2020's rules for participation across the different actors implementing the programme.

Horizon 2020's efficiency has improved compared to FP7 through the large-scale simplification of the rules of participation, to the satisfaction of stakeholders. Simplification reduced the administrative burden on participants and led to large decreases in the time to grant (110 days less than under FP7). Current administrative expenditures are below the target of 5% and are particularly low for the executive agencies.

In particular, Horizon 2020's funding model has been greatly simplified compared to FP7. It is attractive for stakeholders and did not lead to a significant change in funding rates compared to FP7 (EC contribution of 70% of total projects' costs).

Simplification is never finished - it is a continuous endeavour.

Horizon 2020 suffers from underfunding resulting in large-scale oversubscription (success rate of 11.6%), much larger than under FP7, which constitutes a waste of resources for applicants and a loss of high quality research for Europe. An additional EUR 62.4 billion would have been needed to fund all high quality proposals.

The proposal evaluation process is generally highly regarded but some aspects such as the feedback to applicants could be improved.

For successful applicants, benefits are estimated to largely outweigh costs.

Horizon 2020 funding reaches a wide range of stakeholders and newcomers.

Horizon 2020 promotes intensive collaboration between different types of organisations, scientific disciplines.

Horizon 2020 allocates its funding across economic sectors in a balanced manner.

Horizon 2020 is open to the world and has a broad international outreach (participation of over 130 countries) but international cooperation can be further intensified.



## HORIZON 2020 IS MORE EFFICIENT THAN FP7

- Extensive externalisation of programme management to new management modes

Executive Agencies implement **60%** of the budget

Administrative expenditure below the **5%** legal target

- Creation of a Common Support Centre ensuring the harmonised implementation of Horizon 2020's Rules for Participation

- Large-scale simplification of the Rules for Participation

Time-to-grant **110 days** faster than FP7

EC contribution remains at **70%** of total project cost as in FP7

## HORIZON 2020 SUFFERS FROM LARGE-SCALE OVERSUBSCRIPTION

- Success rate of **11.6%** against **18.4%** in FP7

A waste of resources for applicants: **EUR 1.7 billion** spent to write unsuccessful proposals

Increased cost of proposal evaluation (more proposals evaluated)

## HORIZON 2020 INVOLVES AND NETWORKS A WIDE RANGE OF STAKEHOLDERS

- Participants from over **130** countries
- Newcomers represent **52%** of all organisations (almost half are SMEs)

More newcomers from EU-13 (**31.2%**) than EU-15 (**19.7%**)

More SME participating from EU-13 (**21.8%**) than from EU-15 (**21.2%**)

- Partnerships between different types of organisations, countries, scientific disciplines, sectors

## MORE NEEDS TO BE DONE

**+** More than **EUR 60 billion** of additional funds needed to support all high quality proposals received; oversubscription is costly for both applicants and for the EU.

**+** Comprehensiveness of evaluation feedback is a concern

**+** International cooperation can be further intensified.

# TOWARDS SCIENTIFIC IMPACT

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## EARLY SIGNS OF PROGRESS

Horizon 2020 is making progress towards delivering scientific impacts through the reinforcement of research and innovation capabilities, scientific excellence and reputation and through the integration of research and innovation efforts.

Horizon 2020 succeeds in attracting and involving the EU's and world's best research institutions and researchers (~340,000 researchers supported).

In particular the European Research Council and Marie Skłodowska-Curie Actions, and Future and emerging Technologies but also other Horizon 2020 parts, train large numbers of researchers and contribute to Europe's human capital development, which in turns makes the EU an attractive destination for excellent researchers worldwide.

Pan-European research infrastructures supported by Horizon 2020 already contribute to Europe's excellent science with tools, materials and data accessible from across the EU (~35,000 researchers accessing per year) and by supporting the mobility and training of researchers.

Horizon 2020 has already succeeded in generating, and can legitimately be expected to continue to generate, a very large number of scientific publications and data (more than 4,000 peer-reviewed publications).

These are already to a large extent (two thirds of them), but not yet fully, openly accessible to the wider scientific community and public.

The first scientific publications resulting from Horizon 2020 are world class – being cited more than twice the world average.

Horizon 2020 projects have the potential to generate a large number of scientific breakthroughs; researchers have already contributed to major discoveries like exoplanets, the Higgs boson and gravitational waves. At least 17 Nobel Prizes got support from Horizon 2020 prior or after their award.

Horizon 2020 builds cross-sectoral, inter-disciplinary, intra- and extra-European networks. More than 1 in 5 publications is based on academia/private sector collaboration. Co-publications with non-EU country authors are cited more than three times the world average. Horizon 2020 already has more interdisciplinary publications than FP7.

Horizon 2020 is also making progress, albeit slowly, on spreading excellence in Europe.



## INVOLVING AND TRAINING THE BEST



- Attracting and involving the **EU's and world's best** research institutions and researchers
- ~**340,000** researchers supported overall
- Marie Skłodowska-Curie Actions supported the international mobility of **27,000** researchers

## STRENGTHENING RESEARCH INFRASTRUCTURES



- **365** national research infrastructures made accessible to all researchers
- **35,000** researchers having access to Research Infrastructures thanks to Horizon 2020

## PRODUCING KNOWLEDGE AND GENERATING SCIENTIFIC BREAKTHROUGHS



- **4,043** peer-reviewed publications, 2/3 in Open Access, **cited more than twice the world average**
- So far **17** Nobel Prize winners supported before or after their award
- **71%** of European Research Council projects so far made scientific breakthroughs
- Contribution to **key discoveries** like exoplanets, the Higgs boson and gravitational waves

## CREATING SCIENTIFIC COLLABORATION NETWORKS



- More than **1 in 5** publications based on academia/private sector collaboration
- Widening scientific networks compared to FP7 with **more smaller countries**
- Publications with an associated/third country author are **cited more than three times world average**
- More interdisciplinary publications than in FP7 (**7.5%**, especially in EU-13)
- These are cited **78%** more than world average

## MORE NEEDS TO BE DONE:

+ Too early to have a full picture of results and impacts

+ Make Horizon 2020 data and publications even more **openly accessible**

+ Slow progress on **spreading excellence** in Europe

# TOWARDS INNOVATION AND ECONOMIC IMPACT



## EARLY SIGNS OF PROGRESS

Compared to FP7, Horizon 2020 is more successful in attracting and involving the private sector (33.2% of participations against 30.4% in FP7), a necessary precondition for the achievement of innovation and economic impact.

Horizon 2020 attracts and involves more SMEs, the backbone of the European economy and necessary partners for achieving innovation and economic impact.

Horizon 2020 is creating networks between businesses, and between the business sector, universities and research institutions, which is key to bringing knowledge quickly to market and gaining industrial leadership.

Horizon 2020 provides companies, and in particular SMEs, with access to risk finance to carry out their innovation projects, thereby addressing an important market failure:

- 5,700 organisations funded under the Access to Risk Finance programme part (EUR 13 billion of private funds leveraged; EUR 29.6 billion of investments mobilised via debt financing);
- 88 SMEs taking part in the SME Instrument end-2016 secured a total of EUR 481 million of venture capital during or after the project.

Horizon 2020 invests in demand-driven innovation through innovative instruments including procurement and prizes but with low levels of take-up so far.

Horizon 2020 already generates large numbers of high quality, commercially valuable patents and other intellectual property rights, so far mainly from the SME Instrument and the ERC Proof-of-Concept: 153 patent applications (39 awarded), 24 trademarks awarded.

Horizon 2020 already generates proofs of concept and demonstrators and supports the deployment of innovative solutions supporting the commercialisation and diffusion of innovation: 229 prototypes, 801 testing activities, 81 clinical trials.

Horizon 2020 projects already produce new knowledge, strengthen capabilities, and generate a wide range of innovation outputs including new technologies, products and services: 563 firms introducing innovations new to the market (56% SMEs), 471 new to the company (53% SMEs); 70% of SMEs aim at new to the market innovations; more than half of SME Instrument Phase 2 beneficiaries have already reached the market.

Every euro invested under Horizon 2020 brings an estimated GDP increase of 6 to 8.5 euros (EUR 400 to EUR 600 billion by 2030).

Horizon 2020 supported projects already demonstrate potential in terms of generating breakthrough, market-creating innovation (a quarter of the ongoing Innovation Actions are regarded as having breakthrough, market-creating potential) but such support can be strengthened substantially.



## PRODUCES KNOWLEDGE, IPR, INNOVATIONS AND COMPETITIVENESS



> **153** patent applications and **24** trademarks

> Funded projects are **~40%** more likely to be granted patents

> Patents are of higher quality & commercial value



> **229** prototypes, **801** testing activities, **81** clinical trials

> **70%** of SMEs aim at new to the market innovations



> More than half of SME Instrument Phase 2 beneficiaries have already **reached the market**

> A quarter of Innovation Actions have breakthrough, **market-creating potential**

## SUPPORTS, NETWORKS AND FUNDS RESEARCH & INNOVATION BY BUSINESS AND SMEs

> **5,700** organisations funded under Access to Risk Finance



EUR 13 billion private funds leveraged



EUR 29.6 billion via debt financing



> **88** SMEs supported by the SME Instrument secured **EUR 481 million** in venture capital

## GENERATES JOBS, GROWTH AND INVESTMENTS



> SME Instrument beneficiaries have **higher growth paths** than unsuccessful applicants

> GDP gain between EUR **400** to EUR **600** billion by 2030. Every euro invested under Horizon 2020 brings back **6** to **8.5** euros



## MORE NEEDS TO BE DONE

+ Support for **breakthrough, market-creating innovation** should be strengthened

+ More could be done to support the **demand for innovative solutions and user-driven innovation**

+ Address **potential barriers to innovation** (e.g. regulation, standards, access to finance, customer acceptance) for full market uptake

# TOWARDS SOCIETAL IMPACTS

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## EARLY SIGNS OF PROGRESS

Most Horizon 2020 projects, including from the 'Excellent Science' and 'Industrial Leadership' pillars, are expected to generate key discoveries and technologies and cross-cutting societal impacts.

The portfolio of Horizon 2020 projects selected under the Societal Challenges pillar and their progress are so far in line with the objectives set.

Horizon 2020 projects already produce numerous results like publications, patents, prototypes, products, processes and methods in domains of societal relevance. Under the Societal Challenges pillar, 809 peer-reviewed publications already emerged from the projects, 76 patent applications (23 awarded), 600 prototypes and testing activities developed, 106 products, processes and methods were launched into the market.

Horizon 2020 has not yet met the targets for expenditure on sustainable development and climate action but it is expected that they will be achieved by the end of the Programme through decisive action in the remaining

Work Programme 2018-2020. Expenditure amounted to 27.1 % (target of 35%) for the whole period of Horizon 2020 for climate action and 55.4 % against a target of 60 % for sustainable development.

Stakeholders are less convinced about the role of Horizon 2020 in the resolution of societal challenges than in the achievement of knowledge-related objectives, which seems to call for better involvement of end-users and communication with citizens on the contribution that research and innovation can make to tackling societal challenges.

Progress is made with respect to promoting gender equality in Horizon 2020 advisory groups, evaluation panels and in research and innovation content but data quality concerns remain.

Results are encouraging in terms of the embedding of Social Sciences and Humanities and Responsible Research and Innovation in Horizon 2020, even if highly uneven across the programme.





### GENERATING INNOVATION/ ECONOMIC OUTPUTS IN FIELDS RELATED TO SOCIETAL CHALLENGES



- > 76 patent applications, 600 prototypes and testing activities developed

### GENERATING SCIENTIFIC OUTPUTS IN FIELDS RELATED TO SOCIETAL CHALLENGES



- > Most Horizon 2020 projects generate **cross-cutting societal impacts**
- > **809** peer-reviewed publications

### REINFORCING LINKAGES BETWEEN SCIENCE & SOCIETY



- > Progress is made on **gender equality**
- > Women represent: **53%** in advisory groups, **36.7%** in evaluation panels, **31%** of project coordinators
- > Results are encouraging on the integration of **social sciences and humanities** and **responsible research and innovation**
- > Providing direct support to **polymaking**

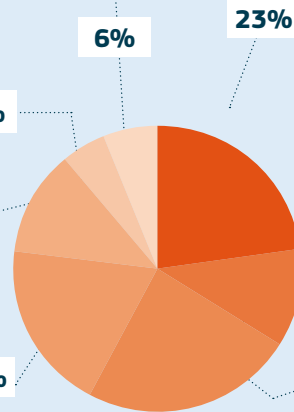
## THE SOCIETAL CHALLENGES PILLAR: EUR 7.4 BILLION TO 2941 PROJECTS

Secure societies- Protecting freedom and security of Europe and its citizens EUR 446.9 million to 177 projects (SC7)

Europe in a changing world – Inclusive, Innovative and reflecting societies: EUR 342.1 million to 194 projects (SC6)

Climate action, environment, resource efficiency and raw materials: EUR 912.6 million to 340 projects (SC5)

Smart, green and integrated transport: EUR 1.4 billion to 655 projects (SC4)



Health, demographic change and well-being: EUR 1.7 billion to 570 projects (SC1)

Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy: EUR 832.1 million to 365 projects (SC2)

Secure, clean and efficient energy: EUR 1.7 billion to 640 projects (SC3)

## MORE NEEDS TO BE DONE

+ **Targets for expenditure on sustainable development and climate action** are not yet met

+ **Gender equality and the embedding of Social Sciences and Humanities** can be further promoted

+ **Feedback from projects to policy-making** can be further strengthened

# HOW DOES HORIZON 2020 WORK INTERNALLY AND WITH OTHER INITIATIVES?

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## KEY MESSAGES

The integration of research and innovation, the three pillar structure, the challenge-based approach, and the use of focus areas contribute to greater internal coherence of Horizon 2020 compared to FP7.

Outside the Excellent Science pillar, Horizon 2020 is increasingly focused on research and innovation at higher Technology Readiness Levels, demonstration and deployment.

The large number of European research and innovation funding instruments is difficult to understand for potential applicants and may lead to overlaps.

Compared to FP7, greater efforts have already been made to increase the synergies between Horizon 2020 and other programmes, notably the European Structural and Investment Funds but these can be strengthened further.

The Seal of Excellence is a prime example of the synergies established between Horizon 2020 and the Structural Funds.

There is great scope for synergies with the European Fund for Strategic Investments, but there are also risks involved.

There is a strong coherence between Horizon 2020 and international obligations.

Horizon 2020 specifically aims to establish synergies with national programmes through the creation of long lasting collaborations between funding agencies and capacity building, but do not seem to really influence the alignment of national strategies and policies in their current format.



## INCREASED INTERNAL COHERENCE

RESEARCH & INNOVATION  
TOGETHER



3 PILLARS STRUCTURE



CHALLENGE BASED APPROACH  
(INCL. CROSS-FUNDING BETWEEN  
CHALLENGES)



USE OF FOCUS AREAS



INCREASED INTERNAL  
COHERENCE

## EFFORTS MADE TO INCREASE COHERENCE OF HORIZON 2020 WITH EXTERNAL INITIATIVES



- With Structural Funds: e.g. through the **Seal of Excellence**
- Structuring effect on Member States level: e.g. through European Research Council and Teaming for Excellence
- Research and Innovation: engine to implement the **Sustainable Development Goals**

## MORE NEEDS TO BE DONE

+ Need to ensure appropriate balance of **technology readiness levels**

+ Internal coherence can be further improved, e.g. through **focus areas**

+ **R&I funding landscape** should be rationalised

+ Synergies with ESIF and other EU funding programmes can be further strengthened

+ **Joint programming** is not substantially influencing the **alignment of national strategies and policies**

# THE EUROPEAN ADDED-VALUE OF HORIZON 2020

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## KEY MESSAGES

Horizon 2020 produces demonstrable benefits compared to national and regional-level support to research and innovation in terms of scale, speed and scope.

Horizon 2020 increases the EU's attractiveness as a place to carry out research and innovation through the organisation of competitions at continental scale, the creation of cross-border, multidisciplinary networks, and the pooling of resources and creation of critical mass to tackle global challenges.

Horizon 2020 improves the competitive advantage of participants:

- Beneficiaries' research capacities and scientific outputs would have significantly decreased had they received national funding instead.
- This decrease would have been especially large in terms of their ability to collaborate with industry and business, transfer of knowledge, the number of participations in scientific conferences and the knowledge in new areas.

The additionality of Horizon 2020 is very strong – support is given to fund distinctive projects, which are unlike those funded at national or regional level:

- 83% of Horizon 2020 projects would not have gone ahead without Horizon 2020 funding;
- beneficiaries had more than twice as many researchers from other EU countries than similar non-funded teams;
- Horizon 2020 helped achieve results faster in 45% of the projects compared to what could have been achieved at national level.

## COMPARED TO NATIONAL & REGIONAL LEVEL, EU-FUNDED TEAMS



- > Attract **twice as many researchers** from other EU countries
- > Achieve results faster in **45%** of projects
- > Have on average more than **twice as many collaborations**
- > **83%** of projects would not have gone ahead without EU funding



## SPEED, SCALE AND SCOPE

- > Creating excellence through **EU-wide competition**
- > Improving the **competitive advantage** of participants
  - > Creation of international, cross-border, and multidisciplinary networks
  - > Sharing of knowledge and technology transfer
  - > Increased access to new markets
- > **Pooling** of resources and strong leverage effect
- > Creating a critical mass to tackle **global challenges**
- > Increasing **EU attractiveness** as a place to carry out R&I

## EU fighting against climate change

**Small changes in the temperature of the planet can translate to large and potentially dangerous shifts in climate and weather - requiring action and cooperation at all scales. EU funded research allows the EU to be at the forefront of both climate change research and environmental technology development: 37% of the environment-related technologies developed worldwide come from the EU.** Under Horizon 2020 EUR 4.9 billion have already been committed to support projects related to climate action.

In many instances, EU projects initiated research and then national/regional authorities topped up with complementary financial resources for the running of operational systems and the acquisition of equipment. Projects engaged for instance in research on air quality by placing sensors on commercial aircrafts or in water-related research by focusing on marine ecology. One project developed a way around the 2-day delay in the weather data accessibility and helped forecasters to improve warnings of hazardous weather, avoiding some of the associated impacts. Because of the global scale of the challenge, many projects are also carried out in non-EU countries: in African countries (building capacity of local researchers), in Southeast Asia (fighting deforestation) or in the Middle East (building a climate data depository).



## EU fighting against Anti-Microbial Resistance

**Overall, the EU has contributed more than EUR 1 billion towards combating the worldwide public health threat of Anti-Microbial Resistance over the years.** Antimicrobial Resistance is the ability of microorganisms to resist antimicrobial drugs. A subset of multidrug-resistant bacteria in Europe are responsible for about 25,000 of human deaths annually. In addition to the avoidable deaths, this also translates into extra healthcare costs and productivity losses of at least EUR 1.5 billion each year.

In 2011, the Commission adopted an action plan against this rising threat. Many research and innovation projects were launched to this purpose in the fields of health, information and communication technologies, nanotechnologies, or bioeconomy. To foster the engagement of industry in antibiotic research, several Antimicrobial Resistance related projects were launched under the Innovative Medicines Initiative a public-private partnership started in 2008. Also in 2015 the Commission launched a EUR 1 million challenge prize to develop a rapid diagnostic test for upper respiratory tract infections that can be safely treated without antibiotics. The prize was awarded to MINICARE HNL for a finger prick test that can diagnose in less than ten minutes a bacterial infection and identify if a patient can be treated safely without antibiotics.



# SUMMARY OF KEY STRENGTHS

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The evidence presented in the Horizon 2020 interim evaluation has demonstrated that, overall, **Horizon 2020 is an attractive and well performing programme**. It has so far attracted more than 100,000 applications, representing a huge increase in the annual number of applications compared to FP7. It involves top level participants from the higher education, research and private sectors; from a wide range of disciplines and thematic fields; and from over 130 countries. 52% of participants are newcomers. Private sector participation has increased compared to FP7. 23.9% of the budget for industrial and enabling technologies and societal challenges goes to SMEs, far exceeding the target. Stakeholders are generally very satisfied with the programme.

Horizon 2020's objectives and rationale for intervention remain highly **relevant** and have been validated by, and are fully consistent with, recent EU and global priorities, such as the Sustainable Development Goals. The programme has also proven that it is flexible and can respond to emergencies (e.g. Ebola, Zika) and emerging needs.

Horizon 2020 is on track to be **cost-efficient**, achieving a very low administrative overhead, thanks to the extensive externalisation of programme implementation, the creation of a Common Support Centre, and the large-scale simplification of the rules for participation, in particular the funding model, which has reduced time to grant and lowered costs for participants, to the satisfaction of stakeholders and without reducing the level of co-funding by beneficiaries.

In terms of **effectiveness**, through its focus on scientific, economic and societal impacts, Horizon 2020 is on track to contribute to the creation of jobs and growth and the achievement of the priorities of the Juncker Commission. It strengthens the science base by involving the EU's

and world's best research institutions and researchers; by training large numbers of EU-based researchers; by producing large numbers of world class open access scientific publications and data; by producing scientific breakthroughs; and by building cross-sectoral, interdisciplinary, intra- and extra-European research and innovation networks.

It fosters industrial leadership by successfully involving the private sector and SMEs; by creating networks between the business sector, universities and research institutions; by providing businesses and SMEs with risk finance to carry out their research and innovation projects; by investing in demand-driven innovation; by producing high quality, commercially valuable patents and other intellectual property rights; by generating proofs of concept and demonstrators and supporting the deployment of innovation solutions; by producing new knowledge, strengthening capabilities, and generating a wide range of innovation outputs including new technologies, products and services; and by increasing the competitiveness of beneficiaries. It addresses major societal challenges by producing publications, patents, prototypes, products, process and methods. It is successful in spreading excellence and widening participation through dedicated instruments and as a cross-cutting issue throughout the programme. It achieves encouraging results in terms of gender equality and the integration of the social sciences and humanities.

Compared to FP7, Horizon 2020 is an internally more **coherent** programme. Synergies with other programmes and instruments are being strengthened.

Horizon 2020 has clear **European added value** in terms of speed, scale and scope and a strong additionality: 83% of funded projects would not have gone ahead without EU funding.

# SUMMARY OF KEY REMAINING CHALLENGES

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In the last three years of Horizon 2020, as well as in the next Framework Programme, efforts will need to be made to address a number of challenges that have been identified. The most important ones would appear to be the following:

1. Horizon 2020 suffers from underfunding, resulting in large-scale oversubscription, much greater than in FP7, which constitutes an enormous waste of resources for applicants and of good proposals for Europe.
2. While Horizon 2020 demonstrates potential in terms of supporting breakthrough, market-creating innovation, such support needs to be strengthened substantially.
3. There is a need for greater outreach to civil society to better explain results and impacts and the contribution that research and innovation can make to tackling societal challenges, and to involve them better in the programme co-design (agenda-setting) and its implementation (co-creation).
4. While great efforts have already been made to increase the synergies between Horizon 2020 and other EU programmes (notably the European Structural and Investment Funds), these can be strengthened further, particularly in view of research and innovation capacity building for lower performing regions.

5. While Horizon 2020 has achieved a broad international outreach, international cooperation needs to be intensified.

6. While compared to FP7, great progress has been made in terms of simplification, simplification is a continuing endeavour, which requires constantly identifying new candidate areas for improvements; at the same time, there is scope for rationalising the Horizon 2020 funding landscape.

7. While Horizon 2020 has made great progress in terms of making openly accessible to the wider scientific community and public the scientific publications and data it generates, more can be done in this respect.

To conclude, so far Horizon 2020 is an attractive and well-performing programme, highly relevant for stakeholders. It goes in the right direction delivering value for money and is on course to meet its knowledge-creating objectives. Main areas for improvement are oversubscription; stimulating breakthrough, market-creating innovation, notably by SMEs, and scaling up to EU level; and bringing results to citizens and involving them more.





# HORIZON 2020 AT WORK – SHOWCASES

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## Horizon 2020's quick reaction to the outbreaks of Ebola and Zika

The outbreak of Ebola in West Africa was one of the international health emergencies of the past few years. EUR 24.4 million from Horizon 2020 were urgently mobilised. In parallel, the IMI-Ebola+ public-private partnership call was launched in record time. This Horizon 2020 research response, very significant in scale, with a total of EUR 140 million, in turn, leveraged a further EUR 101 million from the pharmaceutical industry.

These efforts are already delivering, with trials on the ground in West Africa underway and with the first indication of results. Europe has also taken the lead in establishing the Global Research Collaboration for Infectious Disease Preparedness (GLOPID-r) that links together research funders, the scientific community, industry, patient groups and public health actors. Its goal is to mount an effective research response within 48 hours of an outbreak. It was tested with the Zika outbreak in Latin America in 2015, when the Horizon 2020 Work Programme was updated to include in emergency a call on Zika research.

## Sharing expertise to support the transition to renewable and sustainable energy in Poland

The transition from fossil fuels to renewable and sustainable energy sources has become the European Union's top developmental priority, with low-performing countries in central Europe facing the most urgent need. As the region's largest country, Poland's continuing economic progress has not come without significant environmental costs. While Polish research now has expertise in many of the technologies needed for energy transition, it lacks critical knowledge in modelling, planning, integrating, and managing large scale renewable energy systems in a flexible and effective manner.

The SUPREME project twins one of Poland's best energy research centres, the Instytut Maszyn Przepływowych Im Roberta Szwalskiego Polskiej Akademii Nauk with required expertise in Denmark, the Netherlands, and Austria. Focusing on needed knowledge transfer in integrating energy technologies, the project's mix of extended staff exchanges, joint work, summer schools, and other events is expected to create a long-lasting and effective partnership with a significant impact on Poland's energy systems infrastructure.

## Supporting the development of priority research infrastructures

The ELIXIR-EXCELERATE project aims to accelerate the implementation and early operation of ELIXIR, the European life science Infrastructure for Biological Information, identified as one of the Europe's three priority research infrastructures. With 41 partners in 17 countries this project coordinates and enhances existing resources into a world-leading data service for academia and industry, grow bioinformatics capacity and competence across Europe, and complete the management processes needed for a large distributed infrastructure. Four use cases: rare diseases, human data, plant genotype-phenotype and marine metagenomics, will help best tuning the services.

## Going further with nanopharmaceuticals

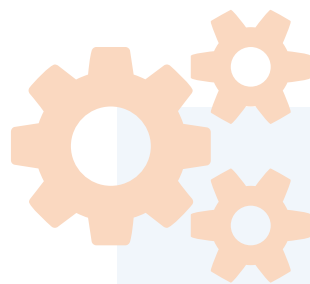
Nanotechnology applied to medicine (nanomedicine) promises more effective and better targeted drugs, with reduced side effects for patients, but these nanopharmaceuticals are still at a very early stage of development. The aim of the NanoPilot project is to establish a flexible and adaptable pilot plant for nanopharmaceuticals. It will provide specific tools and services to SMEs and researchers to validate their technologies and to be able to produce nanopharmaceuticals of sufficient quantity and quality to enter clinical testing.

Three different applications show the flexibility of the planned facility: the treatment of dry eye syndrome, a HIV nanovaccine and a drug for the treatment of painful bladder syndrome. The pilot line will be validated in the project and will continue its certified services after the project, for further drugs and diseases. The consortium includes the operator of the pilot line, an SME, two university institutes which develop the nanopharmaceuticals, and a specialist institute on nanosafety.

## Producing bioethanol from steelmaking process emissions

The project STEELANOL demonstrates the production of bioethanol from emissions of the steelmaking process which has the potential to significantly reduce greenhouse gas emissions compared to oil-derived fuels. A demonstration plant of approximately 25,000 tons/ethanol per year will be built in Belgium; the first of its kind in Europe, and the largest facility built to date utilizing this technology globally. This high-risk/high-impact project is expected to contribute to achieving the targets of the Paris Agreement on climate and advancing the circular economy.





## Detecting and responding to disease outbreaks

When the nature of a disease is unknown, it is difficult to be prepared. With the COMPARE project a team of multi-disciplinary researchers hope to stay one step ahead with a new platform for detecting and analysing outbreaks among humans and animals worldwide through the use of new genome technology. It sets out to integrate state-of-the-art strategies, tools, technologies and methods for collecting, processing and analysing data, for the generation of actionable information to relevant authorities and other users in the human health, animal health and food safety domains. Less than one year into the project, the team has already defined sampling strategies and protocols, while some tools are already online, with 1,000 users daily. The tools will stay in place after the project ends in 2019, becoming part of the European Molecular Biology Laboratory's European Nucleotide Archive.

## Converting sewage treatment plants into power production facilities

The objective of the POWERSTEP project is to convert sewage treatment plants into power production facilities. For this, the partners will design and demonstrate energy positive wastewater treatment plants with available technologies in six full-scale case studies located in four European countries. The estimated benefits are energy savings: EUR 1.7 billion per year; CO<sub>2</sub> – equivalent emission savings: 5,9 million tons; and global market value: EUR 30 billion per year.

## Reducing cyclist and pedestrian casualties

Even though road safety has improved in recent years, accidents remain a serious problem on European roads, where, on average, 75 people lose their lives every day and 750 are seriously injured. Vulnerable road users such as pedestrians, cyclists, motorbike and moped riders represent a particularly serious safety concern, since they account for a disproportionately high percentage of the total number of road fatalities and serious injuries. The PROSPECT project aims to develop, test and demonstrate innovative in-vehicle active safety systems that better protect vulnerable road users in Europe, such as pedestrians and cyclists.

## Greening European aeronautics

For almost ten years Clean Sky is the largest European research programme developing innovative, cutting-edge technology aimed at reducing CO<sub>2</sub>, gas emissions and noise levels produced by aircraft. Equally funded by the EU research and innovation framework programmes (FP7 and then Horizon 2020) and industry, Clean Sky contributes to strengthening European aero-industry collaboration, global leadership and competitiveness. In 2017 the first Clean Sky programme is being finalised: some 20 large Demonstrators have been completed by 600 participants in 24 EU countries, bringing together thousands of experts from leading companies, universities, SMEs and research centres. Thousands of components used in current aircraft and helicopters have been reviewed to identify the areas that can be significantly improved in order to reduce CO<sub>2</sub> emissions and noise by 2020. Clean Sky 2 is larger in scope than the first Clean Sky Programme with a total budget of nearly EUR 4 billion.

## Looking at the interaction between innovation and employment

The QUINNE project investigates how job quality and innovation mutually impact each other at the organisation level, and what employment outcomes result from this interaction i.e. how more and better jobs are created. The employment outcomes are then tracked in terms of their impact on social inclusion and inequality. QUINNE will produce evidence-based advice on how to boost innovation and economic and employment growth in the EU, along with an awareness of ensuing impacts on social inclusion and inequality.

## Improving responses to expected and unexpected crises

The DARWIN project is helping to improve responses to expected and unexpected crises affecting critical societal structures during deliberate man-made disasters (e.g. cyber-attacks) and natural events (e.g. earthquakes). Partners are developing European Resilience Management Guidelines, which will support the ability of crisis management experts and those responsible for public safety to anticipate, monitor, respond, adapt, learn and evolve, to operate efficiently in the face of crises. Furthermore, the project is exploring innovative tools such as serious gaming and training packages to facilitate the adoption of these guidelines.



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The Framework Programmes are the EU's main instruments for the funding of research and innovation in Europe. Horizon 2020 is the eighth EU's Framework Programme for research and innovation for the period 2014 – 2020 with a budget of nearly EUR 77 billion. Horizon 2020 was designed to drive economic growth and create jobs by coupling research and innovation with an emphasis on excellent science, industrial leadership and tackling societal challenges.

The general objective is to contribute to the EU's overarching jobs and growth strategy by: helping to build a society and an economy based on knowledge and innovation across the Union; by leveraging additional research, development and innovation funding; and by contributing to attaining research and innovation targets, including the target of investing 3% of GDP in research and innovation across the Union by 2020.

The interim evaluation of Horizon 2020 demonstrates that Horizon 2020 is an attractive and well-performing programme, highly relevant for stakeholders. It goes in the right direction in delivering value for money and is on course to meet its knowledge-creating objectives. However there are areas for improvement such as oversubscription; stimulating breakthroughs, market-creating innovation, in particular by SMEs, and scaling up to EU level; and bringing results to citizens and involving them more.

The results of this interim evaluation will help improve the implementation of Horizon 2020 in its last Work Programme 2018 – 2020, to provide input to the report of the High Level Expert Group on maximizing the impact of EU Research and Innovation programmes and it will inform the design of future Framework Programmes.

For more information about the 'Horizon 2020 interim evaluation report' :  
[https://ec.europa.eu/research/evaluations/index\\_en.cfm?pg=h2020evaluation](https://ec.europa.eu/research/evaluations/index_en.cfm?pg=h2020evaluation)

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