European Commission

Evaluation study on Excellent Science in the European Framework Programmes for Research and Innovation

Final Report Phase 2 – supporting the interim evaluation of Horizon Europe

Independent Expert Report

Research and Innovation

Evaluation study on Excellent Science in the European Framework Programmes for Research and Innovation – Final Report Phase 2 – supporting the interim evaluation of Horizon Europe

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Manuscript completed in February 2024

PDF ISBN 978-92-68-20836-6 doi: 10.2777/2295765 KI-01-24-031-EN-N

Luxembourg: Publications Office of the European Union, 2024

EUROPEAN COMMISSION

Evaluation study on Excellent Science in the European Framework Programmes for Research and Innovation

Final Report Phase 2 – supporting the interim evaluation of Horizon Europe

Edited by:

PPMI

IDEA Consult

UNU-MERIT

2024 Directorate-General for Research and Innovation

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Key acronyms and abbreviations and definitions

EIC	European Innovation Council
EIT	European Institute of Innovation and Technology
EOSC	European Open Science Cloud
ERA	European Research Area
ERC	European Research Council
ERC PI	ERC principal investigator
ERDF	European Regional Development Fund
FET	Future and emerging technologies
FP	Framework Programme
FWCI	Field Weighted Citation Index
HEI	Higher or secondary education establishment
H2020	Horizon 2020
INFRA	Research Infrastructures
JRC	Joint Research Centre
KIP	Key Impact Pathway
LEIT	Leadership in Enabling and Industrial Technologies
MSCA	Marie Skłodowska-Curie Actions
MSCA DN	MSCA Doctoral Networks under Horizon Europe
MSCA IF	MSCA Individual Fellowships under Horizon 2020
MSCA ITN	MSCA Innovative Training Networks under Horizon 2020
MSCA PF	MSCA Postdoctoral Fellowships under Horizon Europe
MSCA RISE	MSCA Research and Innovation Staff Exchanges under Horizon 2020

MSCA SE	MSCA Staff Exchanges
NCPs	National Contact Points
OPC	Open public consultation
RRF	Recovery and Resilience Facility
R&I	Research and innovation
SC	Societal Challenge
SDGs	Sustainable Development Goals
SEWP	Spreading Excellence and Widening Participation (programme part of Horizon 2020)
SMEs	Small and medium-sized enterprises
SoE	Seal of Excellence
SSAH	Social sciences, arts and humanities
SSH	Social sciences and humanities
SwafS	Science with and for Society (programme part of Horizon 2020)
TRL	Technology readiness level
TTG	Time-to-grant
TTI	Time-to-inform
TTS	Time-to-sign
WIDERA	Widening participation and strengthening the European Research Area under Horizon Europe

Key definitions

Applicant	A researcher or organisation that has applied for a grant or other funding from the EC. An applicant may be successful or unsuccessful, i.e. they received funding or did not.
Associated Country[1]	For the purposes of this analysis, the associated countries under Horizon Europe are taken to be Albania, Armenia, Bosnia and Herzegovina, the Faroe Islands, Georgia, Iceland, Israel, Kosovo, North Macedonia, Moldova, Montenegro, Morocco, New Zealand, Norway, Serbia, Tunisia, Türkiye, Ukraine, and the United Kingdom.

[1] https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/list-3rd-country participation_horizon-euratom_en.pdf

Beneficiary	A researcher or organisation that has received FP funding. Both partner and coordinator roles are considered beneficiaries in our calculations.
High-quality proposal	A proposal that passes the 70% quality threshold during evaluation.
Participation	The number of participations indicates the number of organisations that are involved in the selected project(s). One organisation participating in N projects is counted N times.
Participating organisation	An organisation that participated in any project in any capacity under the specified Framework Programme.

1. Introduction

Horizon Europe is the ninth EU Framework Programme (FP) for Research and Innovation. The programme has a budget of EUR 95.5 billion and is part of the Multiannual Financial Framework 2021-2027. Its aim is to enhance collaboration and bolster the impact of research and innovation (R&I) in developing, supporting, and implementing EU policies while tackling global challenges. This includes addressing the United Nations' Sustainable Development Goals (SDGs) and strengthening the European Research Area (ERA).

This evaluation study serves as an input for the mid-term evaluation of Horizon Europe. Its thematic focus is on excellent science and therefore it covers all programme parts under Pillar 1 of Horizon Europe, namely the European Research Council (ERC), the Marie Skłodowska-Curie Actions (MSCA), and Research Infrastructures (INFRA). It also covers the European Open Science Cloud (EOSC) Partnership[2] and activities falling under the horizontal pillar 'Widening participation and strengthening the European Research Area' (WIDERA). Beyond that, it considers how Horizon Europe (and Horizon 2020, whenever this is relevant for the analysis of long-term effects) contributed to excellent science as a whole.

The results presented in this report serve to answer a number of predefined evaluation questions on the **effectiveness, coherence, efficiency, EU added value, and relevance** of the evaluated intervention. The underlying analysis covers all EU-27 Member States and associated countries under Horizon Europe and, where relevant, under H2020.

This study incorporates existing knowledge and evidence collected and synthesised through the undertaking of extensive **desk research** (see Annex 5 for the full list of publications, documents and other sources used). This includes data from Horizon Europe and H2020 projects and applications provided to the study team as of August 2023. It also builds on the findings of **15 case studies** (see Annex 2) and **four benchmarks** (see Annex 3). The research team carried out **208 interviews** with programme managers, beneficiaries, people managing the schemes and initiatives selected for benchmarks, and officials from the European Commission (for a full list of interviewees, see Annex 8). Other stakeholder consultation activities carried out for this study include an **extensive survey programme**, which consisted of nine online questionnaires (see Annex 7).

In addition, four quantitative analyses (see Annex 6) were carried out: a bibliometric analysis of H2020 publications, an econometric modelling/counterfactual analysis, a network analysis and an analysis of unstructured data.

This report follows the structure for evaluations laid down by the Better Regulation Guidelines. First, it sets the baseline for Horizon Europe by summarising the key findings on the performance of the previous FP, namely H2020 (Chapter 2). It then provides an overview of the current state of play in the implementation of Horizon Europe (Chapter 3). This underlying information helps to interpret the findings of the evaluation. The latter are summarised in Chapter 4, where we assess the extent to which the intervention has been successful (i.e. if it has been effective, efficient and coherent); how it makes a difference (i.e. if there is evidence of the EU added value); and whether it remains relevant. A more detailed analysis of the study's findings on the effectiveness, efficiency, coherence, EU added value and relevance of specific programme parts under evaluation is provided in Annex 1. Chapter 5 presents the overall study conclusions and lessons learned.

[2] The EOSC Partnership Report is presented as a separate deliverable.

2. Background to the initiative

2.1. Description of the initiative and its objectives

Horizon Europe, established by Regulation (EU) 2021/695 of the European Parliament and of the Council[3], and implemented by Decision (EU) 2021/764[4], is the EU's ninth FP for research and innovation (R&I) and runs for the period 2021-2027. The **general objective** of Horizon Europe is 'to deliver scientific, technological, economic and societal impact from the Union's investments in R&I so as to strengthen the scientific and technological bases of the Union and foster the competitiveness of the Union in all Member States including in its industry, to deliver on the Union strategic priorities and to contribute to the realisation of Union objectives and policies, to tackle global challenges, including the SDGs by following the principles of the 2030 Agenda and the Paris Agreement, and to strengthen the ERA.'

This FP aims to achieve the following **specific objectives**:

- Developing, endorsing and advancing scientific excellence to support the generation and dissemination of high-quality new fundamental and applied knowledge, skills, technologies and solutions. In addition, the FP aims to bolster the training and mobility of researchers, attract talent at various levels, and contribute to the full engagement of the Union's talent pool in activities supported under the Programme.

- Generating knowledge, enhancing the impact of R&I in developing, supporting and implementing Union policies. The FP also seeks to promote access to and the adoption of innovative solutions by European industries (particularly among SMEs) and within society, to address global challenges including climate change and to pursue the Sustainable Development Goals adopted by the United Nations.

- Nurturing all forms of innovation; facilitating technological development, demonstration, and the transfer of knowledge and technology. Furthermore, the FP aims to strengthen the deployment and exploitation of innovative solutions.

- Optimising the delivery of the FP to enhance its impact and attractiveness within the ERA. This includes fostering participation based on excellence from all Member States, including those with lower R&I performance, and facilitating collaborative links within European R&I.

A list of Horizon Europe **operational objectives** and the overall intervention logic of this FP are summarised in Figure 1.

[3] Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU) No 1291/2013.
[4] Council Decision (EU) 2021/764 of 10 May 2021 establishing the Specific Programme implementing Horizon Europe – the Framework Programme for Research and Innovation, and repealing Decision 2013/743/EU.

Horizon Europe continues the **three-pillar structure** of H2020, with some changes to its design introduced to increase the coherence between and within these three pillars[5]:

- *Pillar 1 – Excellent science* is designed to continue the focus on excellent science and high-quality knowledge in order to strengthen the EU's science base through the European Research Council, the Marie Skłodowska-Curie Actions and Research Infrastructures.

- *Pillar 2 – Global Challenges and European Industrial Competitiveness* has been redesigned to better address EU policy priorities and to support industrial competitiveness by integrating H2020's Societal Challenges and Leadership in Enabling Industrial Technologies into six clusters, namely: Health; Culture, Creativity and Inclusive Society; Resilience and Security; Digital, Industry and Space; Climate, Energy and Mobility; and Food and Natural Resources. These clusters are intended to better support the full spectrum of the Sustainable Development Goals, and to increase collaborative research and innovation between sectors, disciplines and policy fields – thereby boosting flexibility, focus and impact.

- *Pillar 3 – Innovative Europe* is designed to offer a 'one-stop shop' for high-potential innovators through the European Innovation Council (EIC), and to increase cooperation through innovation ecosystems and actors. This pillar integrates various reorganised H2020 *strengthening the European Research Area* by extending those H2020 actions that helped to tackle low research and innovation performance. It aims to do so through R&I reforms; foresight activities; and the monitoring and evaluation of the FP, as well as the dissemination and exploitation of its results.

[5] Directorate-General for Research and Innovation, European Commission. A New Horizon for Europe: Impact assessment of the 9th EU Framework Programme for Research and Innovation. Luxembourg: Publications Office of the European Union, 2018, available at: https://doi.org/10.2777/194210

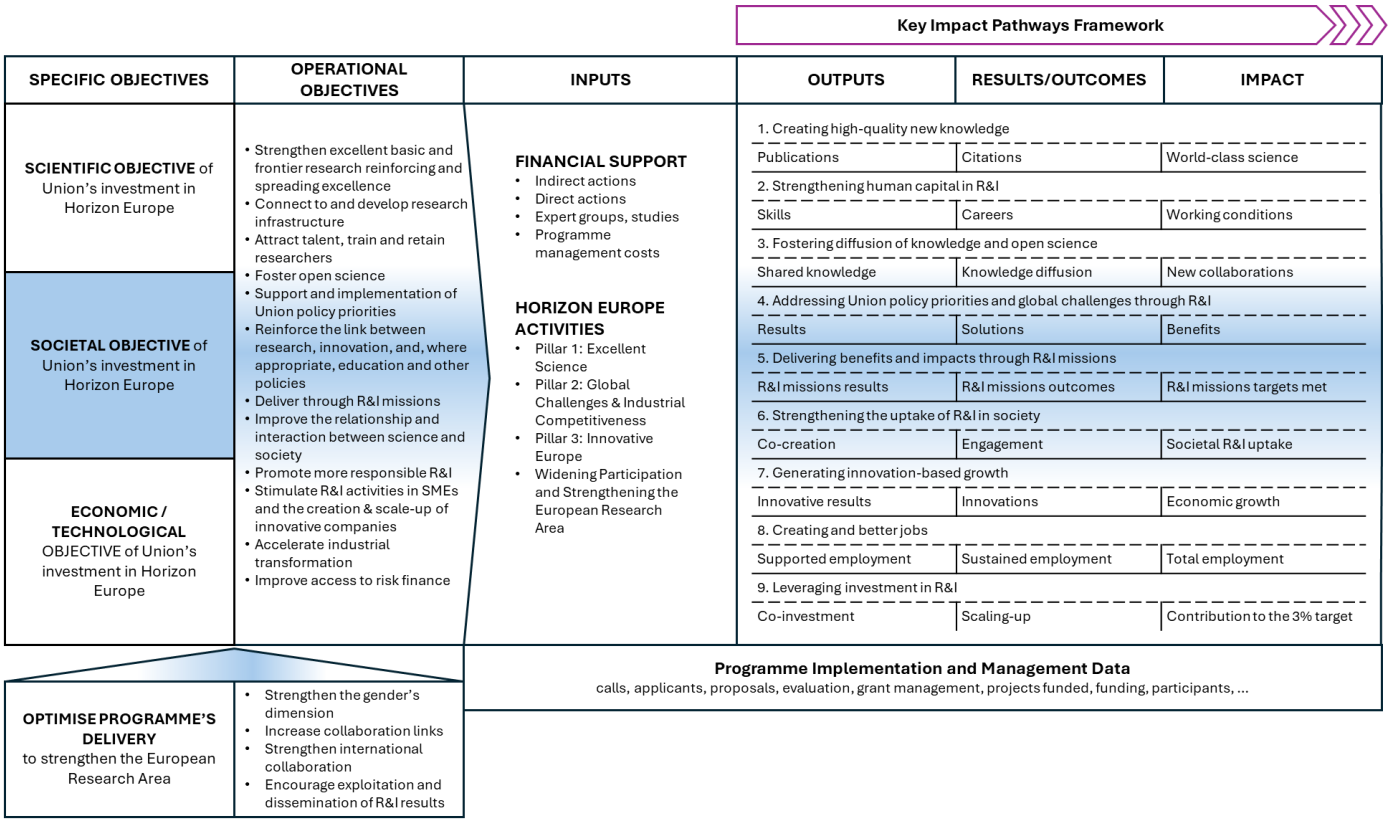

Figure 1. Horizon Europe intervention logic

Source: European Commission, Commission Staff Working Document 'Evidence Framework on monitoring and evaluation of Horizon Europe'. SWD(2023) 132 final, Brussels, 27 April 2023.

2.2. Points of comparison

The previous FP for research and innovation (Horizon 2020) has strengthened the EU's scientific position worldwide. This positive impact stemmed from both outputs and results generated by H2020 via its support to frontier research. H2020 was also characterised by prominent positive societal and economic impacts, albeit these were less pronounced in and pertinent to the programme parts of primary concern to this study.

- *H2020 has generated a substantial number of **peer-reviewed publications**. It surpassed the output of FP7 both in terms of the share of the **top 1% most-cited publications**, and the **average normalised citation score**[6] of its publications.* In total, 276 784 peer-reviewed publications were produced during the period 2014-2022, surpassing the output of FP7 (219 620). Activities funded under the excellent science pillar had the highest number of publications, mainly under the European Research Council (ERC) and Marie Skłodowska-Curie Actions (MSCA) (36% and 22% respectively)[7]. H2020 publications exhibit a citation rate twice the global average (i.e. an FWCI of 2.03), with 3.9% of them ranking among the top 1% most-cited publications worldwide. Furthermore, the citation scores of publications stemming from H2020 exceed those of selected international funders[8].

- *H2020 has contributed to the development of **future and emerging research and technology fields**.* Altogether, 26% of H2020 publications were linked to new and fast-growing topics in science, of which 1.5% were also among the top 1% of most-cited publications worldwide. Although the share of publications linked to hot topics was higher in Pillars 2 and 3 (respectively 33.6% and 34.6%), Pillar 1 stood out in terms of absolute numbers of such publications (22 698)[9].

- *The programme's **open access requirements** have led to high rates of open access, comparable to those achieved by other research funders.* The percentage of publications accessible freely and publicly online rose from 65% in 2014 to 82% in 2022. The number of open access datasets arising from H2020 projects also increased, from 64 open datasets in 2015 to 1 694 open datasets in 2020[10].

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[6] The metrics are based on the sample of peer-reviewed publications identified and validated in the Evaluation study on excellent science under Horizon 2020. European Commission, Directorate-General for Research and Innovation, Budraitis, M., Pranckevičius, P., Dėlkutė, R. et al., Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, Luxembourg: Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2777/967813

[7] Commission Staff Working Document, Evaluation Accompanying the Document, Report From The Commission To The European Parliament And The Council, 'Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', SWD(2024) 29 final of 29.1.2024, p. 26, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD%3A2024%3A29%3AFIN&qid=1706528145182

[8] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 26.

[9] Based on an analysis of EC monitoring, Scopus and MAG/OpenAlex data. Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 36.

[10] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation, op. cit., p. 28.

- *The high quality of the research work supported by H2020 has been recognised through **awards and prizes***. H2020 has supported 33 Nobel Prize winners before or after the award of their prize[11]. Among these were ERC grantees and 12 Marie Skłodowska-Curie Actions (MSCA) researchers and supervisors. Furthermore, more than 1 in 3 European Research Council (ERC) investigators indicated that their work had been recognised through prizes or awards[12].

- *The programme has also promoted **international mobility** and fostered Europe's capacity to attract **world-class talent**.* As of January 2023, H2020 (mainly via the MSCA) supported the international (and, in some instances, intersectoral) mobility of 49 475 unique researchers. 25 676 of these mobile researchers were PhDs. The researchers supported were from 160 nationalities (with 40% of all researchers involved in the MSCA being nationals of non-EU countries), while participating organisations from 139 countries worldwide were involved[13].

- *The programme has had a positive effect on **researchers' career prospects**, particularly for those at earlier career stages.* It enabled study visits to institutions in countries where the research was more advanced, facilitated knowledge exchange with partners more advanced in the field, offered training activities, provided access to high-quality research infrastructure, etc.[14].

- *The programme has played a pivotal role in promoting the development of **pan-EU research infrastructures** and succeeded in providing transnational access to these infrastructures.* The number of networked infrastructures in H2020 reached 883 (912 if e-infrastructures are included), hence reaching the target of 900[15]. A total of 24 235 researchers received access to research (e-)infrastructures, mostly through H2020 INFRA[16].

- *H2020 was open to prominent research organisations and institutions, but participation remained a challenge for **Widening countries**.* Entities from these countries represented 12.3% of H2020 participations, a 1.3 percentage point increase from the FP7 baseline. Widening actions under the SEWP were instrumental to this increase, while also contributing to the improvement of their capacity to produce excellent research: nearly 1 in 3 of the highly cited publications produced by beneficiaries from Widening countries were linked to Widening actions, whereas the share of highly cited publications stemming from the SEWP actions increased from 6% in 2014 to 17% in 2020. However, these actions attracted few new entrants (14% of unique participating organisations) in comparison with H2020. They were found to be more effective at retaining participants

[11] Ibid, p. 30.
[12] Survey of Horizon 2020 ERC beneficiaries, conducted in August-September 2022. Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 38.
[13] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 32.
[14] Ibid, p. 33.
[15] Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 45.
[16] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 34.

from Widening countries within the FP, and also in enhancing their connections with (excellent) organisations and research groups elsewhere[17].

- *The programme has been instrumental in tackling **societal challenges**.* Pillar 1 projects tackled societal impacts in areas, such as health and well-being (with 36% of projects contributing to a Sustainable Development Goal 3), industry, innovation and infrastructure (20% to SDG 9) and climate (14% to SDG 13)[18].

- *H2020 contributed to the performance and competitiveness of the EU´s R&I system, especially through its strong emphasis on **early stages of innovation**.* Pillar 1 contributed 31% of all innovations under H2020, most of which were assessed to have a low level of technological readiness[19]. More specifically, 65% (1 579) of the innovations produced by Pillar 1 projects were in an 'exploring' stage and only 10% (249) were deemed market-ready[20], which is notably below the average share of 17% (1 354) across H2020[21].

In Box 1 below we provide a snapshot of H2020 publications and patents as of 1 January 2017, which is indicative of the achievements of the programme during its first 3 years of operation. The latter period corresponds to the 3 years that Horizon Europe has been operational so far.

Box 1. Horizon 2020 publications and patents, as of 1 January 2017

In what follows, we present the intermediary results of H2020 for Key Impact Pathways (KIPs) 1, 3 and 7, as achieved by the cut-off date of 1 January 2017[22].

KIP1. Number of peer-reviewed scientific publications. By 1 January 2017, H2020 had generated 5 873 publications (5 857 of which could be validated). Of this total, almost half stemmed from Pillar 1, SEWP or SwafS. Overall, 1 002 publications were generated through the ERC (1 001 validated); and 859 (858 validated) were generated through the MSCA. Only 6 publications stemmed from SwafS, and 146 from SEWP (all validated).

KIP3. Research outputs shared through open knowledge infrastructure. By 1 January 2017, 77.1% of the H2020 publications were in open access. Within Pillar 1, these shares were rather diverse, with shares of 88.4%, 82.2%, 69.5% and 58.7% in, respectively, ERC, FET, MSCA and INFRA. In SEWP, this percentage was only 17.8% and in SwafS, this was 50%.

[17] Ibid, p. 35.
[18] Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 41.
[19] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 50.
[20] Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 43.
[21] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 50.
[22] These figures had been recalculated on the basis of the methodology that is currently adopted for the Key Impact Pathways. This methodology is based on the periodic reporting system.

The simplification measures on EU public sector administrative efficiency had a significant aggregate impact on H2020.

- *H2020 outperformed its targets for the **administrative expenditure**.* The administrative expenditure of H2020 was EUR 4 428 million[23] Excluding the JRC and the European Institute of Innovation and Technology (EIT) actions, the total administrative expenditure implemented to date reached 3.9% (3.37% in 2020) of the budget, well under the target of 5% (4.6% or less for 2020)[24].

- *Application costs faced by unsuccessful applicants and administrative burden encountered by beneficiaries of H2020 while implementing their projects were found to be somewhat high:*

  - The time **cost to participate** in H2020, as indicated by beneficiaries, ranged between 4.5 to 7 person-days per month of project duration. If expressed as indicative money value, the total beneficiaries' administrative costs amounted to between EUR 135 million and EUR 215 million[25].

  - The average cost of a H2020 proposal was between EUR 18 000 and EUR 37 000. Based on this estimate, successful H2020 proposals in total may have cost from EUR 609 million to EUR 1.25 billion to prepare. The total **application cost** in the large number of unsuccessful proposals was likely even more substantial and may well have reached a value of between EUR 5 billion and EUR 10 billion[26].

- *H2020 to a large degree succeeded in its efforts to accelerate all **processes relating to proposal and grant management**:* 90% of H2020 grants were signed on time. The average time-to-grant (TTG) period was 187 days, resulting in 126 days saved per grant on average compared with FP7. In aggregate, over 9 500 years of working time in the EU public sector were saved, relative to the time it would have taken if FP7's average TTG performance had continued[27]. All programme parts under Pillar 1 achieved their TTG target except for INFRA, where average TTG period was 265.5 days[28]. For the most part, H2020 has also achieved its other time targets for specific administrative processes, such as time-to-inform (TTI) and time-to-sign (TTS). All programme parts under Pillar 1 and the horizontal pillar achieved their target for TTI. However, the average TTS in ERC, INFRA and SwafS exceeded the target by additional 31, 41 and 33 days, respectively[29].

- *H2020 has piloted and introduced measures for further simplification:*

  - The **lump sum** funding for R&I projects was tested and positively perceived by the H2020 beneficiaries, but this pilot did not yield any quantitative evidence on changes in costs of applicants and evaluators.

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[23] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 64.
[24] Ibid, p. 68.
[25] Ibid, p. 64.
[26] Ibid, p. 64.
[27] Ibid, pp. 68-69.
[28] Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 27.
[29] Ibid, p. 27.

- The **Seal of Excellence** (SoE) quality label was used to lessen the loss of effort invested in unfunded proposals: 21.4% (20 890 out of 97 403) of high-quality proposals not retained for funding received a SoE certificate under H2020[30]. Data from three countries known to have funded SoE-certified SME Instrument proposals, show that on average 26% succeeded in subsequently securing funding from Cohesion Policy funds[31].

H2020 had a high number of instruments with different approaches to grants which served different objectives and interacted in a complementary way. It also complemented and synergised with other funds and programmes at EU, national and regional levels.

- *The combination of **different approaches to grants** across H2020 and within its different pillars interacted in a complementary way*[32]*.* Altogether they targeted and provided support (including subsequent funding) to different cohorts of researchers at different stages of their careers. The mix of instruments also offered support to research and innovation at both lower and higher Technology Readiness Levels. As such, H2020 had a range of **internally coherent** and complementary instruments for addressing both key societal challenges and cross-cutting issues[33]. The number of these instruments was sometimes perceived as too excessive[34].

- *Synergies between H2020 and other EU funds varied.* **Upstream synergies**, where Cohesion Policy funds were used to increase the chances of winning a H2020 grant, or to construct or upgrade research infrastructure used by recipients of H2020 funds for their projects, were more evident and systematic than **downstream synergies**. The latter were often impeded by technical and administrative barriers. They were also impeded by the lack of sufficient information on H2020 projects results[35].

- *H2020 complemented other support schemes at EU and national levels by filling important **gaps in the overall EU R&I landscape**.* H2020 was the only EU programme supporting transnational R&I activities and networks that were based on the criterion of excellence. The programme provided its beneficiaries with opportunities for international networking, knowledge exchange and cooperation on a scale and in formats not supported at national and regional levels. It also served as a benchmark set by more research-intensive for others in the European research system, and thus complemented the Cohesion Policy funding used for capacity building in less research-intensive regions[36]. In Education, H2020 strongly complemented Erasmus+[37].

[30] SoE was available for the SME Instrument, for MSCA, for Teaming actions and for the ERC Proof of Concept.
[31] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 73.
[32] Ibid, p. 74.
[33] Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 24.
[34] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 74.
[35] Ibid, pp. 77-78.
[36] Evaluation study of the European Framework Programmes for research and innovation for excellent science – Horizon 2020: Phase 1 final study report, op. cit., p. 25.
[37] Ex-post evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation', op. cit., p. 79.

The impact of H2020 extended well beyond what could have been achieved at national or regional level.

- H2020 supported R&I activities and collaborative networks that were needed for accelerating the development of solutions to pressing global challenges. As such, the programme also **funded research** less prioritised at national or regional levels, but **of great importance from a European perspective**[38].

- H2020 helped pull together a critical mass of expertise, skills and resources from different countries and disciplines. It also provided researchers and research organisations with a framework for lasting networking and multidisciplinary cross-border collaboration. This included collaboration between research groups from Widening countries and leading research organisations in Europe[39].

- H2020 funded projects that research funders at national and regional levels could not match unless they were downscaled and reduced in terms of **complexity and ambition**. At the same time, the programme provided researchers with **training opportunities that would not be available** or scarcely available if funded **from alternative funding sources**[40].

- H2020 has created strong and direct **pan-European competition** that served to boost the quality of research proposals and general level of **research excellence** achieved in the funded projects. The newly established and/or continued collaborations had a **strong structuring effect on the European Research Area**[41.]

The three-pillar structure of H2020 well represented the major needs of the science, technology and innovation community in Europe. It was also highly responsive to political priorities and contributed to Europe 2020 flagship initiatives. However, H2020 **did not facilitate any fundamental changes to Europe's overall competitive position**[42.]

3. State of play in the implementation of Horizon Europe

This section provides a brief overview of the state of play with regard to the implementation of Horizon Europe in the areas covered by this study, including the distribution of proposals and selected projects by programme part, EU contributions, as well as the distribution of beneficiaries by organisation type, programme newcomers, and the countries receiving the funding[43.]

3.1. Overview of implementation processes, inputs and activities

Overview of Horizon Europe proposals

Overall, there is a visible increase in the success rate between proposals of H2020 and HE proposals so far. Out of the four programme parts analysed in this study, INFRA has the

[38] Ibid, p. 85.
[39] Ibid, 86.
[40] Ibid, pp. 84-86.
[41] Ibid, pp. 87-89.
[42] Ibid, pp. 89-90.
[43] The figures shown below are based on the 20 June 2023 eCorda projects dataset.

highest success rate in Pillar 1, at 62% for 2021 and 47% for 2022 – significantly higher than the overall success rate across H2020 (34%). This is probably linked to the unique nature of the programme part. The ERC and MSCA both have relatively low success rates, at 13% for the ERC and 14% for the MSCA in 2021, and 16% and 18% in 2022, respectively. The success rates for the ERC and MSCA do not differ much from the averages for these programme parts under H2020. As mentioned in the chapter on the baseline for this evaluation, the ERC Scientific Council has been applying resubmission restrictions since 2009. Similar demand management measures have also been introduced under Horizon Europe to address oversubscription in MSCA Doctoral Networks and Postdoctoral Fellowships.

The success rates for applications to WIDERA (Widening Participation and Spreading Excellence) in 2021 and 2022 were 26% and 27%, respectively – approximately 10.5 percentage points higher than their averages under H2020. The success rate for applications under the WIDERA (ERA) programme part was 50% in 2021, dropping to approximately half (28%) in 2022. This figure of 2021 is almost twice as high as the success rate of the equivalent programme part under H2020.

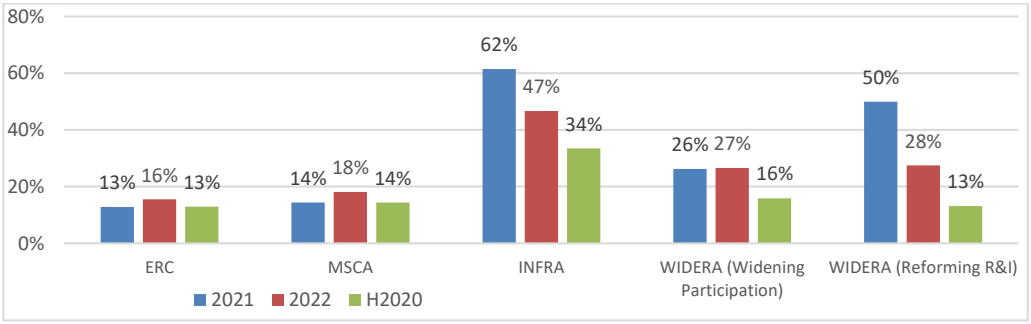

Figure 2. Success rates of Horizon Europe applications, by programme part and call deadline year, in comparison to average for those programme parts under Horizon 2020[44].

*Source: compiled by the study team using eCorda data; June 2023 Corda data release. *The success rate is calculated by dividing the number of accepted proposals (main) by the number of eligible proposals.*

Looking at the success rates among high-quality proposals, INFRA has the highest rate – 65.8%, followed by ERC with 57.4%. Overall, in the ERC, the proportion of all eligible proposals that exceeded the threshold for being considered high quality was modest. However, a significant portion of those considered high quality (i.e. above the threshold) were funded, leading to only a minimal number of outstanding proposals going unfunded. The picture for the MSCA differs significantly, with the majority of proposals submitted being of high quality, but only around one fifth of these receiving funding. INFRA also received a large share of high-quality proposals, most of which received funding. This can be explained by the unique nature of the programme part, which follows a different logic whereby its beneficiaries are research organisations and not research teams. Lastly, in WIDERA, the number of high-quality proposals was also higher than the number of successful proposals. This discrepancy means that an additional 30-35% on top of the total committed budget would have been needed in order to fund all high-quality proposals.

[44] Figures for 2023 are not presented in the graph, as they are too small and not representative of the year.

Table 1. Success rates and additional funding required to fund unsuccessful above-threshold proposals by programme part

Programme part	Number of eligible proposals	Number of proposals above threshold	Number of successful proposals	Success rate	Success rate for proposals above threshold	Additional budget needed to fund all unsuccessful high-quality proposals (in million EUR)
ERC	16 306	3 925	2 283	14.0%	57.4%	2 701.2
MSCA	17 657	13 285	2 841	16.1%	21.4%	5 977.4
INFRA	148	120	79	53.4%	65.8%	278.2
WIDERA (Widening)	927	630	246	26.5%	39.1%	868.9
Widera (ERA)	152	112	54	35.5%	48.2%	151.1
Total for Horizon Europe	49 438	26 571	7 937	16.0%	29.8%	39 078.2

Source: compiled by the study team using eCorda data.

3.2. Overview of implementation status

Overview of Horizon Europe projects

This evaluation study focuses on excellent science under Horizon Europe; in particular, Horizon Europe's R&I activities in Pillar 1, specifically the ERC, MSCA and INFRA, as well as the activities under WIDERA and its two programme parts: 'Widening participation and spreading excellence' (WIDERA (Widening)), and 'Reforming and enhancing the European R&I system' (WIDERA (ERA)).

Moving forward, several major factors that impact the whole of Horizon Europe need to be considered:

- The delayed launch of the Horizon Europe programme resulted in the first calls for proposals being launched during the second half of 2021, with the closing dates of most proposals being in mid-to-late autumn, and some even as late as March 2022. Given that another 7-8 months are required for the proposal selection and evaluation process as well as to conclude grant agreements (13 months, in the case of the ERC), the first R&I activities under Horizon Europe only began in 2022.

- The COVID-19 pandemic disrupted the smooth implementation of the EU's R&I activities. This resulted in a larger number of project beneficiaries requesting extensions or suspensions from certain funding agencies and led to amendments and rescheduling. Therefore, an overall longer time was taken to sign grants and start R&I activities.

- The FP underwent a number of internal changes, and a new strategic plan was created. As a result, during the first semester, some funding agencies devoted considerable time and effort to adapting their call planning for 2021-22, following delays to the start of the new Horizon Europe programmes.

Based on the administrative data received by the study team, for 2021, 2022 and the beginning of 2023[45], the ERC allocated a total of over 4.2 billion to 2 375 projects. The MSCA allocated approximately EUR 1.4 billion to 2 633 projects, and INFRA allocated EUR 523.5 million to 81 projects. WIDERA (Widening) allocated a total of EUR 715.6 million to 255 projects, and WIDERA (ERA) allocated EU contributions of EUR 128.1 million to 56 projects. For the breakdown by year, see Table 2.

The average grant size for the ERC was around EUR 1.8 million, compared with EUR 0.5 million for the MSCA, EUR 6.5 million for INFRA, and EUR 2.7 million for WIDERA.

Table 2. Distribution of selected projects and EU contribution, by call year (in million EUR)[46]

Programme part	Indicator	2021	2022	2023	Total per programme part	Percentage of total budget allocated to the programme part already committed to the selected projects
ERC	Number of projects selected	1 229 (51.8%)	1 146 (48.2%)	-	2 375 (100%)	26.3%
	EU contribution	2 349.5 (55.9%)	1 853.4 (44.1%)	-	4 203.0 (100%)	
MSCA	Number of projects selected	1 382 (52.5%)	1 251 (47.5%)	-	2 633 (100%)	20.8%
	EU contribution	659.6 (48.0%)	715.6 (52.0%)	-	1 375.3 (100%)	
INFRA	Number of projects selected	33 (40.7%)	44 (54.3%)	4 (4.9%)	81 (100%)	21.8%
	EU contribution	238.8 (44.8%)	281.1 (53.7%)	3.6 (0.7%)	523.5 (100%)	
WIDERA (Widening)	Number of projects selected	79 (31.1%)	176 (69.0%)	-	255 (100%)	24.2%
	EU contribution	215.2 (30.1%)	500.4 (69.9%)	-	715.6 (100%)	
WIDERA (ERA)	Number of projects selected	24 (42.9%)	30 (53.6%)	2 (3.6%)*	56 (100%)	29.2%

[45] The data cover the period up to the date when the data were received by the study team, and may not reflect the total figures for the latest years (2022 and 2023).
[46] The data exclude all Rejected, Suspended or Terminated projects.

Programme part	Indicator	2021	2022	2023	Total per programme part	Percentage of total budget allocated to the programme part already committed to the selected projects
	EU contribution	55.5 (43.3%)	69.1 (53.9%)	3.5 (2.7%)	128.1 (100%)	
Total HE	Number of projects selected	3 782 (47.9%)	4 110 (52.0%)	6 (0.1%)	7 898 (100%)	N/A[47]
	EU contribution	8 855.9 (41.5%)	12 499.0 (58.5%)	7.1 (0.03%)	21 362.1 (100%)	

Source: compiled by the study team using eCorda data; June 2023 Corda data release.

Looking at the bigger picture, the ERC has already spent 26.3% of its budget, followed by the MSCA (20.8%) and INFRA (21.8%). Widening has spent 24.2% of its total committed budget, while ERA has spent 29.2% of its total committed budget, the largest share among the programme parts analysed.

Overview of Horizon Europe participants

This section provides a brief overview of data on Horizon Europe participants in the programme parts analysed.

The majority of distinct ERC beneficiary organisations are HEIs (60%), followed by 'Research Organisations' (30.8%). The largest contribution goes to HEIs (72.3% of the total budget). In the MSCA, the majority of unique participating organisations are 'Private (for-profit) Research Centres' (44.5%), followed by HEIs (26%)[48]. However, looking at the number of participations[49] in the MSCA, the majority (57%) come from HEIs, so it is unsurprising to see that the majority of EU contributions (66.8%) under the MSCA were also received by HEIs. The largest share of unique beneficiary organisations in INFRA are 'Research Organisations', which make up 44.3% of beneficiaries, and receive 63.8% of the total budget. Under Pillar 1 overall, a relatively small share of beneficiary organisations come from the categories of 'Public Bodies' and 'Other'[50].

In WIDERA (Widening), the largest share of unique beneficiary organisations are HEIs (30.1%), which receive 46.8% of the funding. 'Public Bodies' received the smallest share of funding, with 1.7% of the total budget. The largest share of beneficiaries in WIDERA (ERA) came from the category 'Other', receiving 21.4% of the total budget of WIDERA (ERA). The

[47] The figures of committed budget so far for funded projects and programmes outside what is recorded in the Corda database are not available, hence we cannot make an informed estimate.
[48] 'Distinct participating organisations' comprise organisations that participate as coordinators, beneficiaries or associated partners.
[49] The number of participations indicates the number of organisations that are involved in the selected project(s). One organisation participating in N projects is counted N times.
[50] For more information on participation patterns, see Annex 6, section 7.

largest share of EU contribution (31.7%) went to HEIs, followed by 'Research Organisations' (25.8%).

The participation analysis shows that the largest EU economies are also the largest HE beneficiaries (in terms of combined EU contributions to beneficiaries of these MS). In the ERC, the largest net EU contribution – proportional to the country's share as a percentage of EU GDP – went to Germany (25.7%), followed by France (15.9%) and the Netherlands (12.2%). The largest share of contribution in the MSCA also benefited beneficiaries from Germany (14.6%), followed by Spain (13.3%), Italy (12.4%) and France (11.9%). The majority of funding for beneficiaries under INFRA went to the Netherlands (20.9%), followed by Germany (18.2%). A relatively large share of contributions relative to the country's share of EU GDP went to Greece (4.4%). Lastly, taking WIDERA as a whole, the largest shares of funding were allocated to beneficiaries from Belgium (22.7%), followed by Portugal (8.9%).

Table 3. Amounts and percentage shares of EU contribution to EU Member States, relative to their GDP size, ordered by the size of the MS economy

	% Share Of Total EU GDP In 2020	Share of EU contribution, ERC (EUR million)	Share of EU contribution, MSCA (EUR million)	Share of EU contribution, INFRA (EUR million)	Share of EU contribution, WIDERA (EUR million)
DE	25.1%	928.4 (25.7%)	200.7 (14.6%)	87.4 (18.2%)	45.5 (5.8%)
FR	17.2%	573.0 (15.9%)	163.4 (11.9%)	57.5 (11.9%)	20.2 (2.6%)
IT	12.3%	290.2 (8.0%)	170.5 (12.4%)	50.2 (10.5%)	26.3 (3.3%)
ES	8.4%	302.1 (8.4%)	182.5 (13.3%)	31.3 (6.5%)	45.8 (5.8%)
NL	6.0%	439.2 (12.2%)	129.7 (9.4%)	100.4 (20.9%)	30.0 (3.7%)
PL	3.9%	45.7 (1.3%)	16.5 (1.2%)	9.7 (2.0%)	23.8 (3.0%)
SE	3.5%	170.4 (4.7%)	64.7 (4.7%)	7.9 (1.6%)	9.7 (1.2%)
BE	3.4%	194.6 (5.4%)	91.2 (6.6%)	37.6 (7.8%)	178.6 (22.7%)
AT	2.8%	167.9 (4.6%)	44.4 (3.2%)	14.0 (2.9%)	13.5 (1.7%)
IE	2.8%	79.5 (2.2%)	55.8 (4.1%)	3.2 (0.7%)	8.6 (1.1%)
DK	2.3%	152.8 (4.2%)	88.5 (6.5%)	10.2 (2.1%)	13.2 (1.7%)
FI	1.8%	76.0 (2.1%)	35.7 (2.6%)	18.5 (3.9%)	13.3 (1.7%)
CZ	1.6%	39.8 (1.1%)	25.1 (1.8%)	7.5 (1.6%)	44.9 (5.7%)

	% Share Of Total EU GDP In 2020	Share of EU contribution, ERC (EUR million)	Share of EU contribution, MSCA (EUR million)	Share of EU contribution, INFRA (EUR million)	Share of EU contribution, WIDERA (EUR million)
RO	1.6%	7.6 (0.2%)	3.7 (0.3%)	1.4 (0.3%)	15.4 (2.0%)
PT	1.5%	65.2 (1.8%)	28.9 (2.1%)	11.7 (2.4%)	70.3 (8.9%)
EL	1.2%	18.2 (0.5%)	24.2 (1.8%)	21.0 (4.4%)	66.0 (8.4%)
HU	1.0%	15.1 (0.4%)	4.6 (0.3%)	1.1 (0.2%)	5.9 (0.7%)
SK	0.7%	1.8 (0.04%)	3.2 (0.2%)	1.3 (0.3%)	10.1 (1.3%)
BG	0.5%	-	1.5 (0.1%)	0.9 (0.2%)	15.5 (2.0%)
HR	0.5%	2.5 (0.1%)	1.9 (0.1%)	1.1 (0.2%)	10.9 (1.4%)
LU	0.5%	4.1 (0.1%)	5.9 (0.4%)	0.7 (0.1%)	0.8 (0.1%)
LT	0.4%	3.1 (0.1%)	1.3 (0.1%)	0.3 (0.1%)	19.2 (2.4%)
SI	0.4%	18.7 (0.5%)	13.6 (1.0%)	1.6 (0.3%)	21.8 (2.8%)
CY	0.2%	12.3 (0.3%)	7.2 (0.5%)	1.0 (0.2%)	31.2 (4.0%)
EE	0.2%	2.0 (0.1%)	3.1 (0.2%)	1.3 (0.3%)	33.1 (4.2%)
LV	0.2%	-	2.3 (0.2%)	0.9 (0.2%)	6.9 (0.9%)
MT	0.1%	-	2.4 (0.2%)	0.3 (0.1%)	8.2 (1.0%)
Total per programme		3 610.2 (100%)	1 372.6 (100%)	480.0 (100%)	787.6 (100%)

Source: compiled by the study team using eCorda data. GDP data from Eurostat; June 2023 Corda data release.

Relative to the size of its budget, WIDERA (ERA) was the most successful programme part at attracting newcomers, who accounted for 2.6% of its total budget. Meanwhile, the MSCA allocated the most funding to newcomers in absolute terms – approximately EUR 25 million. WIDERA (Widening) was also successful in spending 2.0% of its total budget on newcomers; however, in total terms, this only amounted to 3.3 million. ERC allocated the smallest share of its EU contribution to newcomers – just 0.2% of its budget. Since the cases of Switzerland and the UK[51] are somewhat unusual, we also calculated the shares of EU contribution for

[51] Please note that UK became an associated country at the beginning of 2024, which was after this report had been drafted.

third countries that went to these two countries. Except for WIDERA (ERA), most of the funds for third countries went to the UK and Switzerland – a fact that should be noted when considering the funding of the third countries.

Table 4. Allocation of EU funding to selected entities in ERC, MSCA, INFRA and WIDERA[52] by country type and newcomer status

	Widening countries (EUR million and % of funding allocated)	Associated countries (EUR million and % of funding allocated)	Third Countries (EUR million and % of funding allocated)[53]	Funding from Third Countries that went to UK and Switzerland (EUR million and % of Third Country funding)	Newcomers (EUR million and % of funding allocated)	Total funds already allocated, per programme part (EUR million and % of funding allocated)
ERC	232.0 (5.5%)	426.1 (10.1%)	141.3 (3.4%)	140.0 (99.1%)	7.8 (0.2%)	4 202.4 (100%)
MSCA	139.6 (9.6%)	71.2 (4.9%)	17.7 (1.2%)	14.7 (83.1%)	25.1 (1.7%)	1 461.5 (100%)
INFRA	61.2 (11.7%)	28.5 (5.4%)	13.7 (2.6%)	13.1 (95.6%)	9.9 (1.9%)	523.5 (100%)
WIDERA (Widening)	358.8 (50.1%)	46.9 (6.6%)	0.3 (0.0%)	0.3 (100%)	14.4 (2.0%)	715.6 (100%)
WIDERA (ERA)	24.3 (19.0%)	6.1 (4.8%)	1.6 (1.2%)	0.6 (37.5%)	3.3 (2.6%)	128.1 (100%)
Total for Horizon Europe	3 031.2 (13.7%)	1 405.7 (6.4%)	424.4 (1.9%)	246.1 (58.0%)	936.4 (4.2%)	22 044.4 (100%)

Source: compiled by the study team using eCorda data; June 2023 Corda data release.

Lastly, we compared the shares of newcomer and widening participations under Horizon Europe with those of H2020 at its end. The rates of newcomers have decreased, probably due to the fact that, as the programmes continue over time, more and more organisations participate, meaning that the pool of potential newcomers shrinks (this is especially true for participants from the academic sector). The rate of widening participation has increased slightly overall under Horizon Europe compared with H2020, including very slightly in Pillar 1. However, WIDERA has not yet reached the rate of widening participation that the SEWP programme had achieved at the close of H2020.

[52] The percentages in the brackets indicate the share of EU contribution to the select entities out of the total EU contribution for the given programme part.
[53] These calculations exclude rejected applications, the majority of which came from the UK and CH. As a result, this column includes all third countries, including the UK and CH, with the statuses 'Closed', 'Signed', or 'Under preparation'.

Table 5. Overview of participations in Horizon Europe to date, compared with Horizon 2020

	Number of participations in Horizon Europe	Share of newcomer participations in Horizon Europe	Share of newcomer participations in H2020	Share of Widening participations in Horizon Europe	Share of Widening participations in H2020
Total[54]	**55 428**	**7.3%**	**27.5%**	**16.8%**	**13.7%**
Pillar 1	16 095	4.5%	17%	9.9%	9.2%
Pillar 2	35 387	8.6%	35.7%	18.9%	15.1%
Pillar 3	2 066	7.8%	32.9%	14.7%	15.7%
WIDERA[55]	1 880	6.5%	8.1%	38.6%	42.0%

Source: compiled by the evaluation team using CORDA data; June 2023 data release.

4. Evaluation findings

4.1. To what extent has the intervention been successful, and why?

4.1.1. Findings in relation to the criterion of effectiveness

This section evaluates the effectiveness of the Horizon Europe programme parts studied and provides insights into whether Horizon Europe is on track to meet its objectives. A detailed assessment of the progress made under each specific programme part studied is provided in Annex 1. This section aims to provide a synthetic overview of the main results, outcomes and impacts of the programme parts studied.

However, it should be kept in mind that results and impacts can only be partially captured after a short period of the programme period has elapsed. Specifically, only a very small number of Horizon Europe projects have been finished; closed projects represent just 0.7% (44 out of 6 424) of Horizon Europe Pillar 1 and WIDERA projects. Yet, there is little information available regarding scientific publications stemming from Horizon Europe, as reported by the beneficiaries.

4.1.1.1. Key Impact Pathway 1: Creating high-quality new knowledge

H2020 has been highly successful in creating high-quality new knowledge by generating world-class scientific publications (cited at more than twice the world average rate) across its programme parts[56]. The impact assessment of Horizon Europe indicated that the vast

[54] Excludes EIT and EIC Accelerator.
[55] Comparison is with SEWP.
[56] SWD/2024/29 final. Commission Staff Working Document Evaluation Accompanying the document Report From The Commission To The European Parliament And The Council Ex-post

majority of parts and features of H2020 were continued, with various optimisations, and that **Horizon Europe is expected to generate even more new knowledge and technologies, promoting scientific excellence and significant scientific impact**[57]. Horizon Europe aims to strengthen the scientific and technological basis of the Union and to foster its competitiveness. Nevertheless, given the intended continuity and stability of the FP – and in particular, of the ERC and MSCA – it is to be **expected that Horizon Europe will continue with the same momentum, and therefore will continue to deliver high-quality and highly prominent scientific output**.

Scientific output on prominent topics

A look back at H2020 scientific publications provides insights into the most **prominent topics** addressed under the FP, in terms of momentum and visibility[58], and how these have materialised. First of all, H2020 has **contributed to major global discoveries** such as exoplanets, the Higgs boson, COVID-19 vaccines, and perovskite solar cells.

The ERC is one of the programme parts that led to the largest number of publications in these prominent topics. At the same time, an in-depth analysis of the prominent topics reveals that the same prominent topics are researched under different programme parts of the FP. Given the bottom-up character and the breadth of possible research topics covered by the ERC and MSCA, it is not surprising to see that the topics covered in these programme parts are also addressed in other programme parts with a more specific orientation (e.g. LEIT-ICT, FET, SC1)[59]. It is interesting to note that the most prominent topics in which the ERC is highly active in producing research output while the SC are not, relate to astronomy[60] and physics[61]. Conversely, the prominent topics in which SC produced the highest numbers of publications compared with the ERC relate to climate, energy and health. This indicates that the different H2020 programme parts are successful in producing high-quality and highly prominent research, and that at the same time, the projects operated mainly in line with the intentions of the FP. Specifically, the excellent science set of activities aimed to reinforce and extend the excellence of the Union's science base, while the SC activities covered the full cycle including basic and fundamental research, but also applied research, knowledge transfer or innovation, with a focus on policy priorities[62]. Programme parts that favour a bottom-up approach the most (e.g. the ERC and MSCA) drive scientific publications on a large variety of prominent topics, while programme parts that focus more on specific (top-down defined) topics also contribute substantially to scientific knowledge production in prominent topics in

evaluation of Horizon 2020, the EU Framework Programme for Research and Innovation. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2024:29:FIN

[57] European Commission, Directorate-General for Research and Innovation, A new horizon for Europe – Impact assessment of the 9th EU Framework Programme for research and innovation, Luxembourg: Publications Office of the European Union, 2018, available at: https://data.europa.eu/doi/10.2777/194210

[58] The concept of 'prominent topics' refers to important topics in terms of momentum and visibility. To calculate a topic's prominence, the study team combined three metrics into an average to constitute its prominence score. These three metrics are citation counts, Scopus view counts and Average CiteScore (more information on this can be found in Annex 6 of this evaluation study).

[59] More details can be found in Annex 2: Case Study 9.

[60] 'Exoplanets; Kepler; Atmosphere', and 'Planet; T Tauri Star; Pre-main Sequence Stars'.

[61] 'Cavity; Mechanical Oscillators; Resonators', 'Quantum Optics; Thermalization (Energy Absorption); Eigenvalues and Eigenfunctions', and 'Topological Insulators; Topology; Quantum Hall Effect'.

[62] Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 – the Framework Programme for Research and Innovation (2014-2020) and repealing Decision No 1982/2006.

these fields. The prominent topics that led to the highest numbers of publications in each programme parts are, however, not necessarily the ones that are most productive (i.e. producing the greatest number of publications per million EUR of EC funding)[63].

Position of the EU and Horizon 2020 in an international context

The **EU continues to assert its position as a powerhouse in the realm of science**, contributing to nearly 20% of the total publications documented in Scopus in 2022 (while only comprising 6-7% of the world's population). As such, the EU has the second-highest share of scientific output worldwide (after China, with 22.4%)[64]. China has gained its leading position gradually, having gained 16 percentage points in its share of scientific output between 2000 and 2020. This rise has mainly affected the position of the US – which has lost 13 percentage points since 2000 – and to a lesser extent, the EU, which has lost 7 percentage points. However, the US has maintained leadership in terms of both quality[65] and impact[66]. The EU in general stands at the forefront in the domains of economics, social sciences and arts and humanities. It also holds notable influence in clinical medicine and biomedical research and has shown a discernible rise in the proportion of publications spanning the fields of information and communication technologies, enabling and strategic technologies, and physics and astronomy[67].

H2020 has generated a substantial share of the world's publications in several prominent topics. The highest FP contribution can be seen in the topic 'Planet; T Tauri Star; Pre-main Sequence Stars', in which H2020 publications amount to 5% of the total number of publications generated by the main international producers of knowledge (Table 6). Table 6 (and the Top 10) suggests that, considering the knowledge production of the main international knowledge providers under study[68], the contribution of the FP in terms of scientific publications is the strongest in some topics related to astronomy[69].

[63] More information on this analysis can be found in Annex 6 'Quantitative research track findings' and Annex 2 'Case Study 9.

[64] European Commission, Directorate-General for Research and Innovation, Science, research and innovation performance of the EU 2022: building a sustainable future in uncertain times, Luxembourg: Publications Office of the European Union, 2022, available at: https://data.europa.eu/doi/10.2777/78826.

[65] In terms of the top 1% most-cited publications.

[66] European Commission, Directorate-General for Research and Innovation, Science, research and innovation performance of the EU 2022: building a sustainable future in uncertain times, Luxembourg: Publications Office of the European Union, 2022, available at: https://data.europa.eu/doi/10.2777/78826.

[67] Ibid.

[68] i.e. the EU and the main international knowledge producers, including a total of 32 countries, namely the EU-27, the United Kingdom, China, Japan, South Korea and the United States.

[69] The global topic analysis (based on 180 countries rather than 32) confirms that Horizon 2020 has generated a substantial share of publications in several prominent topics, such as physics and astronomy. For instance, considering the world production, the topic to which the FP has contributed the most knowledge is 'Topological Insulators; Topology; Quantum Hall Effect', with 3.8%, followed by 'Weyl; Metalloids; Paul Adrien Maurice Dirac', with 3.0%.

Table 6. Top 3 prominent topics for which the share of FP publications in the total number of publications produced by the main international knowledge providers[70] is the largest

Topic name	Total publications by topic*,**	EU-27 publications	EU-27 as a share of total publications by topic	FP publications as a share of EU-27 publications	FP publications as a share of total publications by topic
Planet; T Tauri Star; Pre-main Sequence Stars	6 573	3 702	56%	8.9%	5.0%
Topological Insulators; Topology; Quantum Hall Effect	6 542	2 443	37%	13.0%	4.9%
Neutron Stars; Mergers; Gravitational Waves	6 357	3 261	51%	8.7%	4.5%

Notes: The data are ranked on the basis of the column 'FP publications as a share of total publications by topic' (see the coloured column).

**These data, based on SciVal, make a 'straight count', assigning whole publications to countries instead of making a 'fractional count'. This means that this column might contain more publications per country than there are in reality. This column might thus be an overestimation.*

***Total number of publications for all 32 countries studied.*

Source: Annex 2, Case Study 9, based on Annex 6. Based on the dataset available at: https://doi.org/10.34894/DNWIXV.

Preliminary findings for Horizon Europe

The European Commission has reported on the short-term KIP1 indicator[71], which is the number of peer-reviewed scientific publications, based on periodic reporting. Specifically, as of 18 October 2023, 323 projects have provided a first-period report (i.e. 3.5% of projects), out of which 49 contain publication data. Importantly, 119 publications have been flagged as peer-reviewed and have a valid Digital Object Identifier (out of a total of 241 publications). Of these publications, **42 were matched and were identified as foreground publications (i.e. published after the start of the project)**[72]. H2020 generated over 5 000 publications in the first three years of its operation. However, comparing the number of publications poses a challenge due to the disparity in the number of completed projects. This disparity arises from the delay in the commencement of Horizon Europe and the fact that most of the projects have a duration of three years and even five under the ERC, which makes direct comparison of publication metrics difficult.

[70] i.e. the EU and the main international knowledge producers, including a total of 32 countries, namely the EU-27, the United Kingdom, China, Japan, South Korea and the United States.
[71] However, the European Commission notes that developments are still in progress for this indicator.
[72] Stemming from Research Infrastructures (Pillar 1), the EIC (Pillar 3) and the Health Cluster (Pillar2).

In addition, the JRC has produced publications that can be assigned to, among others, Horizon Europe[73]. According to data provided by the JRC[74], in 2021-2022, the JRC published almost 1 780 scientific publications that can be attributed to Horizon Europe. The largest shares of these publications address the 'Green transition' (946) and 'Resilient Europe' (706), while the fewest publications relate to 'Innovative Europe' (31)[75]. Publications assigned to Horizon Europe were cited more than twice as often as the world average (FWCI = 2.3), pointing to their high quality. Horizon Europe publications relating to the 'Green transition' were cited at almost three times the world average rate, indicating that **the JRC has focused on producing output relating to the green transition that was of particularly high quality**.

Further analysis in the context of this study indicates that so far[76], 937 publications have been self-reported by Horizon Europe beneficiaries on the CORDIS Open Data Portal. Of those publications that could be matched and validated[77], almost 40% stem from the ERC, MSCA and INFRA programme parts; 32% are attributable to the clusters in Pillar 2; 22% are attributable to EIC; and 5% stem from WIDERA. So far, these publications have an average of 4.1 citations. More generally, the targeted stakeholder consultation[78] indicates that **the majority of respondents (83%) think that Horizon Europe is on track to develop, promote and advance scientific excellence**[79], whereas only 4% believe that this is not the case.

Beneficiaries of the FP continue to be recognised internationally for their high-quality scientific work. For example, Ferenc Krausz[80] and Anne L'Huillier[81] won the 2023 Nobel Prize in Physics for their experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter. Both scholars had received ERC grants and had been funded and supported by the MSCA.

[73] The European Commission's Joint Research Centre (JRC) provides independent, evidence-based science and knowledge, supporting EU policies to positively impact society. The major part of the JRC's budget stems from the EU's research and innovation programme and the complementary Euratom research and training programme. Consequently, several peer-reviewed publications of the JRC can be assigned to Horizon Europe.
[74] Hristova, M. & Lehto, S., (2023) JRC contribution to the interim evaluation of Horizon Europe and Euratom research and training programme. Analysis of peer-reviewed publications 2021-2022 and bibliometric indicators.
[75] These publications have been manually assigned to themes of Horizon Europe, i.e. Innovative Europe; Digital and industrial transition; Resilient Europe; Green transition.
[76] As of 21 October 2023.
[77] 450 publications could be matched, validated and had administrative data available.
[78] Public consultation on the past, present and future of the EU's Horizon research and innovation programmes 2014-2027, available at: https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/results-public-consultation-future-eu-research-and-innovation-programmes-are-now-public-2023-04-19_en.
[79] 30% strongly agreed, 53% agreed; total replies: 1,564; response rate: 56%.
[80] He was granted an ERC Advanced Grant (2009). He supervised MSCA postdoctoral researchers and coordinated MSCA projects.
[81] Anne L'Huillier has received several ERC Advanced Grants (2008, 2013 and 2019) and Proof of Concept grants (2013, 2017, 2023). She has also supervised MSCA postdoctoral researchers and coordinated several MSCA projects. Recently, she has obtained funding for the MSCA doctoral training network MEDEA, training and supervising doctoral researchers.

Drivers of and barriers to high-quality knowledge creation under the Framework Programme

Various factors could be identified that foster or hinder the creation of high-quality knowledge under the FP[82]. Beneficiaries and stakeholders (in the context of the OPC[83]) mention that the landscape of the FP has become more complex. This makes it difficult for researchers to understand the full scope of the possibilities presented. Proposal and project administration often brings important administrative burdens and inefficiencies, especially in case of large collaborative projects. The survey evidence from beneficiaries of the Horizon Europe programme parts under study[84] shows that around half of respondents are satisfied to a 'very large' or 'large' with the ease with which relevant funding opportunities across the different Horizon Europe programme parts can be identified (i.e. between 43% and 55%). Responses from ERC principal investigators were more positive, with 72% being satisfied to a 'very large' or 'large' extent[85]. Furthermore, between 6.5% of INFRA beneficiaries and 22% of MSCA PF fellows strongly agreed that the burdens of the administrative and legal requirements were proportionate, and between 36% and 44% rather agreed. The barriers to and drivers of application and participation, as identified by the survey, are presented in Section 4.1.1.7. In creating new knowledge, it is important that potential applicants are not discouraged from applying and participating in the FP, and that as far as possible, valuable time and resources are spent on R&I activities rather than administrative and organisational issues.

Also, interdisciplinarity was often highlighted by beneficiaries and stakeholders as an important factor in the production of high-quality and impactful research, either through interviews or positioning papers in the context of the OPC. Specifically, it has frequently been argued that interdisciplinarity is the preferred pathway to address complex societal and grand challenges, and that it contributes to impactful and high-quality knowledge creation. At the same time, beneficiaries indicated that interdisciplinarity should not be considered an absolute must, and that it should be promoted as much as possible to the extent that it is relevant in addressing specific avenues of research.

4.1.1.2. Key Impact Pathway 2: Strengthening human capital in R&I

Early evidence highlights the positive effects Horizon Europe has on the career prospects and reputations of researchers, as well as on skills development, international and intersectoral mobility, and working conditions. In particular, Horizon Europe currently supports more than 130 000 researchers, who are involved in 9 288 ongoing projects. Notably, **48 642 of these researchers are involved in upskilling activities** (training, mentoring/coaching, mobility and access to R&I infrastructures) in projects funded by the FP (KIP2)[86]. Upskilled researchers are researchers that are in the earlier stages of their research

[82] See Annex 2, Case Study 9 'The impact of the Framework Programmes on creating high-quality new knowledge'.
[83] Public consultation on the past, present and future of the EU's Horizon research and innovation programmes 2014-2027, available at: https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/results-public-consultation-future-eu-research-and-innovation-programmes-are-now-public-2023-04-19_en.
[84] Survey of Horizon Europe beneficiaries, conducted May-July 2023. More information on the survey can be found in Annex 7.
[85] Between 17.9% and 41.3% were moderately satisfied; between 4.8% and 10.4% were satisfied to a small extent; between 0% and 2.2% were not at all satisfied; and between 2% and 10.4% did not know.
[86] This reflects the short-term KIP 2 indicator, and is provided by the EC.

careers (i.e. first-stage researchers and recognised researchers). Conversely, the FP is so far supporting 81 778 established researchers (i.e. senior researchers and top-grade researchers)[87].

Horizon Europe and, more specifically, the programme parts under study, appear to contribute to improving the career prospects of researchers. Survey evidence[88] presents very positive findings, especially in relation to MSCA fellows and MSCA organisations participating in MSCA DN, MSCA COFUND and MSCA SE actions, as well as WIDERA (Widening) beneficiaries, with 80% or more respondents agreeing that their project contributes or will contribute to improving career prospects to a 'large' or 'very large' extent (Figure 3). In addition, 50% of ERC PIs expect that their Horizon Europe ERC project will advance their career towards higher levels of responsibility or more senior academic positions, and 69.9% expect to become established researchers with a higher level of independence[89]. So far, there is no evidence available regarding the career paths of researchers outside academia and the role of Horizon Europe in supporting this transition. There are, however, preliminary insights into the intentions of FP researchers to establish spin-off or startups based on their Horizon Europe project. This is discussed in Section 4.1.1.6.

[87] No comparable indicator was calculated for the mid-term evaluation of Horizon 2020. Nevertheless, the mid-term evaluation did mention that the MSCA had supported the training, mobility and career development of around 27 000 researchers during the first three years of the FP. European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020 – Commission staff working document, Publications Office, 2017, https://data.europa.eu/doi/10.2777/220768

[88] Survey of Horizon Europe beneficiaries, conducted May-July 2023; surveys of Horizon Europe MSCA researchers, conducted May-November 2023. More information on these surveys can be found in Annex 7.

[89] Survey of Horizon Europe beneficiaries, conducted May-July 2023, N = 236 (respondents could tick the box or not). More information on this survey can be found in Annex 7.

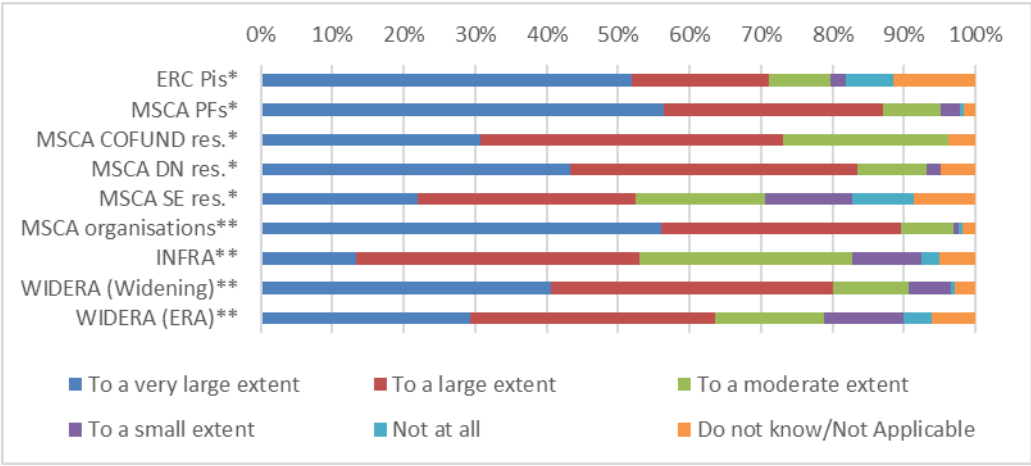

Figure 3. Projects contributing to improving the career prospects of researchers.

**Question: 'To what extent do the opportunities provided by your Horizon Europe project respond to your following needs? Gain a research position with better career prospects.' **Question: 'To what extent, if at all, has your Horizon Europe project achieved/is likely to achieve the following results: Improving the career prospects of researchers.'*

MSCA organisations = MSCA organisations participating in DN, COFUND and SE actions; MSCA PF = MSCA Postdoctoral Fellows; MSCA DN/COFUND/SE res. = researchers participating in MSCA DN/COFUND/SE; WIDERA (Widening) = beneficiaries of the Widening actions under the WIDERA programme part; WIDERA (ERA) = beneficiaries of the 'Strengthening the ERA' component of the WIDERA programme part. ERC PIs, N = 241; MSCA PF fellows, N = 827; MSCA COFUND res., N = 26; MSCA DN res., N = 454; MSCA SE res., N = 278; MSCA Organisations, N = 478; INFRA, N = 157; WIDERA (Widening), N = 170; WIDERA (ERA), N = 99.

Source: survey of Horizon Europe beneficiaries, conducted May-July 2023; surveys of Horizon Europe MSCA researchers, conducted May-November 2023. More information can be found in Annex 7.

Moreover, **preliminary evidence suggests that the Horizon Europe programme parts under study promote better recruitment practices and working conditions for researchers across Europe.** For instance, the MSCA require host organisations to advertise open positions for fellows in MSCA doctoral and postdoctoral programmes on Euraxess, to provide clear eligibility criteria, and to ensure that the selection process is fair and unbiased. The results of the Horizon Europe beneficiaries' survey indicate that almost half of organisations participating in MSCA DN, COFUND and SE actions, and almost half of WIDERA (Widening) beneficiaries expect that their Horizon Europe project will lead to improved working conditions for researchers at organisational level (to a 'large' or 'very large' extent) [90]. Among INFRA and WIDERA (ERA) beneficiaries, this expectation is somewhat lower, at 25.5% and 35.0%, respectively[91].

Under Horizon Europe, the programme parts studied have so far contributed to the mobility of researchers from their country of residence to another country, both within the EU, as well as with Associated and third countries. Mobility was stimulated most under the MSCA, but the Widening actions also contributed. Under Horizon Europe so far, the mobility patterns of MSCA PF fellows have not undergone any drastic changes compared with the mobility patterns of MSCA IF fellows under H2020, with non-Widening countries

[90] MSCA organisations, N = 480; WIDERA (Widening), N = 170. Fewer than 20% of MSCA organisations and WIDERA (Widening) beneficiaries believe this will happen 'to a limited extent' or 'not at all'. More information on the survey can be found in Annex 7.
[91] INFRA, N = 157; WIDERA (ERA), N = 97. Around 30% of INFRA and WIDERA (ERA) beneficiaries believe this will happen 'to a limited extent' or 'not at all'. More information on the survey can be found in Annex 7.

continuing to host the largest shares of researchers (e.g. Spain, Italy, France, Germany, the Netherlands and Denmark). The MSCA also continue to support fellows returning to their home countries. This is particularly notable in the case of Greece, Italy, Cyprus and Spain. In addition, following the success of the 'Widening Fellowships' under H2020, applicants to the MSCA Postdoctoral Fellowships who aim to carry out their research in a Widening country benefit from a second chance to be funded under the ERA Fellowships (under the WIDERA programme part)[92], an action widely appreciated by applicants and stakeholders[93]. The ERA Fellowships play an essential role in supporting mobility towards Widening countries, as 'the number of MSCA fellows going to Widening countries is limited'[94].

Efforts are being made to support intersectoral mobility, even if room for improvement remains. 41.5% of MSCA postdoctoral fellows indicate that their Horizon Europe project responds to their intersectoral mobility needs. 19.6% of the ERC principal investigators report the same (although the ERC does not put forward the objective of facilitating intersectoral mobility as such)[95].

The participation of the non-academic sector has slightly increased in the MSCA Postdoctoral Fellowships between Horizon 2020 and Horizon Europe. However, the share of non-academic beneficiaries has decreased. Only 1% of MSCA postdoctoral fellows are recruited in the private sector, compared with 2.6% of individual fellows under H2020[96].

In addition, Widening actions have introduced a new action, ERA Talents, which encourages intersectoral collaboration in R&I through the cross-sectoral exchange of staff. MSCA SE also require that exchanges of staff between organisations in EU Member States and associated countries occur between different sectors, academic and non-academic (including business), unless they are interdisciplinary.

4.1.1.3. Key Impact Pathway 3: Fostering the diffusion of knowledge and Open Science

Horizon Europe aims to open up science, as reflected by research outputs being openly shared and reused, and by new collaborations being stimulated. Under Horizon Europe, Open Science is embedded throughout the FP and has evolved to become its *modus operandi*. Horizon Europe beneficiaries, as per the grant agreement, need to provide immediate open access to scientific peer-reviewed publications. They must also align the

[92] HORIZON-WIDERA-2022-TALENTS-02-01, HORIZON-WIDERA-2022-TALENTS-04-01 and HORIZON-WIDERA-2023-TALENTS-02-01 (for which projects are expected to start in June 2024).
[93] e.g. European Regions Research and Innovation Network (ERRIN) (2023). ERRIN input to the public consultation on the past, present and future of the European Research & Innovation Framework Programmes 2014-2027.
[94] Masaryk University (MUNI) (2023). Contribution of Masaryk University to Public consultation on the past, present and future of the European Research & Innovation Framework Programmes 2014-2027.
[95] Survey of Horizon Europe beneficiaries, conducted May-July 2023. MSCA PF, N = 285:10.9% agreed 'to a small extent' or 'not at all'; ERC PIs, N = 239: 25.6 % agreed 'to a small extent' or 'not at all', 42.5% indicated 'do not know' or 'not applicable'. More information on the survey can be found in Annex 7.
[96] Under Horizon 2020, a multidisciplinary panel (Society & Enterprise) was introduced between 2016 and 2020 with a dedicated budget allocated to fund projects with a non-academic main host in MSCA IF. This panel was discontinued under Horizon Europe and non-academic placements introduced as an incentive for more intersectoral mobility in MSCA PF.

management of research data with FAIR principles and there are Open Science measures to increase the reproducibility and potential validation of research outputs[97].

The European Commission reports on the short-term KIP3 indicator, which is called 'shared knowledge' and is defined as 'the share of research outputs resulting from the Programme that is shared through open knowledge infrastructures'[98]. **Specifically, 85.2% of the publications reported so far**[99] **(without distinction between foreground and background) are in open access** (i.e. an OpenAire ID could be identified). These positive findings are corroborated by an additional analysis carried out by the study team[100]. Furthermore, **25% of the 28 reported datasets so far are in open access**. As a baseline, the European Commission calculated that, by January 1 2017, or three years in Horizon 2020, 77.1% of the H2020 publications were in open access.

The preliminary insights from the surveys of Horizon Europe beneficiaries (see Table 7) provide more information about the barriers that beneficiaries still experience to making research output available in open access. In these surveys, most respondents indicated that the question regarding barriers is not yet applicable (or that they did not know the answer). Between 14% and 26% of the Pillar 1 and WIDERA survey respondents indicated that they did not experience specific difficulties or challenges concerning the openness of project results. The most frequent difficulties experienced by beneficiaries mainly concern access to sufficient funds to pay the fees required by some journals or data repositories (non-eligible processing charges). However, Table 7 shows that fewer MSCA researchers (Postdoctoral Fellows and researchers participating in MSCA DN, COFUND, and SE) have reported this as a barrier.

[97] Horizon Europe (HORIZON). Programme Guide. Version 3.0, available at: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/programme-guide_horizon_en.pdf.
[98] European Commission, Directorate-General for Research and Innovation, Nixon, J., Study to support the monitoring and evaluation of the framework programme for research and innovation along key impact pathways – Indicator methodology and metadata handbook, Nixon, J.(editor), Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2777/44653
[99] As of 18 October 2023.
[100] An additional analysis on Horizon Europe publications identified through the CORDIS Open Data Portal (and for which information was available) shows that 90% of those publications are open access and 10% are restricted.

Table 7. Share of Horizon Europe beneficiaries that experienced difficulties in publishing project results in open access

	ERC PI	MSCA PF	MSCA SE res.	MSCA DN res.	MSCA COFUND res.	MSCA ORG	INFRA	WIDERA (Widening)	WIDERA (ERA)
Difficulties accessing sufficient funds to pay for the fees required by some journals or data repositories (non-eligible processing charges)	29%	10%	15%	4%	4%	34%	38%	36%	28%
Lack of guidance on the implementation of the data management plan	26%	5%	4%	3%	0%	9%	13%	16%	5%
There were **no specific difficulties or challenges** related to the openness of project results	26%	14%	27%	9%	15%	19%	24%	22%	22%
Lack of knowledge or resources to share data and metadata in open access	20%	3%	4%	3%	4%	7%	13%	17%	15%
Difficulties identifying relevant open repositories or archives	19%	3%	6%	2%	4%	8%	13%	14%	7%
Lack of competences and knowledge on processes for publishing in open access	14%	3%	5%	3%	0%	6%	5%	17%	11%
Challenges to complying with data protection regulation (GDPR)	13%	2%	3%	2%	0%	11%	15%	17%	6%
Possible negative impact on your career progression related to publishing in open access	9%	5%	4%	0%	0%	14%	12%	10%	10%
Other	3%	2%	2%	1%	0%	6%	3%	4%	5%
Do not know/Not applicable	23%	67%	49%	82%	77%	33%	24%	24%	33%

Note: respondents to the survey could indicate multiple barriers, hence the sum of the percentages per programme part exceeds 100%.

MSCA PF = MSCA Postdoctoral Fellows; MSCA DN/COFUND/SE res. = researchers participating in MSCA DN/COFUND/SE; MSCA organisations = MSCA organisations participating in DN, COFUND and SE actions; WIDERA (Widening) = beneficiaries of the Widening actions under the WIDERA programme part; WIDERA (ERA) = beneficiaries of the 'Strengthening the ERA' component of the WIDERA programme part.

Source: survey of Horizon Europe beneficiaries, conducted May-July 2023; surveys of Horizon Europe MSCA researchers, conducted May-November 2023. More information on the surveys can be found in Annex 7.

4.1.1.4. Structuring effects of the Framework Programme

Encouraging collaboration

Early evidence collected on Horizon Europe indicates that the programme parts under analysis **foster collaboration, possibly inducing a structuring effect on the European research landscape**. While collaborative grants fund projects in which organisations from different Member States, associated countries, and/or third countries can collaborate, mono-beneficiary grants also seem to foster collaboration. The survey of Horizon Europe beneficiaries[101] shows that between 73% and 88% of ERC PIs, MSCA PF fellows and researchers participating in MSCA DN, COFUND, and SE agreed to a 'large' or 'very large' extent that their grant provides opportunities to build new collaboration ties. Similarly, between 77% and 88% of the responding organisations participating in MSCA (DN, COFUND, SE), INFRA, WIDERA (Widening) and WIDERA (ERA) agreed to a 'large' or 'very large' extent that their project allows the creation or strengthening of collaborations with leading research organisations. The network analysis carried out in the context of this study[102] shows that globally, over one third of countries are connected through researchers participating in Horizon Europe-funded projects, and that **Pillar 1 is the most globally connected Pillar in Horizon Europe**. The most central countries (normalised by population density) in the European research ecosystem under Horizon Europe so far are Germany, France, Italy and Spain. So far, researchers from Spain and Italy have collaborated together more than any other two nationalities in Horizon Europe. Non-Widening countries are generally more connected than Widening countries. However, amongst Widening countries, researchers from Greece, Portugal, Poland and Czechia are found to be central to the European research ecosystem (in terms of the employed centrality measures, i.e. degree, closeness and betweenness centrality[103]). When we focus on the networks of researchers under Horizon Europe Pillar 1 and WIDERA we see similar results. Spain, Germany, France and Italy are the most connected countries, with most collaborations happening between Spanish and Italian researchers. This analysis also shows that Widening countries are less well connected than non-Widening countries, with the exception of non-Widening country Luxembourg, which has the lowest centrality rankings of the EU-27 countries.

International collaboration

International collaboration[104] is one of the fundamental principles within the EU, reinforcing R&I excellence, strengthening competitiveness, addressing global societal challenges and enabling the construction of required infrastructures. Horizon Europe is one of the main tools for implementing the EU's strategy for international cooperation[105]. So far, the overall share of participations under Horizon Europe representing associated countries is 5.3%; third

[101] Survey of Horizon Europe beneficiaries, conducted May-July 2023. Surveys of Horizon Europe MSCA researchers, conducted in May-November 2023. More information on the survey can be found in Annex 7.
[102] For more information and details, see Annex 6 'Quantitative research track findings'.
[103] Centrality measures the level of the 'central-ness' of the countries under study (i.e. nodes). Degree centrality is a simple measure of how many connections each node has; Closeness centrality looks at how close each node is to every other node in the network; betweenness centrality measures how important a node is to the information flow of the network.
[104] This paragraph is based on information described in Annex 2, Case Study 13 'International cooperation and association'.
[105] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2021%3A252%3AFIN

countries[106], 3.4%; Switzerland, 2.3%; and the United Kingdom, 4.4%[107]. Compared with the previous funding period, the share of beneficiaries representing associated countries has increased and the share of third countries has decreased (excluding Switzerland and the United Kingdom). In addition, as a result of Brexit, the status of the United Kingdom changed from Member State (under H2020) to Third Country (under Horizon Europe) and most recently, to Associated Country (as of September 2023). This has led to fluctuations in participations from the United Kingdom, whose share has decreased between H2020 and Horizon Europe (from 9.6% to 4.4%). More than half of Horizon Europe participants from non-associated third countries (excluding the UK and Switzerland) participate in projects under Pillar 1.

Several findings should be highlighted in the context of international collaboration supported by the FP:

- **The association of third countries to Horizon Europe strengthens the coherence and integration of the European R&I system**. Association helps to advance R&I capacities, especially in those associated countries with less well-developed R&I systems, and prepares them for alignment with the European Research Area.

- An analysis of international co-publication data for H2020[108] shows that **authors from Associated and third countries have contributed significantly to the pool of FP-related publications** (more than 15% and 29%, respectively).

- The non-associated status of Switzerland and (previously) of the United Kingdom[109] constitutes a challenge to the excellence of the FP and for these countries. Compared with H2020, the participation of these countries in Horizon Europe is lagging behind, and has introduced levels of uncertainty into previously established international collaboration efforts.

- For research infrastructures, the **ERIC regulation has the potential to further foster and facilitate international cooperation**. While the ERIC regulation was initially conceived to facilitate collaboration among Member States and associated countries, it also has the potential to become an important policy instrument for boosting international cooperation with third countries; however, current legal and operational obstacles need to be overcome first[110].

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[106] Here, we present data for the third countries and associated countries excluding Switzerland and the UK.
[107] Source: Horizon Dashboard, accessed on 22 October 2023.
[108] Here, we refer to Horizon 2020 publication data, given the lack of Horizon Europe publication data.
[109] On 7 September 2023, a joint Statement by the European Commission and the UK Government on the UK's association to Horizon Europe (and Copernicus) was made public. It stated that an agreement in principle had been made under the Trade and Cooperation Agreement. It notes that 'UK researchers will be able to fully participate in the Horizon Europe programme on the same terms as researchers from other associated countries, including leading consortia, from the 2024 Work Programmes and onwards – including any 2024 calls opening this year.' Transitional arrangements for 2023 calls will remain in place. See: https://ec.europa.eu/commission/presscorner/detail/en/statement_23_4375.
[110] Report from the Commission to the Council and the European Parliament, 2023, Third report on the application of Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community

Widening countries and collaborations

One of the key objectives of the **Widening actions** is to support less-advanced R&I countries by increasing their participation in (international) research networks**.** Early survey evidence for Horizon Europe indicates that **almost 90% of WIDERA (Widening) beneficiaries find that their Widening project creates or strengthens collaborations with leading research organisations to a 'large' or 'very large' extent**[111].

Nevertheless, qualitative evidence (gained through interviews with, for example, representatives of WIDERA NCPs) indicates that some researchers in Widening countries (especially at institutions with less of a tradition of engaging in European projects) still experience difficulties in setting up and engaging in collaborative consortia. The network analysis conducted in the context of this study[112] indicates that the share of collaborations between Widening and non-Widening Member States accounts for 31.6% of the collaborations in Horizon Europe excluding WIDERA. Focusing on WIDERA alone, the share of cross-collaborations between Widening and non-Widening Member States is higher, at 40.0%. Moreover, when examining new connections within WIDERA's Widening calls, it was found that there were 4, 04 collaborations within Widening, of which 3 631 were new, meaning that the two entities had not previously collaborated anywhere else in Horizon Europe. The highest number of new collaborations were formed between Greek organisations, followed by Croatian organisations and Greek–Bulgarian collaborations.

Collaboration between research and industry

The participation of and EU contribution to private for-profit entities in Horizon Europe projects and grants in Pillar 1 and WIDERA is somewhat limited, as was the case under H2020. Within Pillar 1, the MSCA have the largest participation of private for-profit entities, and the ERC has the smallest[113]. Specifically, in Horizon Europe Pillar 1 and WIDERA so far, around 16% of participations have come from private for-profit entities. **In general, interviewees confirm that engaging industry remains a rather difficult task**. Nevertheless, when focusing on the number of unique participants in each programme part, the numbers show a higher share of unique private for-profit entities participating in the FP.

Inducing structural change

In addition to encouraging collaboration, **the FP is expected to have a structuring effect on institutions and on regional/national research systems in terms of the changes it induces in institutional and national policies and practices**. Yet, it is important to underscore that such effects generally need a longer time to unfold and manifest themselves, and that these structuring effects should be considered a potential long-term impact of the

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legal framework for a European Research Infrastructure Consortium (ERIC), available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2023:488:FIN.

[111] Survey of Horizon Europe beneficiaries, conducted May-July 2023, namely, 158 out of 180; WIDERA-WIDE-BEN-025. Only 1.2% agreed 'to a small extent' or 'not at all'. For more information, see Annex 7.

[112] For more information and details, see Annex 6 'Quantitative research track findings', Entities network analysis.

[113] For instance, the Horizon Dashboard indicates that in terms of participations, the share of private for-profit entities (excluding higher or secondary education establishments) in the ERC is 2.2%; in INFRA it is 8.4%, and in MSCA it is 21.4%. Detailed information on participation by entity type can be found in Annex 6.

FP. The next sections present concrete illustrations that point to the structuring effect of (previous) FPs and programme parts[114].

The **Widening actions** are intended to advance R&I systems in Widening countries by spurring structural changes in the institutions, regions or countries involved. Evidence collected on H2020[115] indicates that Widening actions have proved effective in inducing diverse types of structural changes and that **these changes occur most often at institutional level**[116]. Structural changes at regional and national level are more diverse in nature, scope and degree of impact, and are somewhat less visible than institutional changes. In addition, the absence of a **clear-cut definition of structural changes** in the context of the Widening actions (beyond a mere list of changes) hinders the monitoring and evaluation of this type of impact.

In terms of **Open Science practices**, the FP often has a structuring effect on many institutions and regional and national research systems[117]. In particular, it aims to serve as a catalyst for Open Science practices across its Member States (and beyond)[118]. Qualitative evidence collected through interviews with national Open Science experts and through the OPC confirms the role the FP plays in fostering Open Science within the EU. Based on interviews, the mechanisms of the FP in driving the uptake of Open Science at national level could be described as: 1) supporting the development of knowledge and tools on Open Science; 2) supporting the development of infrastructures, environments and platforms that enable open access practices; and 3) inspiring the uptake of Open Science practices through guidelines, the requirements of the FP and participation in Missions and consensus-building activities. Preliminary insights from the targeted stakeholder consultation[119] show that the changes introduced in Horizon Europe in terms of Open Science policy are considered to contribute to strengthening the impact of the EU's research and innovation by a large majority of the respondents (71%)[120].

The **Policy Support Facility**[121] has been one of the key instruments in achieving structuring changes at national level, by supporting reforms to the R&I systems of Member States and associated countries. In total[122], the **Policy Support Facility under Horizon Europe has supported 27 different Member States and associated countries through its Country, Challenge and Open services**, with Romania (seven projects), Austria and Belgium (five projects each) being the most active participants.

[114] We refer to Case Study 3, 'The structuring impacts of the MSCA' on more structuring impacts that are generated by the MSCA.
[115] Focused on Horizon 2020 Twinning, Teaming and ERA Chairs.
[116] More information can be found in Case Study 7 (Annex 2).
[117] More information can be found in Case Study 11 (Annex 2).
[118] SWD(2023)132 final (2023). Evidence Framework on monitoring and evaluation of Horizon Europe. Brussels, 27 April 2023.
[119] Public consultation on the past, present and future of the EU's Horizon research and innovation programmes 2014-2027, available at: https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/results-public-consultation-future-eu-research-and-innovation-programmes-are-now-public-2023-04-19_en.
[120] 1 106 out of 1 564 respondents.
[121] https://ec.europa.eu/research-and-innovation/en/statistics/policy-support-facility
[122] As of October 2023.

Informing policy

Results from EU-funded projects provide a wealth of knowledge that can potentially be used to inform policy decisions. However, according to the Horizon Europe beneficiaries' survey[123], large differences exist between programme parts when it comes to how many projects foresee the production of outputs that will **provide inputs into national or EU policies and recommendations for policymakers**. While only 18.1% of ERC principal investigators expect to produce such results, 81.9% of WIDERA (ERA) beneficiaries expect to do so, which is in line with the expected contributions.

One takeaway from H2020 was the need for a more structured policy feedback framework. In response to this, a **Feedback-to-Policy Framework has been progressively rolled out within Horizon Europe**. Under this framework, joint teams work together to define policy needs as well as the policy inputs needed, feeding them into Feedback-to-Policy plans. These inputs are intended to go beyond collecting information about project conclusions, and to instead contribute to a more holistic impact assessment. The Commission has been working closely with the executive agencies to realise this goal.

While it is still too early to pinpoint specific policies that have emerged from the Feedback-to-Policy activities under Horizon Europe, it is clear that progress has been made in **refining the feedback mechanism**. Indeed, during the early stages of Horizon Europe, several noteworthy instances of the Feedback-to-Policy activities made significant contributions to the Commission's policymaking efforts. For instance, the Research Executive Agency held the third edition of its 'Projects to Policy' seminar, at which consortia and policymakers discussed newly funded projects under a call in Cluster 3. This provided an opportunity for policymakers to directly engage with the most up-to-date information regarding novel advances in civil security[124].

4.1.1.5. Contribution to SDGs, policy priorities and global challenges

Preliminary evidence for Horizon Europe[125] points to the significant importance of the SDGs in the projects funded, with at least one SDG being covered in 99.2% of project proposals analysed. Compared with H2020, it appears that the contribution to the SDGs has intensified[126]. Overall, the SDGs on which Horizon Europe has focused most intensely (in terms of number of projects), are SDG3 – Good Health and Well-being (44%); SDG7 – Affordable and Clean Energy (24.2%); and SDG9 – Industry, Innovation and Infrastructure (22.9%). From H2020 to Horizon Europe, a higher share of projects have been contributing to all SDGs[127], with the exception of SDG6 – Clean Water and Sanitation, SDG8 – Decent Work and Economic Growth, and SDG9 – Industry, Innovation and Infrastructure.

[123] Survey of Horizon Europe beneficiaries, conducted May-July 2023; surveys of MSCA researchers under Horizon Europe, conducted May-November 2023. More information on the surveys can be found in Annex 7.
[124] REA Annual Activity Report 2022.
[125] For more information, see Annex 6 'Quantitative research track findings', SDG Analysis.
[126] The documents on which the SDG analysis is based differ between Horizon 2020 and Horizon Europe: the Horizon Europe analysis was carried out using the proposal texts, while for Horizon 2020 the analysis was based on publications. This makes it difficult to compare the SDG contributions of the two Framework Programmes.
[127] Please see the previous footnote on the limitations in comparing between the two Framework Programmes.

Under Horizon Europe Pillars 1 and 3, the most pronounced SDG (in terms of number of projects) is SDG 3 – Good Health and Well-being. Under Pillar 2, it is SDG 7 – Affordable and Clean Energy, and in WIDERA, it is SDG 16 – Peace, Justice and Strong Institutions.

In addition, **Horizon Europe has stepped up to address emerging and global challenges** (e.g. the economic crisis, climate change, increased global competition, COVID-19). Moreover, the FP aims to accelerate the twin and digital transitions and related transformations of the economy and society. To achieve this, it has committed sizeable financial efforts to invest in creating new knowledge in areas of strategic importance to Europe, and into diffusing this knowledge into relevant industries and society[128]. For instance, the budget has been raised; six clusters have been identified that make up the pillar 'Global Challenges and European Industrial Competitiveness'; and Missions and European co-funded and co-programmed partnerships have been identified. However, since Horizon Europe projects are largely ongoing, it is too early to draw conclusions as to the effectiveness of these actions in terms of impacts they generate. Nevertheless, preliminary evidence indicates the importance of the FP in addressing, for example, the COVID-19 pandemic, with 183 ERC projects in related fields[129] (see also Section 4.3.1).

Horizon Europe is also committed to increasing the involvement of citizens and civil society in the research process, contributing to building a society based on knowledge and education. In this context, there are preliminary results for the short-term indicator of KIP 6 on co-creation. In particular, 323 out of 9 288 ongoing projects have submitted their first periodic reporting[130]. **Citizens were engaged in 35 of these projects (10.8%)[131]**.

4.1.1.6. Innovation and economic impact

A first point of interest in relation to the architecture of the FP is whether research ideas are 'transported' throughout the programme – in other words, whether research ideas and knowledge developed under one programme part can be taken up and further elaborated and applied in other programme parts. The survey results indicate that among the programme parts in Pillar 1 and WIDERA, INFRA projects and WIDERA (ERA) projects are mainly a continuation of H2020 projects (as indicated by 42.4% and 34.2% of respondents, respectively)[132]. In addition, the results of the network analysis indicate that within Horizon Europe, Pillar 1 researchers more often participate in projects in other pillars than they do in

[128] European Commission, Directorate-General for Research and Innovation, Horizon Europe – Strategic plan 2021-2024, Luxembourg: Publications Office of the European Union, 2021, available at: https://data.europa.eu/doi/10.2777/083753.
[129] European Research Council, COVID-19 Frontier research in the spotlight, 2022, available at: https://erc.europa.eu/sites/default/files/2022-08/COVID19-Frontier_research_in_the-spotlight.pdf.
[130] As of 18 October 2023.
[131] There is no concrete comparable baseline for this indicator corresponding to the interim evaluation of Horizon 2020. Nevertheless, the study indicates as an area for improvement the involvement of end-users and citizens in co-designing the R&I agenda and co-creating solutions. European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020 – Commission staff working document, Publications Office, 2017, https://data.europa.eu/doi/10.2777/220768
[132] Survey of Horizon Europe beneficiaries, conducted May-July 2023; surveys of Horizon Europe MSCA researchers, conducted May-November 2023. More information on the surveys can be found in Annex 7.

an additional project within Pillar 1. For instance, the MSCA and INFRA programme parts both share the highest number of researchers with Cluster 4, in terms of absolute numbers.

Furthermore, an analysis of the trajectory of H2020 ERC researchers in Horizon Europe[133] shows that around **8% of PIs from H2020 ERC projects have participated in a Horizon Europe project**. They participate most frequently in Pillar 2 of Horizon Europe (52% of participations in Horizon Europe by PIs that previously participated in ERC under H2020), followed by Pillar 1 (24%), Pillar 3 (18%) and WIDERA (6%). In Pillar 1, the most frequent destination programme part is the MSCA (15% of total H2020 ERC PI participations in Horizon Europe), followed by INFRA (5%). In Pillar 2, the most frequent destination programme part is Cluster 4 'Digital, Industry and space' (20% of total H2020 ERC PI participations in Horizon Europe), followed by Cluster 1 'Health' (10%). In Pillar 3, almost all PIs went to the EIC, accounting for 18% of total H2020 ERC PI participations in Horizon Europe.

The FP is expected to achieve technological and economic impact, especially within the Union, by stimulating innovation-based growth, creating jobs both directly and indirectly (especially within the Union), and leveraging investments in R&I. While it is too early to fully assess the innovation and economic outcomes of Horizon Europe projects, there are some indicators pointing to preliminary results.

- First, the European Commission has already reported on **157 innovative projects, processes and methods developed in Horizon Europe**, but has no information on patents (KIP7) yet[134]. The survey provides insights into the expected exploitation activities of Horizon Europe Pillar 1 and WIDERA projects: 30% of MSCA participating organisations in MSCA DN, COFUND and SE actions expect to develop, manufacture or market a product or process, and 28% expect to engage in patenting activities[135]. WIDERA (ERA) beneficiaries are least likely to foresee innovation and commercialisation activities, compared with the other beneficiaries under Pillar 1 and WIDERA.

[133] Specifically, the analysis first identified the PIs of Horizon 2020 ERC projects, and then determined in which projects they have participated under Horizon Europe. In the following paragraphs we discuss the results of this analysis.
[134] The baseline for KIP7 corresponding to the interim evaluation of Horizon 2020 indicates that 122 patents were created through Horizon 2020 at 1 January 2027.
[135] MSCA organisations, N = 462.

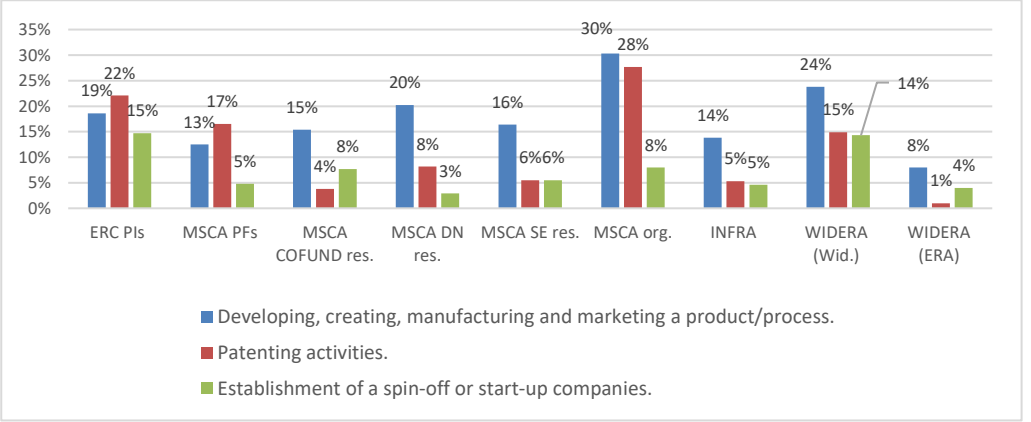

Figure 4. Expected exploitation activities in Horizon Europe Pillar 1 and WIDERA.

MSCA PF = MSCA Postdoctoral Fellows; MSCA DN/COFUND/SE res. = researchers participating in MSCA DN/COFUND/SE; MSCA org. = MSCA organisations participating in DN, COFUND and SE actions; WIDERA (Wid.) = beneficiaries of the Widening actions under the WIDERA programme part; WIDERA (ERA) = beneficiaries of the 'Strengthening the ERA' component of the WIDERA programme part. Question: 'Are there any exploitation activities foreseen as part of your project?' Source: survey of Horizon Europe beneficiaries, conducted May-July 2023; surveys of Horizon Europe MSCA researchers, conducted May-November 2023. More information on the surveys can be found in Annex 7.

- Second, the European Commission indicates that 77 out of the 323 projects that submitted a periodic reporting reported the creation of jobs within the project. The reports point to **525 full-time jobs being created and maintained in the participating legal entities** (KIP8)[136].

- Lastly, the FP aims to stimulate further R&I funding, which is typically lacking in Europe in comparison to other leading world economies. So far, the amount of public and private investment mobilised through the initial investment from the Programme (i.e. co-investments) is EUR 6.99 billion, or 19.5% of Horizon Europe's total investment[137].

Horizon Europe beneficiaries are also stimulated to carry out activities to increase the impact of their project results by sharing their research results with a broad range of stakeholders, such as the scientific community and civil society. In addition, they are encouraged to use their project results to address societal problems or to exploit them for commercial purposes. Two initiatives have been set up by the EC to spur the exploitation of results, i.e. the Horizon Results Platform[138] and Horizon Results Booster[139].

[136] There is no equivalent KIP8 indicator calculated for the mid-term evaluation of Horizon 2020. Nevertheless, based on macro-economic simulations, the interim evaluation concluded that the, at 1 January 2027, Horizon 2020 was on track to contribute to the creation of jobs and growth. European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020 – Commission staff working document, Publications Office, 2017, https://data.europa.eu/doi/10.2777/220768

[137] It should be noted that data for co-funded partnerships and the EIC fund are not included in this figure.

[138] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform

[139] https://www.horizonresultsbooster.eu/

4.1.1.7. Barriers to and drivers of application and participation

To identify relevant barriers and drivers that either impede or motivate applicants to Horizon Europe in general, we use data from the survey of Horizon Europe beneficiaries conducted from May to July 2023. Examining the satisfaction of Horizon Europe beneficiaries with various aspects of the project application process shows that **Horizon Europe beneficiaries seem fairly satisfied with the application process, with successful ERC PIs being the most satisfied group**. Those aspects with which successful applicants were generally most satisfied are 'the clarity of the aims and objectives of the calls' and 'the clarity of the "general conditions" and eligibility and funding rules'. Conversely, those aspects for which satisfaction was the lowest, are the 'transparency of the evaluation process' and the 'level of details of the feedback provided in the evaluation report'. This is especially the case among successful INFRA applicants, WIDERA (Widening) applicants, and MSCA organisations.

When examining the perceptions of beneficiaries regarding the administrative and management processes of Horizon Europe projects, it is noticeable that, compared with the other statements, the statement that is agreed with most often is 'the time the process takes up to the signature of the grant agreement is adequate'. Conversely, the two statements with which the greatest number of respondents disagreed were 'the online reporting platform is user-friendly' (especially among ERC principal investigators) and 'the burden of the administrative and legal requirements for granting procedures was proportionate'.

4.1.2. Findings in relation to the criterion of efficiency

This section addresses the extent to which Horizon Europe is operating efficiently for its various stakeholder groups. The main focus of this analysis is the overall performance of Horizon Europe, as well as findings from Pillar 1 and WIDERA[140]. The complete efficiency analysis can be found in Annex 1. In the analysis below, we look at key indicators at each step of the applicant's participation in Horizon Europe, beginning with proposals and the help available to applicants, moving on to project selection, and ending with project implementation.

Proposal preparation effort

Despite the positive steps taken to address the problem of oversubscription (a widely discussed challenge in H2020), applicants expressed mixed levels of satisfaction with the efforts required to prepare a Horizon Europe proposal, in the light of the chances of success. In total, 58% of survey respondents from Pillar 1 and WIDERA agreed[141] with the statement that the efforts needed were in proportion to the chances of securing Horizon Europe funding. In addition, around 82% of all Pillar 1 applicants (successful and unsuccessful respondents) agreed that the application costs (total time and resources needed) are proportionate to the volume of funding requested in the proposal. Also, 87% of all Pillar 1 applicants believed that the efforts needed were proportionate to the complexity of the proposed project[142].

[140] The main data sources that fed into this analysis were administrative data of projects and participants (Corda) and the survey of unsuccessful applicants and beneficiaries. The results of the public consultation and other sources available online have also been used.
[141] To a 'very large', 'large' or 'moderate' extent. N = 6 959.
[142] Share of respondents who agreed to a 'very large', 'large', or 'moderate' extent in response to the following survey question: 'The efforts needed were proportionate to the complexity of the proposed project: To what extent do you agree with the following statements about the effort needed to prepare and submit your Horizon Europe project?, n= 6 283.

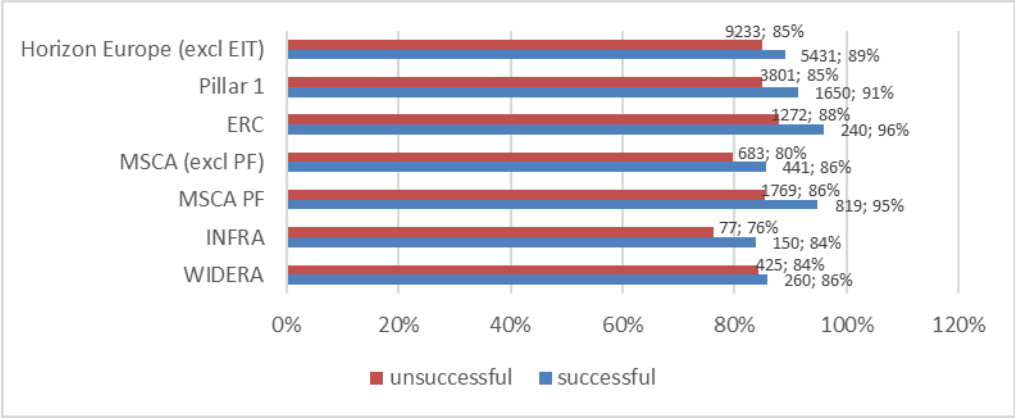

Figure 5. To what extent do you agree with the following question: 'The efforts needed were proportionate to the complexity of the proposed project'.

Source: survey of Horizon Europe beneficiaries, conducted May-July 2023 and survey of unsuccessful Horizon Europe applicants, conducted May-July 2023. Combined number of responses: 16 960.

In fact, we estimated that **a median coordinator under Horizon Europe spends between 36 and 45 person-days in preparing an application. A median value for contributing partners is between 16 and 25 person-days in addition to those of the coordinator**[143]**. In the case of mono-beneficiary programmes (ERC and MSCA PF), the survey data show that median applicants take between 36 and 45 person-days to submit an application.** The effort required from mono-beneficiary applicants is comparable to that required from consortium coordinators. This could be because, while mono-beneficiary applicants do not have to manage multiple partner consortia, they still need to implement most of the steps required of coordinators in consortium projects. The distribution of responses is presented in Figure 6.

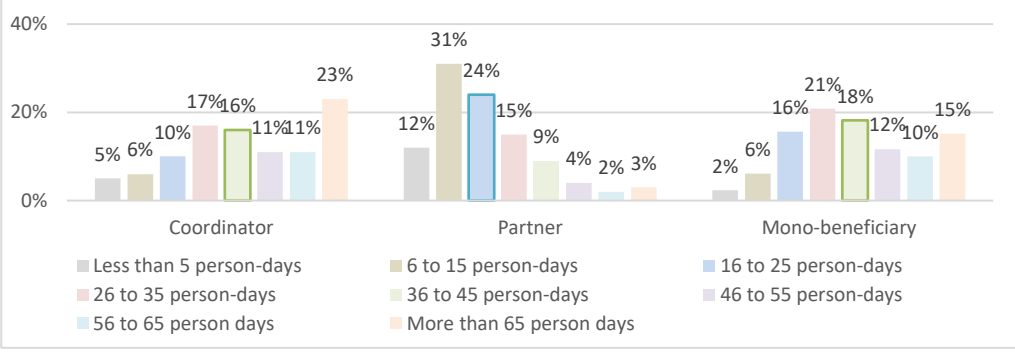

Figure 6. Number of person-days spent preparing Horizon Europe proposal by share of responses, as reported by successful and unsuccessful applicants (all consortium-based and mono-beneficiary programme parts in HE).

Source: survey of Horizon Europe beneficiaries, conducted May-July 2023, and survey of unsuccessful Horizon Europe applicants, conducted May-July 2023. Question: 'In your estimation, how many person-days did your organisation spend in preparing your Horizon Europe proposal?' Combined number of responses: 14 314. Median value highlighted.

The proposal preparation effort that is required from coordinators seems to increase with the size of the potential project: the requested budget level, the length of the project

[143] These estimated figures apply to all consortium-based programmes under Horizon Europe.

and the number of consortium partners[144] (for more details, please refer to Annex 1, section 1.3). Our analysis showed that **consortium size is very much related to the effort** required from the coordinators. **Larger consortia require more time from coordinators in the proposal preparation process**. Further analysis indicated that the **effort needed increases by about 10 person-days for every 15 additional partners**[145]. Proposals that included only one partner (i.e. only the coordinator) required somewhat less time (median response being between 26 and 35 days) than proposals from larger consortia (for example, consortia with 31+ partners require between 56 and 65 days as a median). The consortia for this analysis were grouped according to their size and their responses. Therefore, when looking at the median response in these groups, we see that the reported burden increases by increments, a continuous linear correlation was not observed. Nevertheless, while we observe an incremental 'growth' in the value of a median response as the consortium size increases by approximately 15 partners, it is also important to note that such a breakdown also captures the high percentage of > 65 person-day value in larger consortia.

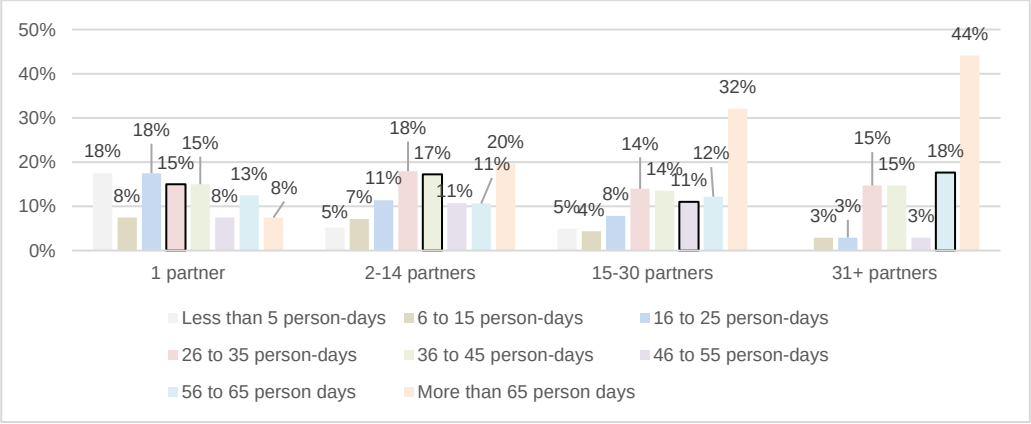

Figure 7. Number of person-days spent preparing Horizon Europe proposal by share of responses, as reported by the coordinators of successful and unsuccessful applications, by consortium size[146].

Source: survey of Horizon Europe beneficiaries, conducted May-July 2023, and survey of unsuccessful Horizon Europe applicants, conducted May-July 2023. Question: 'In your estimation, how many person-days did your organisation spend in preparing your Horizon Europe proposal?' Combined number of responses: 1 916. Median value highlighted.

Our analysis also shows that the coordinators of successful proposals spend longer on preparing their proposals than those of unsuccessful proposals. This is especially true in the case of successful proposals that foresee a project length of three years or longer. Such an observation is a potential hint that the effort coordinators put into preparing their proposal matters, and that the proposal evaluation process rewards the effort, even in a context of high competition.

[144] For more details refer to the Annex, section 1.3.2.1.
[145] The increase in effort due to additional partners shows discontinuities and steps up approximately every 15 partners.
[146] Number of responses reported for all consortium-based programme parts of Horizon Europe.

Table 8. Number of person-days spent preparing Horizon Europe proposals, as reported by the coordinators and applicants of successful and unsuccessful applications[147]

Person-days	Coordinator		Partner		Mono-beneficiary (ERC and MSCA PF)	
	Successful (% of total)	Unsuccessful (% of total)	Successful (% of total)	Unsuccessful (% of total)	Successful (% of total)	Unsuccessful (% of total)
< 5	24 (3%)	78 (6%)	358 (11%)	571 (13%)	23 (2%)	80 (2%)
6 to 15	34 (5%)	87 (7%)	991 (29%)	1 485 (33%)	50 (5%)	222 (7%)
16 to 25	50 (7%)	150 (12%)	Median response: 847 (25%)	Median response: 1 089 (24%)	147 (14%)	547 (16%)
26 to 35	117 (17%)	205 (17%)	572 (17%)	633 (14%)	231 (22%)	693 (20%)
36 to 45	115 (16%)	Median response: 195 (16%)	328 (10%)	386 (8%)	Median response: 204 (20%)	Median response: 602 (18%)
46 to 55	Median response: 90 (13%)	113 (9%)	138 (4%)	157 (3%)	109 (10%)	408 (12%)
56 to 65	76 (11%)	139 (11%)	71 (2%)	91 (2%)	109 (10%)	335 (10%)
> 65	197 (28%)	246 (20%)	100 (3%)	148 (3%)	166 (16%)	507 (15%)
Total responses	703 (100%)	1 213 (100%)	3 405 (100%)	4 560 (100)	1 039 (100%)	3 394 (100%)

Source: survey of Horizon Europe beneficiaries, conducted May-July 2023, and survey of unsuccessful Horizon Europe applicants, conducted May-July 2023. Question: 'In your estimation, how many person-days did your organisation spend in preparing your Horizon Europe proposal?' Combined number of responses: 14 314.

For a summary of the findings above, please refer to Table 9 below. Overall, the analysis shows that proposal coordinators undertake the lion's share of the preparation effort. The time needed to prepare a proposal increases with the size of the consortium. The effort needed from partners to prepare a proposal does not appear to vary according to the characteristics of the project / proposal. For ERC and MSCA PF, proposal preparation effort is comparable to that of the coordinators of consortium proposals.

[147] Number of responses reported for all consortium-based programme parts of Horizon Europe (coordinators and partners data).

Table 9. Summary of survey findings regarding the costs of application, presented as median responses reported by each group[148]

Group of proposals	Person-days (median response)
Consortium-based programme parts: MSCA (DN, SE, Cofund), INFRA, WIDERA, all Pillar 2, European Innovation Ecosystems, EIC (Pathfinder and Transitions)	
One beneficiary	16 to 25 person-days
Small consortium coordinators (2-14 partners)	36 to 45 person-days
Large consortium coordinators (15-30 partners)	46 to 55 person-days
Very large consortium coordinators (31+ partners)	56 to 65 person-days
Lump Sum proposal coordinators	16 to 25 person-days
Lump Sum proposal partners	6 to 15 person-days
Partners in small and large consortia (2-30 partners), incl. EIC	16 to 25 person-days
Partners in very large consortia (31+ partners)	6 to 15 person-days
EIC proposal coordinators	26 to 35 person-days
Mono-beneficiary programme parts	
MSCA PF and ERC	36 to 45 person-days
Lump Sum proposal	16 to 25 person-days

Source: compiled by the study team.

When asked to compare the effort required for applications under H2020[149] **with those under the current FP, the largest share of Horizon Europe applicants (47%) were relatively indifferent**: they neither agreed nor disagreed with the statement that proposal preparation and submission under Horizon Europe is simpler than under H2020. Pillar 1 and WIDERA applicants did not show any deviation from this trend, with the bulk of applicants in each programme part indicating neutrality. WIDERA applicants were slightly more positive, with 39% agreeing or strongly agreeing that the process was simpler, while MSCA PF

[148] Table contains median values for all groups.
[149] The survey asked the following question: 'Proposal preparation and submission in Horizon Europe is simpler than those in Horizon 2020: Based on your overall Framework Programme experience, would you agree or disagree with the following statements on the project's lifecycle processes in Horizon Europe, compared to Horizon 2020?'

applicants were the most critical, with 32% disagreeing or strongly disagreeing that proposal preparation and submission under Horizon Europe is simpler than under H2020[150].

Support available to applicants

The majority (71%) of applicants to Horizon Europe programmes receive some kind of support, often from more than one source. Around half (51%) reported receiving support from a dedicated department within their organisation; one fifth (19%) from the NCPs; and 17% from an external consultant. A minority of respondents (6%) reported providing this type of help to their consortia (i.e. they are consultancies themselves), while 29% reported receiving no help at all[151]. We looked at the overlap between those survey respondents who sought the help of NCPs and those who used or acted as consultants, in order to test the theory that consultants make more use of the help of NCPs than regular applicants. **Based on the survey data, we found that around half (53%) of applicants who used or were themselves consultants also used the help of NCPs, compared with just 19% of applicants overall.**

The success rates within the survey sample provide some clues as to why applicants might choose to hire external experts. Success rates among those survey respondents who used outside consultants were higher than those who did not, across all pillars and WIDERA: 32% with experts, and 22% without. Success rates were also higher among those applicants who used the help of NCPs compared with those who did not: 34% with NCP help, and 21% without. This suggests that applicants stand to benefit from help on their application from any source. Successful applicants reported paying more, on average and in the median, for consultancy services, probably due to the existence of 'success fees'. These can consist of a flat rate or a percentage of anything from 2% to 12% of the final grant, according to survey respondents. Nevertheless, after combining survey responses with information from CORDA, we found that **an overwhelming majority (74-80%) of high-quality proposals were written without the involvement of external experts.**

Using the survey data as the basis for our extrapolation, we used confidence intervals to estimate that between 21% and 25% of applicants to Horizon Europe programmes may be using external consultants[152]. We estimate the median fee paid to be EUR 7 500 for consortia, EUR 2 000 for single-beneficiaries, and EUR 12 000 for the EIC Accelerator. This means that, in total, **applicants may have spent between EUR 39 million and EUR 55 million on consultancy fees across Horizon Europe, or around 0.2% of the total budget committed so far**.

Horizon Europe introduced a number of simplification measures to the proposal process to ease the burden on participants. One of them is lump sum-based project funding which is designed to alleviate the burden in the financial reporting process after the project has already started. Due to the timing of the survey, there was only a very limited number (233 in total) of successful (75 responses) and unsuccessful applicants (158 responses) to lump sum grants among the survey respondents. Survey responses are, therefore, not informative about their experience with lump sums under Horizon Europe. It may be noteworthy that 41 out of 80 respondents who received lump sum funding indicated their belief that lump sum increases

[150] For a detailed breakdown of this survey question and answers please refer to Annex 1, section 1.7.3.
[151] The total amounts to over 100%, as respondents were invited to choose more than one option.
[152] A detailed breakdown of the methodology used can be found in Table 53 in Section 5.2 of Annex 1.

the financial risks for project participants. Nevertheless, the sample size was too limited to carry out any further meaningful analysis on these responses, or make generalisations about the lump sum funding.

Project selection

Project selection has not yet reached the peak efficiency levels of H2020, in particular when it comes to time-to-grant (TTG) and the share of eligible proposals. Average TTG under Horizon Europe is currently longer than under H2020 at the 'close' and 'interim' phases of that FP. Having said that, **with the exception of Pillar 1, all pillars of Horizon Europe achieved TTGs below the target of 244 days** (Table 10). When we compare Horizon Europe with H2020 during the interim phase (years 2014-2015), we see that Pillar 1's TTG is only 6 days longer, and in fact ERC and INFRA have achieved TTGs which are one month shorter compared with the H2020 interim. WIDERA has been the most stable, with the current, H2020 interim, and H2020 close average TTG within 4 days of each other.

Table 10. Comparison of TTG between Horizon Europe and Horizon 2020

Programme part	Horizon Europe TTG (244 days)	H2020 TTG	H2020 interim TTG[153]	Δ from H2020 interim
Overall	**275.5**	**231.0**	**249.4**	**+26.1**
Pillar 1	292.3	266.7	286.0	+6.3
Pillar 2[154]	237.5	194.1	188.4	+49.1
Pillar 3	240.0	157.1	186.5	+53.5
WIDERA	220.7	223.5[155]	220.6	+0.1
ERC	356.7	359.0	386.9	-30.2
MSCA	244.4	208.5	205.7	+38.7
INFRA	226.3	265.5	262.3	-36.0

Source: compiled by the evaluation team using CORDA data, June 2023 release and excellent science Phase 1 report.

A longer project selection process is to be expected early on in the new FP, as staff adjust to newly introduced procedures under Horizon Europe. The 2022 Annual Activity Report of the Research Executive Agency notes that changes to Grant Agreement Preparation – in particular, the introduction of the two-step procedure and the Gender Equality Plan – had been more time consuming than anticipated and led to a longer time-to-grant[156]. When it comes to project payments, this evaluation finds that pre-financing is functioning very well.

[153] Interim figure that only includes projects with call closure years 2014 and 2015.
[154] Data exclude EIT and EIC Accelerator.
[155] SEWP was used as a comparison.
[156] European Commission, Research Executive Agency, Annual Activity Report 2022.

Over 99% of Pillar 1 makes use of pre-financing, and all pre-financing payments have been made within the 30-day target.

Administrative costs of project implementation

Once the proposal is successful and funding has been secured, participants in Horizon Europe must manage the administrative costs of project implementation. These include reporting, monitoring and financial management. To measure the efficiency of this part of the process, the survey of beneficiaries asked respondents to estimate what share of their budget was allocated to administrative costs. Respondents could choose between seven grouped options (less than 1%, between 1% and 3%, etc.). In a similar manner to that used for proposal costs, we took the value reported by the median number of respondents in a category to be most representative for that category[157]. **By so doing, we found that a partner in a median consortium-run project (of any size or duration) allocates between 6% and 10% of the project budget to implementing administrative tasks**. A similar percentage was also found for median mono-beneficiary projects. Median project coordinators report spending slightly more – between 11% and 15% of the project budget – on administrative tasks. Both the median and mode survey responses suggest the same finding. In addition, no variation was observed in relation to different sizes of project teams, different lengths of projects, or different programme parts.

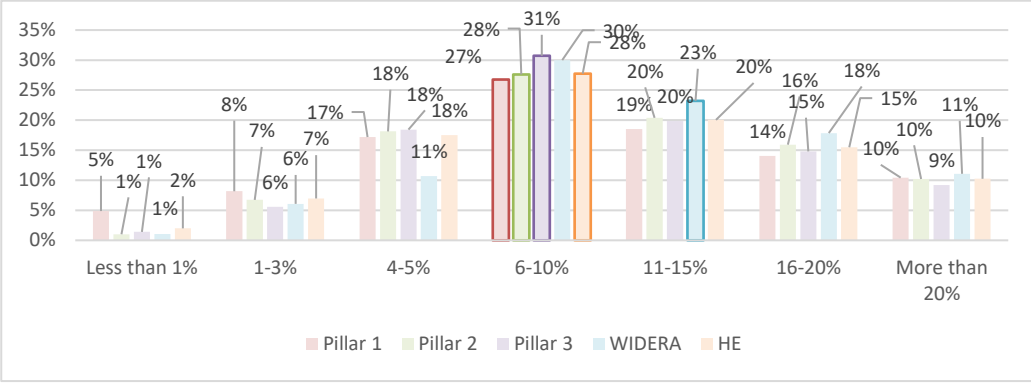

Figure 8. Distribution of responses to the survey question asking what percentage of the budget was spent on administrative tasks – all pillars.

Source: survey of Horizon Europe beneficiaries, conducted May-July 2023. Question: 'In your estimation, what is the percentage share of your Horizon Europe project budget that is spent on administrative tasks (e.g. project reporting, project financial management, and similar)'. Number of responses: 5 183. Median value highlighted.

4.1.3. Findings in relation to the criterion of coherence

Internal coherence

Study evidence indicates that overall, Horizon Europe provides a mix of complementary actions that contribute to higher-level objectives by supporting different types of research and collaborative activities, target groups, geographical areas and/or fields of intervention. Table

[157] A detailed breakdown of the methodology used can be found in Annex 1, Section 5.5.

12 summarises the main differences and similarities between the Pillar 1 programme parts and WIDERA.

Table 11. Differences and similarities between ERC, MSCA, INFRA and WIDERA

	ERC	MSCA	INFRA	WIDERA
Year of establishment	2007	1996	2002	2021
Budget	EUR 16 billion	EUR 6.6 billion	EUR 2.4 billion	EUR 3 billion
TRLs covered	TRL 1-5	TRL 1-9	TRL 1-7	1 to 9
Approach	Bottom-up	Bottom-up	Bottom-up	Bottom-up
Funding mechanism	Work Programmes / calls for proposals	Work Programmes / calls for proposals	Work Programmes / calls for proposals	Work Programmes / calls for proposals
Provision of grants	Yes	Yes	Yes	Yes
Provision of direct investment	No	No	No	No
Geographical coverage	All world countries	All world countries	EU and Associated countries	EU and Associated countries
Regional dimension	No	No	Yes	Yes
Selected Target Group				
Stat-ups	No	Yes	No	No
SMEs	No	Yes	No	No
Research	Yes	Yes	Yes	Yes
Higher education	Yes	Yes	Yes	Yes
National regional authorities	No	Yes	No	Yes

Source: compiled by the study team.

In general, the range of interventions supported by Horizon Europe have provided **a coherent mix of actions to address some of the key strategic objectives of the European Commission and Europe's needs**. Quantitative research track findings confirm that there has been an increase in the importance of the Sustainable Development Goals (SDGs) under

Horizon Europe compared with H2020[158]. In this study, SDGs have been assigned to Horizon Europe project proposals using the OSDG tool[159]. Case study[160] findings show that different pillars of Horizon Europe complement each other by focusing on different SDGs. The most pronounced SDG in Pillar 1: excellent science and Pillar 3: Innovative Europe was SDG 3 – Good Health and Well-being. In contrast, in Pillar 2: Global Challenges and European Industrial Competitiveness, the most prominent SDG was SDG 7 – Affordable and Clean Energy. Furthermore, in terms of the number of projects addressing a particular SDG, the most prominent SDG in WIDERA was SDG 16 – Peace, Justice and Strong Institutions.

Evidence shows that the **MSCA and ERC continue to produce significant complementarities by contributing to the overarching objective of advancing researchers' careers and producing excellent science**, while supporting complementary types of activities and target groups. Both programmes are bottom-up and researcher-driven and share a similar emphasis on the stimulation of excellence and the production of high-quality research.

Multiple areas of **coherence were also identified between the MSCA and the WIDERA programme**:

- Both MSCA SE and the ERA Talents scheme stimulate innovative collaboration in R&I by facilitating the exchange of personnel and knowledge, and place particular emphasis on intersectoral collaboration. ERA Talents, unlike MSCA SE, also allow intra-country staff exchanges[161]. Similarly, synergies exist between MSCA PF and ERA Fellowships, as unsuccessful proposals under MSCA PF that include a Widening host institution are automatically resubmitted to the ERA Fellowships call, thereby supporting the mobility of researchers towards Widening countries.

- Actions supported under the 'Strengthening the ERA' thematic priority and under the MSCA contribute to the same overarching objective of strengthening Europe's human capital base and improving the working conditions of researchers: while the MSCA contribute to this goal by supporting the mobility and training of individual researchers (but not only), ERA actions contribute by providing expert policy, knowledge support and incentivise institutional transformation across different fields, such as RRIs, professionalisation of research management profession, gender equality in research, etc.

Different FP programme parts also complement each other by **supporting the same topic areas / fields of research while employing different instruments and supporting different types of activities**. Case study evidence[162] shows that the largest shares of projects in Pillar 1, Cluster 3, Cluster 4 and Cluster 6 of the Pillar 2, the EIC and the 'Widening'

[158] See Annex 6 to this study, 'Quantitative research track findings'.
[159] For a detailed explanation of this tool, please refer to: https://arxiv.org/ftp/arxiv/papers/2211/2211.11252.pdf.
[160] Case Study 9: The impact of the Framework Programmes on creating high-quality new knowledge.
[161] It must be noted that although ERA talents places an explicit emphasis on widening countries, the MSCA SE also provide substantial support for organisations from widening countries: e.g. around 170 organisations from widening countries benefit from the MSCA SE every year, compared with fewer than 50 under ERA Talents. Moreover, both actions have a clearly pronounced intersectoral dimension.
[162] Case Study 9: The impact of the Framework Programmes on creating high-quality new knowledge.

part of WIDERA were in the fields of Natural Sciences and Engineering and Technology. Similarly, topical analysis[163] assessing the scientific publications resulting from projects finds that there is a high incidence of overlap in topics between the ERC and MSCA.

The available evidence also points to complementarities and **potential synergies between programme parts under Pillar 1 and other pillars of Horizon Europe, in particular Pillar 3**. The links between activities supported under the EIT and the MSCA is one example. The Commission published a guide on 'Synergies and complementarities between the MSCA and the EIT' to better inform stakeholders from either programme about the opportunities available in the other programme, and potential bridges that can be developed between existing initiatives and projects[164].

In addition, the links between EIC and ERC projects are a good example of complementarity stemming from such continuity between projects: in 2021 calls, 25 out of 42 recipients of the new EIC 'Transition' funding originated from research funded by ERC[165]. In 2022, 24 out of 51 recipients under EIC 'Transition' calls originated from the ERC Proof of Concept grants.

External coherence

In general, Horizon Europe complements other European funding programmes that support research and innovation projects. As the EU's main R&I programme, Horizon Europe supports excellent research and collaborative cross-border research activities. In contrast, the Recovery and Resilience Facility (RRF) focuses on improving the research capacities of Member States. RRF provides large-scale financial support for public investments and reforms addressing the country-specific challenges identified in the European Semester, and promoting the green and digital transitions.

Annex IV of Regulation (EU) 2021/695 establishing Horizon Europe outlines for the first time the expected and desirable synergies between Horizon Europe and 21 other EU programmes/funds[166]. The present study finds varying degrees of synergies between Pillar 1 and WIDERA and 13 of these EU programmes/funds (Erasmus+, DEP, LIFE Programme, Creative Europe, COSME (2014-2020), SMP, ISF, EMFAF, ESF+, CEF, INNOVFUND, ERDF and RRF). These synergies span all types identified in Article 15 of Horizon Europe Regulation (EU) 2021/695, encompassing alternative, combined, and cumulative funding, along with transfers of resources. However, in eight cases, no synergistic evidence was

[163] This research included a refinement of the topical analysis of the Horizon 2020 Programmes and Social Challenges (SCs) to calculate the overlap, in terms of the number of overlapping programmes and SCs, for each of the top 200 topics. The study team tried to pinpoint those topics in which EC-sponsored outputs have been distributed across several programmes and SCs.

[164] European Commission, Directorate-General for Education, Youth, Sport and Culture, Synergies between the Marie Skłodowska-Curie actions and the European Institute of Innovation and Technology, Luxembourg: Publications Office of the European Union, 2022, available at: https://data.europa.eu/doi/10.2766/42217

[165] https://erc.europa.eu/news/erc-funded-research-wins-most-new-eu-innovation-grants.

[166] The EU programmes/funds foreseen in Annex IV of Regulation (EU) 2021/695 establishing Horizon Europe are: CAP, EMFAF, ERDR, ESF+, EU4Health, CEF, DEP, SMP, LIFE, Erasmus+, Union Space Programme, NDICI and IPA III, ISF, Integrated Border Management Fund, InvestEU, Innovation Fund, Just Transition Mechanism, Euratom, European Defence Fund, Creative Europe Programme and RRF.

observed[167]. This assessment was conducted using both quantitative data, which will be detailed in the following paragraph, and qualitative evidence. The qualitative evidence comprises interviews, case studies, and a comprehensive mapping of synergies carried out by the European Commission in 2023.

For the first time, the evaluation had at its disposal details of beneficiaries that are funded by HE and at least one other EU programme/fund – limited to those that are managed in e-grants[168] (Table 12). The data showed that, in total, 724 ERC participants secured 2 415 grants (totalling EUR 861 million); 4 292 MSCA participants secured 4 752 grants (totalling EUR 1 536 million); 890 INFRA participants secured 2 677 grants (totalling EUR 942 million); and 1 230 WIDERA participants secured 3 608 grants (totalling EUR 1 153 million) from other EU programmes / funds.

Table 12. Grants signed and EU contributions received by ERC, MSCA, INFRA and WIDERA beneficiaries from other European programmes (limited to those managed in e-grants)

Programme	Count of signed grants				EU contribution (million EUR)			
	ERC	MSCA	INFRA	WIDERA	ERC	MSCA	INFRA	WIDERA
Erasmus+[169]	1 381	2 621	1 343	1 936	472.7	678.3	416.5	523.6
Digital Europe Programme (DEP)	612	1 095	774	845	280.7	454.5	361.6	375.3
LIFE Programme (LIFE)	210	453	283	352	66.9	172.6	87.0	105.9
Creative Europe	71	154	59	110	10.9	21.4	8.1	17.7
COSME (2014-2020)	45	134	67	129	7.2	22.7	11.1	22.7
Single Market Programme (SMP)	29	126	70	121	7.9	32.8	18.2	36.9

[167] CAP, EU4Health, Union Space Programme, NDICI and IPA III, Integrated Border Management Fund, Just Transition Mechanism, Euratom and European Defence Fund.
[168] The analysis of synergies relied on data provided by the EC as of the June 2023 cut-off. These data covered 724 unique ERC participants; 4 292 unique MSCA participants; 890 unique participants; and 1,230 unique WIDERA participants. To link these beneficiaries with participants in other programmes and funds, the study team used the researchers' unique PIC numbers. The grants and EU contributions received by these beneficiaries from other programmes and funds were then examined.
[169] Limited to the 20% of its budget that is managed in e-grants.

Programme	Count of signed grants				EU contribution (million EUR)			
	ERC	MSCA	INFRA	WIDERA	ERC	MSCA	INFRA	WIDERA
Internal Security Fund (ISF)[170]	34	56	25	45	9.9	13.1	7.2	10.8
European Maritime, Fisheries and Aquaculture Fund (EMFAF)	15	35	25	33	3.0	6.3	4.9	4.8
European Social Fund+ (ESF+)[171]	11	31	15	18	0.8	3.5	1.0	1.3
Connecting Europe Facility (CEF)	6	39	13	16	0.8	84.0	25.4	52.8
Innovation Fund (INNOVFUND)	1	8	3	3	0.5	46.9	1.1	1.1
Total	**2 415**	**4 752**	**2 677**	**3 608**	**861.3**	**1 536.0**	**942.0**	**1 152.8**

Source: compiled by the study team using eCorda data; September 2023 Corda data release.

For Pillar 1 and WIDERA, **the strongest evidence of synergies was found with Erasmus+**. Notably, synergies with ERASMUS+ were harnessed and grants were secured by participants from the ERC (1 381 grants; EUR 473 million), the MSCA (2 621 grants; EUR 678 million), INFRA (1 343 grants; EUR 416 million) and WIDERA (1 936 grants; EUR 524 million). This collaboration is further exemplified through the Erasmus+ Mobility Projects, facilitating the incorporation of participants into MSCA research teams via traineeships and staff exchanges, and the participation of MSCA researchers in Erasmus+-funded blended intensive programmes[172].

The Erasmus+ European Universities Initiative and Horizon Europe have also demonstrated significant synergies, particularly through the MSCA, facilitating collaborative projects, doctoral, and postdoctoral programmes among university networks[173]. This collaboration, evident in both Horizon 2020 and Horizon Europe, has been furthered by the involvement of European University Alliances in MSCA COFUND actions, linking projects to these alliances and fostering partnerships between European Universities and WIDERA projects, notably

[170] Limited to the 15% of its budget that is managed in e-grants.
[171] Limited to the 10-15% of its budget that is managed in e-grants.
[172] Synergies between the Marie Skłodowska-Curie Actions and Erasmus+ in the area of higher education, Luxembourg: Publications Office of the European Union, 2021, available at: https://marie-sklodowska-curie-actions.ec.europa.eu/document/synergies-between-the-marie-sklodowska-curie-actions-and-erasmus-in-the-area-of-higher-education
[173] Ibid.

enhancing the professionalisation of research management[174]. Moreover, Horizon Europe calls on the European Excellence Initiative foresee competitive calls for cooperation on the R&I dimension, related to the ERA Policy Agenda. These calls are open to all types of alliances, including but not limited to the European Universities alliances. In addition, European University alliances are eligible to compete for other opportunities under Horizon Europe to fund transformative aspects (under the WIDERA (ERA) component) and collaborative research and innovation activities.

After Erasmus+, the Digital Europe Programme and the LIFE Programme emerge as the programmes with the second- and third-most synergies with Pillar 1 and WIDERA. These three initiatives constitute 91% (2 203 out of 2 415) of grants secured by ERC participants, 88% (4 169 out of 4 752) of grants secured by MSCA participants, 90% (2 400 out of 2 677) of grants secured by INFRA participants, and 87% (3 133 out of 3 608) of grants secured by WIDERA participants. Notably, the synergies outlined in Annex IV of the Regulation establishing Horizon Europe primarily originate from these three EU programmes/funds, indicating a certain level of concentration.

In addition, the share of synergistic participants varies between programme parts of Horizon Europe[175]. The ERC (56.1% of beneficiaries received grants from other EU programmes/funds), WIDERA (55.7%) and INFRA (51.1%) had more unique participants with synergies with the EU programmes/funds foreseen in Annex IV of the Regulation establishing Horizon Europe than the MSCA (27.8%). Compared with the contributions received under Horizon Europe, ERC beneficiaries were able to mobilise an additional 17.7% EU contribution from other programmes / funds[176], followed by MSCA (96.2%), WIDERA (136.0%) and INFRA (179.9%).

In addition, synergies exist between Horizon Europe and the Cohesion Policy funds, whereby both sources of funding are used to support FP project activities through co-funding instruments, such as the MSCA COFUND action, Teaming and Excellence Hubs. An internal mapping exercise carried out by the European Commission in 2023 confirms that one of the key factors for success in achieving synergies is the fact that the work programme of the MSCA under Horizon Europe strongly encourages synergies with the Cohesion Policy funds and RRF, notably under the MSCA COFUND and the SoE. In March 2023, a new instrument, Pathways to Synergies, has been set up to stimulate synergies between Horizon Europe and Cohesion Policy funds, mainly the European Regional Development Fund (ERDF), including INTERREG and RRF. **Synergies between Cohesion Policy funds and Horizon Europe funding are also evidenced by the results of the beneficiary survey**: e.g. 3% of Widening project beneficiaries (five out of 192) and 2% of INFRA beneficiaries (four out of 177) confirmed that their project is a continuation of a research project funded under other European funding programmes (e.g. ERDF, EESF, CF, Common Agricultural Policy, EMFAF, etc.). Synergies in the form of transfers between Horizon Europe and Cohesion Funds have also been observed. Lithuania has requested a transfer of EUR 6 million from EDRF to ERC, MSCA PF and WIDERA (ERA) for the years 2024 and 2025. Similarly, Malta has requested a transfer of EUR 5 million to Horizon Europe for the period 2023-2027, mainly for mono-beneficiary projects under excellent science, Innovative Europe and WIDERA.

[174] For more details, see Annex 2, Case Study 8. WIDERA actions on enhancing the European RI system.
[175] Source: compiled by the study team using eCorda data; September 2023 Corda data release.
[176] On average, for every EUR 1 million financed under Horizon Europe, ERC participants could mobilise an additional EUR 177 000 in funding from other EU programmes/funds.

Evidence shows that FP beneficiaries also **use national/regional funding or other non-FP funds to cover parts of their research agenda / idea that could not be covered in their FP project**. Interviews with ERC PIs confirmed that in some cases ERC beneficiaries applied for such funding to complement newly emerging research paths related to, or stemming from, their ERC grant research. National funding then allows the PIs to expand or explore these ideas in a parallel trajectory.

Survey evidence confirms that while only a minority of Horizon Europe beneficiaries applied for national/regional or other additional sources of funding[177] for the research idea/activities addressed in their project, the shares of such beneficiaries varied significantly between different programme parts. The share of beneficiaries who applied for national/regional, private, international or other sources of funding to support the research idea/activities addressed in their Horizon Europe project was around 25% (62 out of 251) among the ERC PIs surveyed, and 20% (172 out of 862) among the MSCA PF fellows. The share was somewhat higher among beneficiary the MSCA organisations (39%; 194 out of 499), and highest among INFRA beneficiary organisations (44%; 75 out of a total of 170 respondents). It is notable that the majority of beneficiaries that applied for additional funding to support the research idea/activities addressed in their Horizon Europe project applied to national/regional R&D public funding schemes (e.g. 19% of ERC beneficiaries; 22% of the MSCA beneficiary organisations; 25% of RI beneficiary organisations). In contrast, fewer beneficiaries applied to other European funding schemes (1-6%) or private R&D funding (1-7%).

Analysis of administrative data using the semantic textual similarity method also confirms that there were **relatively few cases in which Horizon Europe and other EU funding schemes complemented**[178] **each other by supporting thematically related research projects**. This analysis was based on the semantic textual similarity of project abstracts. It showed, for instance, that there were 13 cases in which Horizon Europe MSCA and other EU funding schemes supported thematically related projects. This analysis is limited to funds and programmes that are managed in e-grants: CREA2027, DIGITAL, EMFAF, INNOFUND, LIFE2027 and SMP, and small shares of ERASMUS2027, ESF+ and ISF (less than 20% of the budget is managed in e-grants and thus available for analysis). In total, this amounted to EUR 75.2 million in funding from Horizon Europe and other EU funds. Similarly, there were 15 cases in which WIDERA and other EU funding schemes supported thematically related projects, amounting to around EUR 20.1 million.

Synergies between Horizon Europe and national/regional funding schemes are also evidenced by the evaluation of survey data relating to **continuity between projects funded at national/regional level and Horizon Europe projects**: 13% of ERC PIs (32 out of 252) and the MSCA PF fellows (110 out of 862), as well as 10% of the MSCA beneficiary

[177] The survey question asked Horizon Europe beneficiaries to indicate if they had applied for any additional funding for the research idea/activities addressed in their Horizon Europe project by also indicating the source of this additional funding. The application for this funding could have taken place before or after obtaining Horizon Europe funding.

[178] Complementary funding analysis was performed by comparing the administrative data of Horizon Europe projects (participant PIC numbers and project abstracts) with administrative data from other EU funding programmes (particularly CREA2027, DIGITAL, EMFAF, ERASMUS2027, ESF, INNOFUND, ISF, LIFE2027, SMP). Where the PIC numbers of Horizon Europe applicants match with those of applicants to other EU funding programmes, the project abstracts were compared to find similarities in the projects (using the semantic textual similarity method). Where a signed/ongoing Horizon Europe project was found to match a signed/ongoing project in one of the other EU funding programmes, these projects were flagged as receiving complementary funding from other EU sources.

organisations (50 out of 512) confirmed that their Horizon project is a continuation of a research project funded under national/regional R&D public funding programmes (in terms of being based on work carried out in a past research project). The corresponding shares were somewhat lower among INFRA and WIDERA projects.

Analysis of administrative data using the semantic textual similarity method also assessed the number of unsuccessful Horizon Europe applications that received **alternative funding** from other EU funding programmes such as CREA2027, DIGITAL, EMFAF and ERASMUS2027[179]. The results show that, for example, 24 unsuccessful applications to Horizon Europe MSCA received alternative funding from other EU funding programmes (amounting to around EUR 43.5 million), followed by 22 WIDERA applications (amounting to around EUR 10.9 million received from other EU funding sources). Furthermore, 11 unsuccessful Horizon Europe ERC applications received alternative funding from other EU funding programmes, amounting to around EUR 22.6 million.

It is notable that in some instances the amount of alternative funding received from other EU funding programmes by unsuccessful Horizon Europe applicants was actually higher than the amount requested in their original Horizon Europe application. For example, the amount of EU funds received in alternative funding by unsuccessful Horizon Europe MSCA applicants (EUR 43.5 million) was around 75% higher than the total amount of Horizon Europe grants originally requested in their unsuccessful Horizon Europe applications. Similarly, the total amount of funding received by unsuccessful ERC applicants was around 26% higher than the amount originally requested in their Horizon Europe applications. Nevertheless, the proportion of unsuccessful applicants receiving alternative funding is less than 1%, for both the ERC and MSCA.

The SoE remains an example of the synergies between Horizon Europe and national/regional funding schemes. The SoE is awarded to project proposals submitted under a Horizon Europe call for proposals that have been ranked above a predefined quality threshold but were not funded due to budgetary constraints. In this way, Horizon Europe identifies the highest quality research proposals that can be funded, and encourages other funding schemes to support these projects, thereby creating synergies stemming from the Horizon Europe evaluation process. Specific measures have been implemented to ensure synergies between Horizon Europe proposals labelled with the SoE and Cohesion Policy funds: for instance, Managing Authorities for the Cohesion Policy in the Member States can follow a simplified selection procedure when deciding whether to fund proposals with a SoE under ERDF programmes, as long as these operations meet specific criteria[180,181,]. Under Horizon Europe, the MSCA SoE – which was previously only awarded to MSCA IF proposals – was extended in 2021 to also cover MSCA COFUND proposals. So far, the European

[179] Analysis of alternative funding took the unsuccessful Horizon Europe proposals and compared these with projects funded under other EU funding programmes (particularly CREA2027, DIGITAL, EMFAF, ERASMUS2027, ESF, INNOFUND, ISF, LIFE2027, SMP) in terms of the PIC numbers of applicants and the project abstracts. The semantic textual similarity method was used to flag unsuccessful Horizon Europe proposals that secured funding from other EU funding programmes and thus went ahead with their research projects.
[180] Notice on synergies between ERDF programmes and Horizon Europe, available on: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2022:421:FULL.
[181] In addition, the amendment to the General Block Exemption Regulation provides for exemptions from the notification requirement and from the requirement to carry out a quality assessment at national level of a project that has already been assessed under the rules established under the Horizon 2020 and Horizon Europe programmes for Marie Skłodowska-Curie actions and ERC Proof of Concept actions that have been awarded a SoE.

Commission has awarded MSCA SoE certificates to a significant number of applicants for MSCA Postdoctoral Fellowships (1 956 in 2021, 1 607 in 2022 and 1 737 in 2023). Additionally, 21 Seals of Excellence were awarded to applicants who presented outstanding proposals but fell short of receiving funding from the COFUND action in 2021 and 34 in 2022.

The number of institutional, regional and national-level schemes supporting projects that have been awarded a SoE has been increasing. A total of 32 funding schemes are currently in place across 17 EU Member States catering for the MSCA SoE holders who applied for the MSCA PF and COFUND, including national, regional or institutional funding schemes in Austria, Belgium (Flanders), Bulgaria, Czechia, Cyprus, Estonia, France, Germany, Italy, Lithuania, Poland, Romania, Slovakia, Slovenia, Spain and Sweden. Out of the 32 existing support schemes, 14 have been established on a national scale, with five operating at regional level, and the remaining schemes being funded institutionally[182]. Five countries[183] are (or have been) making use of Cohesion Policy funds under ERDF and ESF+, as compared with only three countries[184] under H2020. For example, France's Hauts-de-France region allocates EUR 9.7 million from ERDF to excellent R&I projects, including those awarded the MSCA SoE – with eligible beneficiaries being HEIs, research organisations and technical centres, as well as businesses[185]. New schemes to support SoE-labelled projects have also been launched and funded under National Recovery and Resilience Plans. In Italy, the Ministry of Research launched an initiative to support approximately 400 researchers under its National Recovery and Resilience Plan. In Slovenia, a new initiative funded by RRF provides financial support to Slovenian researchers who have been awarded the MSCA SoE when they applied with a host organisation abroad under MSCA IF or MSCA PF calls since 2019[186]. It is notable that national/regional support for SoE projects is growing steadily, and varying practices exist among national/regional funders with regard to different Horizon Europe programme parts. The flexibility for national, regional or institutional-level funders to design and choose their support schemes enables them to focus on preferred areas of the Horizon Europe programme, thereby tailoring their approach to their own specific priorities (for instance, Smart Specialisation Strategies). Interviews show that while a scheme may be established to fund MSCA SoE, it does not systematically fund Teaming SoE since, according to the view of national funders, the excellence criteria under this programme part do not live up to the same standards as those of the MSCA.

To compare with the baseline, by the end of Horizon 2020 a total of 14 countries had introduced support programmes for MSCA applicants who have received a SoE, including eight widening countries (Bulgaria, Cyprus, Czechia, Lithuania, Poland Slovakia, Romania, and Slovenia). These 14 countries had, in total, 22 different support schemes (either at national, regional or institutional level, with one scheme being privately funded).[187] This

[182] Funding opportunities under MSCA, Research and Innovation, 2023, available at: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/seal-excellence/funding-opportunities-under-msca_en
[183] Cyprus, Czechia, Estonia, France and Lithuania (as of April 2024).
[184] Cyprus, Czechia and Lithuania.
[185] Ibid.
[186] ARIS - Načrt za okrevanje in odpornost – Javni poziv za (so)financiranje projektov in programov za krepitev mednarodne mobilnosti slovenskih raziskovalcev in raziskovalnih organizacij ter za spodbujanje mednarodne vpetosti slovenskih prijaviteljev, 2023. http://www.arrs.si/sl/NOO/razpisi/23/poziv-mobilnost-23.asp
[187] Evaluation study on excellent science in the European Framework Programmes for Research and Innovation. Phase 1 Final Study Report. February 2023.

means that at this point in Horizon Europe there already are 10 SoE schemes more than by the end of Horizon 2020, and that three more countries launched SoE schemes.

Potential measures to improve the complementarities/synergies between the Excellence Science pillar and other EU/national/regional/ international initiatives

Some interviewees noted that greater clarity could be brought to potential programme beneficiaries and the wider public concerning the complementarities and differences between various EU funding instruments that support ecosystems, networks and alliances. One example is that the differences and complementarities could be better emphasised between the support for capacity building to strengthen networks of HEIs and cooperation with surrounding ecosystems provided by European Excellence Initiative and other EU instruments for capacity building among universities (such as Erasmus+ Key Action 2: Cooperation among organisations and institutions). Similarly, a number of stakeholders noted that the potential for complementarities could be increased by emphasising more clearly the different opportunities provided by Excellence Hubs, ERA Hubs, Digital Innovation Hubs and Regional Innovation Valleys. These instruments are sometimes confused by potential beneficiaries. To ensure greater clarity, a joint communication identifying the distinct values brought by different instruments could help to address this issue.

In addition, despite progress being made since H2020 to ensure that FP grants secure the timely arrival of complementary funding from EU Cohesion Policy funds and other sources[188,189], some stakeholders still identify the process of securing complementary funding for Horizon Europe projects from Cohesion Policy funds as being potentially very complicated[190]. Some interviewees confirmed there is still a mismatch between Cohesion Policy funds (where the types of initiatives funded are decided by Managing Authorities at national and/or regional level) and FP funding, in terms of timing: the Cohesion Policy funds have to be allocated early on, often before a particular Horizon Europe call comes out, and it is subsequently difficult to renegotiate these allocations.

4.2. How has the EU intervention made a difference, and for whom?

4.2.1. Findings in relation to the criterion of EU added value

European added value refers to value that is additional to what would have been created through the actions of individual Member States. It may result from different factors – for example, coordination gains, legal certainty, greater effectiveness or complementarities. Evidence focusing on previous FPs shows that the FPs support high-quality research that could not be supported at national/regional level alone, due to its scale, scope and level of

[188] European Commission, Directorate-General for Research and Innovation, Budraitis, M., Pranckevičius, P., Dėlkutė, R. et al., Evaluation study of the European Framework Programmes for research and innovation for excellent science: Horizon 2020: Annexes, Luxembourg: Publications Office of the European Union, 2023, available at: https://data.europa.eu/doi/10.2777/353383

[189] e.g. in Horizon Europe, second-stage proposals should include a binding commitment for the necessary complementary funding.

[190] e.g. Initiative for Science in Europe (ISE). (2023). ISE Response to the European Commission Public Consultation on the past, present and future of the European Research & Innovation Framework Programmes 2014-2027.

complexity[191]. Assessment of the first two years of H2020 finds that 83% of projects rated as 'excellent' would not have gone ahead without EU support[192]. Similarly, the Evaluation study on excellent science in the European Framework Programmes for Research and Innovation focusing on H2020 found that a large share of unsuccessful applicants did not implement their projects or the activities proposed in their application after being rejected for H2020 funding.

Likewise, the available evidence also shows that (at the time of the survey) the **majority of respondents to the survey of unsuccessful Horizon Europe applicants did not implement the project activities proposed in their Horizon Europe application after being rejected for FP funding**. Most respondents to the survey of unsuccessful applicants across all programme parts (except for the ERC) **did not apply for alternative sources of funding** (e.g. national/regional funds, grants from international organisations, etc.) to implement the activities proposed in their Horizon Europe application. The share of unsuccessful applicant respondents who did not apply for alternative funding ranged from around 80% (257 out of 323) of unsuccessful applicants to Widening, to around 60% (1 073 out of 1 779) of unsuccessful MSCA PF applicants. In contrast, more than half of unsuccessful ERC applicant respondents (around 54%, or 676 out of 1258) applied for alternative funding after being rejected for FP support. Low rates of applications for alternative funding may be explained by the fact that these actions fund cross-border collaborative research, and **few alternative funding opportunities exist for these types of actions, thus indicating the EU added value of Horizon Europe support**.

In addition, only **a small fraction of respondents secured alternative funding** for the project activities planned in their Horizon Europe application. The shares of these respondents who applied for and secured alternative funding to implement the activities proposed in their Horizon Europe application range from 26% of unsuccessful ERC applicants (332 out of 1 258) and 18% of unsuccessful MSCA PF applicants (312 out of 1 779), to around 5% of Widening applicants (17 out of 323) and 7% of INFRA applicants (5 out of 76).

Applicants who were unsuccessful in their Horizon Europe applications usually adapted their project applications when applying for alternative sources of funding. The majority of respondents confirmed that, **compared with their original Horizon Europe project application, the research applications for alternative funding involved significant or at least some changes** (e.g. in terms of the project scope, research conditions, the number of partners involved or the project duration). These kinds of adaptations were reported by around 84% of unsuccessful ERC applicants surveyed (565 out of 675), 83% of MSCA institutional applicant respondents (95 out of 115), and 63% of unsuccessful MSCA PF applicants surveyed (420 out of 667) who applied for alternative funding. Similarly, a detailed assessment of the survey responses from unsuccessful applicants who implemented their projects using alternative sources of funding confirms that **Horizon Europe is instrumental in funding research of a scale, complexity and scope that cannot be supported by alternative sources of funding at national/regional level**.

[191] The EU Research and Innovation Funding Landscape 2021-2027, available at: https://europamediatrainings.com/assets/content/EU_Research_Innovation_Funding_By_Europa_Media.pdf

[192] Assessment of the Horizon 2020 Programme, available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2016/572678/IPOL_STU(2016)572678_EN.pdf

Compared with what can be achieved in the case of Member States' own interventions, **Horizon Europe provides substantial EU added value in its contribution to some of the key strategic R&I objectives**. In particular, Horizon Europe provides added value in terms of **promoting attractive research careers and a balanced circulation of research talent** in Europe – one of the key ERA policy priorities identified in the ERA Policy Agenda 2022-2024[193]. According to data from the beneficiary survey, 72% of ERC PIs (168 out of 232) and 85% of the MSCA PF fellows (684 out of 807) agreed or strongly agreed that, compared with the research funding available to them at national and/or regional level, **Horizon Europe is more likely to make them pursue their career in Europe** (as opposed to seeking opportunities outside Europe). This aligns with evidence collected from the survey of unsuccessful applicants, which shows that Horizon Europe **supports better working conditions for researchers in comparison to alternative funding**. In-depth evidence gathered through interviews and case studies also shows that in some cases, Horizon Europe serves as an 'excellence label' and contributes to the career progression of its beneficiaries through the prestige associated with the FP's grants.

Similarly, the pooling of resources and expertise under Horizon Europe makes it **a more suitable instrument to address societal challenges (such as climate change, ageing, the digital transition, etc.), compared with the individual initiatives of Member States**. Case study[194] evidence shows that, thanks to the introduction of the MSCA Green Charter, the MSCA act as a robust catalyst for the enhancement of changes relating to the green transition in institutions that already implement sustainable research practices.

The mobility and cross-border training opportunities provided by Horizon Europe to researchers in and outside Europe (primarily, by the MSCA) is also one of the key areas in which Horizon Europe **creates significant value** in addition to what is available to researchers at national/regional level. Altogether 93% of MSCA PF fellows (753 out of 809) and 84% of ERC PIs (196 out of 233) agreed or strongly agreed that Horizon Europe provides more international mobility opportunities for researchers compared with what is available to them at national/regional level.

Evidence reveals that Horizon Europe facilitates the pursuit of more complex research than would be possible using funding from alternative sources: between 66% and 87% of unsuccessful ERC and MSCA applicants who responded to the survey indicated that their project application for alternative funding involved a less complex/diverse set of research methods compared with those planned in their original Horizon Europe proposal. This trend is further evidenced by a significant majority of unsuccessful applicants of ERC (89%, 465 out of 525), MSCA PF fellows (61%, 225 out of 368) and MSCA institutional applicants (81%, 74 out of 91) confirmed that their applications for alternative sources of funding envisaged a **smaller amount of research outputs and innovations being produced in comparison to those planned in their original Horizon Europe project applications.**

Compared with their original Horizon Europe proposals, **project applications to alternative sources of funding usually involved a smaller project scope in terms of research areas and subareas covered**: this was reported by 92% of unsuccessful ERC applicants who responded to the survey (501 out of 546), 85% of unsuccessful MSCA institutional applicants (78 out of 92), and 63% of unsuccessful MSCA PF applicants (246 out of 390) who applied for alternative funding. This need for scaling down illustrates a clear advantage of the EU

[193] European Research Area Policy Agenda – Research and Innovation Overview of actions for the period 2022-2024. European Commission, 2021.
[194] Case Study 4: How the MSCA contribute to more sustainable and greener research.

added value of FPs, demonstrating **the economies of scale that can be achieved by pooling financial and other resources** (compared with what could be achieved by Member States acting on their own). Horizon Europe (in particular, the European Partnerships) enables the establishment of long-term collaborations and economies of scale in research that is needed to tackle common societal challenges[195].

Horizon Europe also allows the establishment of larger and more diverse collaborative research teams compared with what is possible without FP support: 82% of unsuccessful MSCA institutional applicants surveyed (73 out of 89) who had applied for alternative funding after being rejected for Horizon Europe funding indicated that, compared with their original Horizon Europe project application, their adapted applications for alternative funding involved less diversity in terms of the project partners involved (e.g. fewer international partners, fewer partners from other sectors, etc.). Case study evidence[196] similarly confirms that, for example, the funding provided by the ERC allowed projects with a longer duration and larger teams than other types of funding, thereby providing better opportunities for researchers to engage in ground-breaking and frontier research.

This aligns with qualitative evidence stemming from the interviews and case studies carried out for this study which indicates that Horizon Europe continues to generate significant added value by **investing in discovery-driven/frontier research** that is a foundation for scientific discoveries, but for which funding opportunities at national/regional level are often limited. ERC grantees, for example, consider the bottom-up design of the programme with its sole selection criterion of excellence as the key source of its added value compared with what is available at national level. ERC grants offer researchers the possibility to obtain funding for high-risk/high-gain research projects of adequate scale and without the prerequisite to define *ex ante* and in detail the impact of such research.

Study evidence also strongly confirms that Horizon Europe creates significant added value though the opportunities that the programme provides to **form diverse, cross-border collaborative research networks that enable cross-border knowledge sharing and are crucial for the project results.** Around 92% of unsuccessful applicants to the programme parts surveyed (55 out of 60), 89% of unsuccessful applicants under the WIDERA (ERA) thematic priority (55 out of 62), and 88% of unsuccessful MSCA institutional applicants (489 out of 555) indicated that their project required the involvement of a variety of international partners, and could not be implemented without them.

The **added value from Horizon Europe support to cross-border collaborations and networking is also strongly evidenced through its Widening dimension**. Case study evidence shows that there are no grants available in Widening countries that are comparable to those available under Horizon Europe Widening actions aimed at fostering connections with leading partners and boosting the quality of the research produced in Widening countries[197].

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[195] European Commission. Horizon Europe Strategic Plan 2025-2027 Analysis. May 2023. https://op.europa.eu/en/publication-detail/-/publication/b3baec75-fdd0-11ed-a05c-01aa75ed71a1/language-en/format-PDF/source-287596143

[196] Case Study 1: Contribution of the ERC to emerging areas in the Life Sciences, Physical Sciences and Engineering.

[197] Case Study 7: Impact of the widening actions on inducing structural change.

Horizon Europe also continues to exhibit added value by **contributing to the research excellence that stems from the higher level of competition at EU level (compared with that seen at regional or national level)**. Around 89% of ERC PIs surveyed (207 out of 233), as well as 92% of MSCA PF fellows (744 out of 810) and 75% of INFRA beneficiaries (114 out of 152) agreed that Horizon Europe involves a higher level of competition for research funding compared with the research funding available at national and/or regional level.

Access to research infrastructures was also identified as a key area of Horizon Europe's added value. INFRA plays a pivotal role by opening up and better coordinating research infrastructures across EU countries. Funding for transnational access allows researchers to use research instruments, services and infrastructure located in another country[198], demonstrating clear EU added value. According to case study findings[199], Horizon Europe complements national and regional schemes through its emphasis on the international dimension of research: a common limitation of national/regional funding schemes is their geographical restriction of support, which hinders the potential for cross-border collaborations and knowledge exchange. In contrast, Horizon Europe complements these schemes by also providing support for collaborative activities and mobility across national borders.

4.3. Is the intervention still relevant?

4.3.1. Findings in relation to the criterion of relevance

4.3.1.1. Balance within the programme design, and fit to stakeholders' needs

Balance within the programme design

The balance between diverse types of instruments in the FP is perceived as critically important (e.g. multi-beneficiary projects versus mono-beneficiary grants, bottom-up versus top-down calls, coverage of TRLs) since all these instruments serve unique needs and possess the ability to produce high-quality and highly impactful research[200]. H2020 placed an increased focus on top-down, challenge-oriented approaches and the themes of climate change, digital transformation, and mission-oriented research. Examples of top-down approaches in H2020 include the Pillars 'Societal Challenges'[201] and 'Industrial Leadership' (LEITs). Horizon Europe continued this emphasis on top-down approaches through the six clusters, which provide top-down funding opportunities[202], as well as through the newly introduced EU Missions[203,204]. Bottom-up approaches include grants and projects funded through the ERC, the MSCA, part of INFRA and the Widening part under WIDERA (SEWP under H2020).

[198] Case Study 5: Analysis of Transnational and Virtual Access support.
[199] Case Study 10: Strengthening Human Capital in Research and Innovation.
[200] See Case Study 9 on 'Creating high-quality knowledge in the Framework Programme'.
[201] The Social Challenges pillar focused on projects in the fields of Health, Food, Energy, Transport, Climate, Inclusive Societies, and Security.
[202] i.e. for projects in Health; Culture, Creativity & Inclusive Society; Civil Security for Society; Digital, Industry & Space; Climate, Energy & Mobility; Food, Bioeconomy, Natural Resources, Agriculture & Environment.
[203] These are: 1) Adaptation to Climate Change; 2) Cancer; 3) Oceans, Seas and Waters; 4) Climate-Neutral and Smart Cities; 5) Soil Health and Food.
[204] https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-12-missions_horizon-2021-2022_en.pdf.

While the bottom-up approach remains a key feature of the Widening actions, Horizon Europe has introduced some calls relating to specific themes, such as the Twinning Green Deal call[205]. Horizon Europe's INFRA programme part also has an increased focus (in comparison to H2020) on interdisciplinary research aimed at solving big societal challenges – increasing the link between this programme part and EU policy priorities, especially in relation to the green and digital transitions. Many interviewees are positive towards this shift to societal challenges and acknowledge the need for INFRA to contribute to solving critical societal challenges. On the other hand, interviewees also stressed the importance of 'blue-sky' research to address future challenges, in addition to funding for more applied research that is directed towards specific challenges. For INFRA, longer-term planning and the stability of priorities with a view to the continuity of projects are mentioned as important. Both top-down and bottom-up approaches are well appreciated and evidence from interviews with beneficiaries and stakeholders, as well as survey and desk research, points to the importance of the balance between both.

Meanwhile, some concerns remain concerning the need to direct sufficient resources towards bottom-up research, which is considered essential to fostering excellent science within the respective programme parts. Stakeholders point to limited opportunities for collaborative discovery research (currently available through the Widening actions, the EIC Pathfinder and, to some extent, through the ERC Synergy grants and the MSCA,). With respect to collaborative bottom-up research funding, lessons can be drawn from the benchmark reports, in which this type of instrument is linked to expanding opportunities for innovative research ideas, facilitating access to new collaborative networks, providing training for researchers, and granting access to research infrastructure and equipment.

The survey of Horizon Europe beneficiaries conducted May-July 2023 shows that ERC and MSCA beneficiaries, in particular, find that Horizon Europe provides (to a 'large' or 'very large' extent) sufficient funding opportunities for the conduct of basic/fundamental research in new and emerging research areas (79% or 191 out of 241 ERC PIs; 69% or 568 out of 825 MSCA PF fellows; 54% or 266 out of 495 organisations participating in the MSCA DN, COFUND and SE actions). Among the beneficiaries of Widening actions, the share is 50% (89 out of 178). Regarding the extent to which Horizon Europe provides sufficient funding opportunities for research into technological applications in areas that are important to addressing global challenges (including climate change and the SDGs), the largest shares of beneficiaries indicating to a 'large' or 'very large' extent that this was the case are found in the Widening actions (67.7%, or 555 out of 820), followed by organisations participating in the MSCA DN, COFUND and SE actions (59.8%, or 293 out of 490) and MSCA PF (55.5%, or 133 out of 240).

Consideration of feedback within the programme design

For the MSCA programme part, stakeholder consultation during the transition towards Horizon Europe resulted in a few changes being made that further enhanced both intersectoral mobility (e.g. in Postdoctoral Fellowships) and interdisciplinary mobility (e.g. in Staff Exchanges). In the case of the Widening actions, in line with the new ERA objectives, the ERA Action Plan, the New European Innovation Agenda, as well as gaps that had not been addressed in H2020, several new or updated actions have been introduced into Horizon Europe that focus more on balanced brain circulation, intersectoral mobility, the internationalisation of institutions, and the strengthening of regional ecosystems. In the initial feedback on these changes to the Widening actions, various stakeholders stressed in their

[205] HORIZON-WIDERA 2023-ACCESS 02-02.

positioning papers[206] that the Widening actions could benefit from actions supporting R&I activities. This could be achieved by including more Research and Innovation Actions or Innovation Actions[207] in which there is no requirement to include non-Widening partners. This would allow Widening countries to truly drive collaborative R&I projects[208]. Other stakeholders indicated that it is crucial to gain in-depth knowledge on the reasons for the limited participation of Widening countries in the FP – most of which are systemic. This is necessary in order to comprehensively evaluate the Widening activities and, as a result, design future calls that further encourage Widening actors to apply to the FP. By doing so we can improve their R&I capabilities.

Addressing stakeholders' needs

The survey of Horizon Europe beneficiaries, conducted May-July 2023, asked about the extent to which the opportunities provided by the Horizon Europe project respond to the needs of the beneficiaries. On average, MSCA PF fellows showed the strongest level of agreement that their Horizon Europe project responded to the various needs stipulated in the question, followed by ERC grantees. Beneficiaries of INFRA on average showed the lowest level of agreement, followed by WIDERA (ERA) and organisations participating in MSCA DN, COFUND and SE actions.

A similar analysis was performed on the responses of unsuccessful applicants to the more general question of to what extent Horizon Europe responds to their needs. This analysis reveals that fewer respondents overall indicate that their needs are being addressed 'to a very large extent' under Horizon Europe (compared with beneficiaries indicating that their needs are being addressed in their specific project). Having said this, the patterns regarding which specific needs appear to be best addressed are more or less similar.

Addressing horizontal issues

Interdisciplinarity and cross-sectoral collaboration constituted a major component of H2020 and opportunities for interdisciplinary projects are further encouraged in Horizon Europe – especially in Pillar 2 on Global Challenges and Industrial Competitiveness. Although stakeholders welcome the increased attention to interdisciplinarity, they also warn that a 'one-size-fits-all' approach is to be avoided[209]; that evaluators should be better guided on the topic, that briefings on interdisciplinarity could be further improved[210]; and that topics need to be built in the first place around a strong research component to enable interdisciplinary collaboration[211]. In the Survey of Horizon Europe beneficiaries, conducted in May-July 2023,

[206] Public consultation on the past, present and future of the EU's Horizon research and innovation programmes 2014-2027, available at: https://research-and-innovation.ec.europa.eu/news

[207] e.g. European Regions Research and Innovation Network (ERRIN). (2023). ERRIN input to the public consultation on the past, present and future of the European Research & Innovation Framework Programmes 2014-2027.

[208] e.g. European Regions Research and Innovation Network (ERRIN). (2023). ERRIN input to the public consultation on the past, present and future of the European Research & Innovation Framework Programmes 2014-2027.

[209] e.g. The Guild of European Research-Intensive Universities (2023). Lessons learned and way forward: The Guild's recommendations for Horizon Europe.

[210] League of European Research Universities (LERU) (2023). LERU key messages for the current and future European R&I Framework Programmes.

[211] e.g. The Guild of European Research-Intensive Universities (2023). Lessons learned and way forward: The Guild's recommendations for Horizon Europe.

the majority of the respondents in all programme parts agreed (to a 'large' or 'very large' extent) that there are sufficient funding opportunities for interdisciplinary research. This is particularly true for ERC and MSCA beneficiaries, with between 68% and 77% of such respondents finding that Horizon Europe provides (to a 'large' or 'very large' extent) sufficient funding opportunities for conducting interdisciplinary research[212]. For other programme parts, the share was between 58% and 65%.

Along the same lines, it is also the ambition of the EC to better integrate **Social Sciences and Humanities (SSH)** or Social Sciences, Arts and Humanities (SSAH), and several steps have been taken under Horizon Europe to encourage this. Steps such as using a flagging system for call topics that are relevant to the SSAH; including an SSAH component in evaluations; and appointing SSAH experts to evaluation panels. However, there is room for further improvement with regard to explaining the potential social dimensions and expectations for SSAH-flagged calls, and to better valorise the full potential of SSAH.

In terms of relevance to developing the knowledge base in Europe with regard to **ethics and integrity**[213], FPs fund projects with a clear focus on ethics and integrity in research. Under Horizon Europe, such research is mainly funded under the thematic priority 'Reforming and enhancing the European R&I system' within the WIDERA programme part (WIDERA (ERA)). Evidence from Horizon 2020 projects illustrates that these projects have had an effect in terms of increasing the knowledge base – raising awareness and understanding of the need to conform to high standards of research ethics and integrity; developing a broad range of tools that can be applied by various stakeholders to support compliance with norms and standards; and setting up a network of experts and disseminating insights to a broad group of stakeholders. Interviewees in the context of the relevant case study expressed the need to strengthen the dissemination of project outcomes in order to further valorise their results. Initiatives have been taken in this regard via, for instance, the Embassy of Good Science. Calls for projects on research ethics specify structured cooperation with the Embassy of Good Science, with the aim of increasingly building on the outputs of earlier projects and at the same time strengthening the content in the repository. More generally, Horizon Europe's enhanced focus on ethics and integrity is supported by interviewees and can further drive the development of networks and skills in this regard. However, it is emphasised that 'one-size-fits-all' frameworks are to be avoided.

With respect to **gender equality**[214], the FP foresees the integration of the gender dimension into R&I content, thus contributing to pooling experience and expanding the knowledge base on the topic. Under Horizon Europe, the integration of a gender dimension into R&I content is a requirement by default and is evaluated under the criterion of excellence, unless the topic description explicitly specifies otherwise. The importance of gender equality and inclusiveness for the coming strategic planning period was confirmed in the OPC[215].

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[212] 71.2%, or 171 out of 240 ERC PIs; 76.6%, or 628 out of 820 MSCA PF fellows; and 68.5%, or 338 out of 493 MSCA organisations.

[213] See also Case Study 14 on the impact of the Framework Programmes on fostering research integrity and ethics.

[214] See also Case Study 12 on 'Gender equality in the European Framework Programmes for Research and Innovation'.

[215] Public consultation on the past, present and future of the EU's Horizon research and innovation programmes 2014-2027, available at: https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/results-public-consultation-future-eu-research-and-innovation-programmes-are-now-public-2023-04-19_en.

4.3.1.2. Relevance of themes and issues addressed

In terms of the main fields of science covered, preliminary evidence shows that Horizon Europe follows the patterns identified for H2020, with the excellent science pillar and Widening part supporting many projects in the field of Natural Sciences. The clusters in Pillar 2 accommodate projects in different fields of science, in line with their focus. For H2020 projects, the bibliometric analysis also found that their scientific output aligns in terms of scientific disciplines with this coverage of these fields of science in the projects. For instance, the excellent science pillar produced its largest share of scientific publications in the scientific discipline of Natural Sciences – namely, in 'physics and astronomy', followed by 'engineering'; the Industrial Leadership pillar produced its largest share of publications in the scientific discipline of Computer Science, followed by Engineering, in line with the strong focus of the projects in this pillar on the 'engineering and technology' field of science. Meanwhile, many papers in Societal Challenges are on the scientific discipline of medicine, related to the focus of SC1 – Health, and the fact that SC1 produced the most publications compared with the other SCs.

To capture the longer-term effects of the FP in terms of knowledge creation, an analysis was performed to identify the prominent topics[216] addressed by H2020 research outputs. Among the 10 prominent topics with the highest numbers of publications, the ERC is one of the programme parts that led to most publications (in particular in the fields of astronomy, quantum physics and perovskite solar cells). On the other hand, topics (in the top 10 prominent topics that led to the most publications in the FP[217]) related to COVID-19 are mostly covered under SC1, while topics related to ICT are mostly covered under LEITs-ICT, programme parts that are designed to focus on health and ICT, respectively.

In terms of contributions to the SDGs, Section 4.1.1.5 on effectiveness has shown that preliminary evidence for Horizon Europe[218] points to the significant importance of the SDGs in the funded projects, with at least one SDG being covered in 99.2% of project proposals analysed. Compared with H2020, it appears that the FP's contribution to SDGs has intensified[219]. Yet in Pillar 1, the overall emphasis (in terms of EU contribution) has remained on SDG3 – Good Health and Well-being. In WIDERA, SDG 16 – Peace, Justice and Strong Institutions is most prominent. The SDG most widely addressed in Pillar 2 was SDG 7 – Affordable and Clean Energy, while in Pillar 3, it was SDG 3 – Good Health and Well-being.

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[216] The concept of 'prominent topics' refers to topics in terms of their momentum and visibility. To calculate a topic's prominence, three metrics are combined into an average to constitute its prominence score: citation counts, Scopus view counts and Average CiteScore. Based on the set of publications from Horizon 2020, the 200 topics with the highest prominence scores were thus identified by the study team. The Top 5 topics with the highest prominence scores are: 1) Perovskite Solar Cells; Solar Cell; Formamidine; 2) Nivolumab; Pembrolizumab; Immunotherapy; 3) Molybdenum Disulfide; Monolayer; Van Der Waals; 4) Oxygen Production; Electrocatalysts; Catalyst; and 5) Intestine Flora; Ruminococcaceae; Microorganisms. The full set of Top 200 topics can be retrieved online at: https://doi.org/10.34894/QIJZK8. More information can be found in Annex 6 to this evaluation study and in Case Study 9 on Creating high-quality new knowledge.

[217] See Case Study 9 on Creating high-quality knowledge, section 'Which highly prominent topics do the research outputs from Horizon 2020 cover in the different programme parts?'.

[218] For more information, see Annex 6 'Quantitative research track findings', SDG analysis.

[219] The documents on which the SDG analysis is based differ between Horizon 2020 and Horizon Europe: the Horizon Europe analysis was carried out on the proposal texts, while in Horizon 2020 the analysis was based on publications. This makes it difficult to compare SDG contributions between the two Framework Programmes.

Analysis of H2020 shows that ERC-funded research has contributed to the EU priorities 'Europe fit for the digital age'[220] and the European Green Deal[221] in different fields, among which some also remain at the forefront under Horizon Europe (e.g. quantum technologies and climate change). Also, in Horizon Europe, evidence demonstrates that Widening actions generally align with current technological, scientific, and socio-economic trends and challenges as well as with newly emerging needs. Under Horizon Europe, the largest share of projects in the Widening action are in the field of natural sciences, and the topics that are most frequently addressed in signed grants are: ecosystems, climate change, educational sciences, innovation management, oncology, pollution, and sustainable economy[222]. Machine learning and artificial intelligence are also fairly common subjects in Horizon Europe Widening projects, more so than under H2020.

4.3.1.3. Flexibility to cope with changing circumstances in the EU and the world

The analysis shows that activities under the FP are able to adapt flexibly to address newly emerging needs. A telling example is the FP's rapid response and high degree of flexibility in the context of the COVID-19 pandemic. One interviewee explicitly mentioned it as a strength and a crucial element in addressing the crisis that the EU was the first funder at international level to launch specific calls and to flexibly allocate budget to this response. The ERC programme part provided a strong contribution to research on COVID-19; while two EMERGENCY topics among the challenge-oriented topics in INFRA, launched in response to the COVID-19 crisis, called for RI services as well as FAIR and open data-sharing to enable rapid research responses to enhance European preparedness for COVID-19 and other infectious diseases. Also, a substantial number of 100 MSCA projects are directly related to COVID-19 research issues.

In response to the Russian invasion of Ukraine, the MSCA took proactive steps to support affected doctoral candidates and postdoctoral researchers from Ukraine, e.g. via the dedicated MSCA4Ukraine scheme launched in 2022. This new dedicated fellowship scheme was established to provide support to displaced researchers from Ukraine to enable them to continue their work at academic and non-academic organisations in EU Member States and Horizon Europe associated countries, while maintaining their connections to research and innovation communities in Ukraine.

4.3.1.4. Participation of international partners and associated countries

Horizon Europe is one of the main tools for implementing the EU's strategy for international cooperation, set out in the Global Approach to Research and Innovation[223]. Under Horizon Europe's Pillar 1, international researchers can apply for MSCA Fellowships to come to work

[220] European Research Council (2022). ERC Frontier Research contribution to a Europe fit for the digital age, available at: https://erc.europa.eu/sites/default/files/2022-08/H2020_factsheet_FitforDigitalAge.pdf.
[221] European Research Council (2022). ERC Frontier Research contribution to the European Green deal, available at: https://erc.europa.eu/sites/default/files/2022-08/H2020_factsheet_EuropeanGreenDeal.pdf.
[222] Source: Horizon Dashboard, accessed in June 2023.
[223] COM(2021) 252 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Global Approach to Research and Innovation Europe's strategy for international cooperation in a changing world.

in European research groups, or for ERC grants to establish a research group in Europe[224]. Furthermore, partners from associated countries can participate in Horizon Europe under similar conditions to those for EU Member States, and partners from third countries can participate in a Horizon Europe project together with institutions from EU Member States or associated countries. Within Pilar 1, most EU contributions to participants from Associated and third countries are allocated through the ERC.

With respect to associated countries, it is important to note that although Switzerland was associated to all parts of H2020 as of January 2017 (after a period of partial association), it is not associated to Horizon Europe[225]. The United Kingdom is associated to Horizon Europe as of 2024 under the Trade and Cooperation Agreement[226]. In H2020, both countries featured in the top 10 beneficiary countries in the programmes analysed: the UK ranked first, with 14.2% of participations and 16.8% of EU contribution received; Switzerland ranked seventh, with 3.9% of participations and 6.5% of EU contribution received. The number of participations from the UK under Horizon Europe so far appears lower than under H2020 and there are indications that UK participation has dropped in Pillar 2, probably due to the uncertainty related to (non-)association leading to hesitancy on the part of international research consortia over the inclusion UK organisations, especially in a leading role[227].

Under H2020, 11.7% of EU funding under Pillar 1 was allocated to associated countries and 0.4% to third countries. So far under Horizon Europe, these figures are 8.2% and 2.5%, respectively. Of the EU funding allocated to third countries, 97% has gone to the UK and Switzerland. When the UK and Switzerland are excluded from calculations, the share of total Pillar 1 EU funding going to third countries under Horizon Europe is 0.1%.

5. Conclusions and lessons learned

5.1. Effectiveness

Conclusion 1: Although it is still in its early stages, **initial evidence suggests advancements in the generation of high-quality knowledge in Horizon Europe**. The European Commission has reported 42 foreground[228] publications by mid-October 2023, which reflects the short-term Key Impact Pathway (KIP) 1 indicator (or the number of peer-

[224] https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/europe-world/international-cooperation_en.
[225] https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/europe-world/international-cooperation/bilateral-cooperation-science-and-technology-agreements-non-eu-countries/switzerland_en.
[226] Association was confirmed in a joint statement by the EC and the UK Government on 7 September 2023, available at: https://ec.europa.eu/commission/presscorner/detail/en/statement_23_4375.
[227] https://theconversation.com/horizon-europe-how-the-uks-delay-in-rejoining-eu-funding-scheme-is-damaging-scientific-research-209279#:~:text=Until%202020%2C%20the%20UK%20was,Brexit%20changed%20that.
[228] i.e. published after the start of the project.

reviewed scientific publications)[229,230]. In addition, according to data provided by the JRC[231], the JRC published almost 1 780 scientific publications that can be attributed to Horizon Europe in 2021-2022. The targeted stakeholder consultation[232] indicates that most respondents think that Horizon Europe is on track to develop, promote and advance scientific excellence[233].

Conclusion 2: The early evidence collected suggests that **the association of third countries to Horizon Europe strengthens the coherence and integration of the European R&I system**. Specifically, association helps to advance R&I capacities, especially in associated countries with less well-developed R&I systems, and prepares them for alignment with the European Research Area[234].

Conclusion 3: The geographical diversity of participants in Horizon Europe is **comparable with that of Horizon 2020, with 12.6% of Horizon Europe funding so far allocated to participants in Widening Member States**[235]. This analysis needs to be considered in the light of 1) the opportunities available through other types of funding for regional development (e.g. ERDF or RRF), as well as 2) the overall objectives of the FP in terms of achieving excellence in science, but also in terms of facilitating collaboration, strengthening the impact of research and innovation, and creating and spreading excellent knowledge and technologies.

Lesson Learned 3.1: *While concentration of funding, in light of the objective of excellence in science, is not alarming, there continues to be a **need for dedicated support for less advanced R&I systems to build R&I capacity**, hence allowing the EU to advance as a whole. The FP's role in addressing this issue is to deliver support in addition to the support for capacity building from other EU programmes, by focusing on the creation and diffusion of excellent knowledge in the EU. As such, the FP supports those countries by enabling them to access excellent research networks, build R&I capacity and improve their excellence – in particular, through its Widening actions. Nevertheless, major national structural changes come with the support and commitment of the countries themselves, and go beyond the effects of specific FP, and in particular Widening, projects.*

Conclusion 4: Preliminary evidence suggests that the programme parts under study **appear to have strengthened the human capital engaged in R&I**, as shown by the positive effects

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[229] This is based on periodic reporting on 18 October 2023. Yet, it is important to note that only 323 projects have already provided a first periodic report, and that many projects are not yet finished. This is largely because Horizon Europe started with a delay, with many calls only opening mid-2021 and many projects having a duration of three years and in the ERC, five years.

[230] As a baseline, H2020 generated over 5 000 publications in the first three years of its operation.

[231] Hristova, M. & Lehto, S., (2023) JRC contribution to the interim evaluation of Horizon Europe and Euratom research and training programme. Analysis of peer-reviewed publications 2021-2022 and bibliometric indicators.

[232] Public consultation on the past, present and future of the EU's Horizon research and innovation programmes 2014-2027.

[233] 30% strongly agreed; 53% agreed;4% indicates 'not at all'. total replies: 1 564; response rate: 56%

[234] See section 4.1.1.4 and Annex 2. Case Studies. Case Study 13. International cooperation and association.

[235] 10.1% is allocated to associated countries, 1.0% to third countries and 76.3% to non-widening Member States.

they have had on the career prospects and reputation of researchers, as well as skills development, international and intersectoral mobility, and working conditions[236]. Support is provided to more than 130 000 researchers, most of them supported under the MSCA, and who are involved in the 9 288 currently ongoing projects, of whom 48 642 are involved in upskilling activities (e.g. training, mentoring/coaching) in projects funded by the FP (reflecting KIP2)[237].

Lesson learned 4.1: *It is important to* ***continue efforts on talent circulation and development, and to follow up on innovations and new initiatives*** *in this regard. For example, as regards talent development, the EU Competence Framework for Researchers[238,239] could contribute to the development of a common vision on skills development across sectors, countries and monitoring approaches. Furthermore, the strategic thinking that took place in the UK to prepare for possible non-association[240] may provide interesting insights (e.g. the possibility to offer fellowships of longer duration to foreign senior-level researchers).*

Conclusion 5: Preliminary results show a **positive trend with regard to open access publications** and point out that the European Commission's actions in the field of Open Science are influential and considered best practice at Member State level[241]. Nevertheless, the need remains to keep considering the (pace of) changes in Open Science policy in order to avoid adverse effects such as jeopardising the quality of research and the prospects of EU research and researchers (compared with worldwide competitors).

Lesson learned 5.1: *The FP should* ***continue to foster and support the application of Open Science,*** *while making sure that* ***all elements needed for the optimal deployment of Open Science practices are fully installed****. This could encompass better communication as to the mission, objectives and specific activities of the EOSC partnership; awareness raising on the relevance, limitations and risks of the approach; broader support for the provision of training on Open Science principles and skills; as well as fostering the convergence of practices through joint actions around a common vision conducted with the Member States and national research funding organisations.*

Conclusion 6: In comparison with H2020, **Horizon Europe has so far been more successful in attracting newcomers**. H2020 finished with 14% of organisations being

[236] Survey of Horizon Europe beneficiaries, conducted May-July 2023; surveys of Horizon Europe MSCA researchers, conducted May-November 2023. More information on the surveys can be found in Annex 7.
[237] No comparable indicator was calculated for the mid-term evaluation of Horizon 2020. Nevertheless, the mid-term evaluation did mention that the MSCA had supported the training, mobility and career development of around 27 000 researchers during the first three years of the FP. European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020 – Commission staff working document, Publications Office, 2017, https://data.europa.eu/doi/10.2777/220768
[238] European Commission, Directorate-General for Research and Innovation, Knowledge ecosystem: defining a European competence framework for R&I talents, Luxembourg: Publications Office of the European Union, 2022, available at: https://data.europa.eu/doi/10.2777/1117.
[239] Or the 'Council Recommendation on a European framework to attract and retain research, innovation and entrepreneurial talents in Europe', formally adopted on 18 December 2023. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2023%3A0436%3AFIN
[240] As described in the benchmark study on the United Kingdom Research & Innovation (UKRI). See Annex 3. Benchmark on the United Kingdom Research & Innovation (UKRI).
[241] See Case study 11 on knowledge diffusion and open access.

newcomers. At the time of this evaluation study, 22% of Horizon Europe participants were newcomers. The rate of newcomer participation among traditional types of participants (e.g. universities and other research-performing organisations) is a lot lower, suggesting an increased focus of Horizon Europe on the involvement of non-traditional actors.

5.2. Efficiency

Conclusion 1: In the first two years, the administrative performance of the evaluation and grant agreement preparation processes has not met the targeted time values and also does not reach the (very efficient) levels achieved under Horizon 2020 overall. It is worth noting that averages in the first few years can be disproportionately affected by a limited number of delayed calls. The performance improved between 2021 and 2022 and can still meet the time targets with respect to the average performance over the entire programme. (see Annex 6).

Conclusion 2: The attractiveness of Horizon Europe is comparable to H2020. A slight increase in the application success rate between H2020 and Horizon Europe has been recorded (from 11.4% to 15%). This positive change is affected by an increased budget for the Horizon Europe programme parts, suggesting that a relatively higher share of excellent proposals is funded under Horizon Europe. This change positively impacts the costs incurred by applicants as a whole, as fewer high-quality applications did not lead to productive outcomes.

Conclusion 3: The targeted survey of unsuccessful and successful applicants of Horizon Europe suggests that the costs of preparing the proposal are overall not perceived to be disproportionate. However, applicants also indicated that there has been no substantial change in the costs involved in proposal preparation - nor in the administrative burden during project implementation – between H2020 and Horizon Europe. A median project coordinator spends around 36 to 45 person-days preparing the proposal, in addition the median effort spent by a consortium partner, who contributes to a proposal, is between 16 to 25 person-days. If the proposal is successful, the consortium also has an obligation to perform administrative tasks related to project reporting, financial management and similar. Such tasks consume around 6%-10% of the project budget (reported as a median value of survey responses).

Applicants/beneficiaries do not see much difference in the administrative burden between H2020 and Horizon Europe, however, specific simplification measures introduced under Horizon Europe are seen as effective. The introduction of lump sums has been received positively, suggesting the potential for simpler procedures (such as the development of a project workplan, or reporting). Nevertheless, the scheme is very new to the FP and it is still too early to draw definitive conclusions.

Lesson learned 3.1: *While the number of lump sum recipients is small (and the survey sample only included just 75 lump sum beneficiaries), the analysis points towards the cost-saving potential for beneficiaries of lump sums, suggesting that this funding model should be continued and further monitored to understand its impact in the costs to beneficiaries and the EC. This scheme received particular support from small-scale projects, those at a higher TRL, and projects originally funded via the Coordination and Support Action.*

Conclusion 4: Support in preparing Horizon Europe applications is welcomed by applicants. The majority of applicants (70%) receive some type of assistance in preparing their Horizon Europe proposals. In Pillar 1, applicants mostly rely on internal departments within their organisations (50%), receive support from NCPs (19%), involve external consultancies (17%). However, the involvement of external consultants is particularly relevant across the

rest of Horizon Europe. Some respondents elaborated in the comment section of the survey on the reasons for involving external consultancies, among the most mentioned was that respondents seek to increases their chances of success in many cases it means that the external consultancies review the proposals prepared by the applicants. Indeed, only 59% of applicants agreed to a 'very large', 'large' or 'moderate' extent that efforts needed to prepare an application were in proportion with the chances of securing Horizon Europe funding.

Lesson learned 4.1: *Applicants could benefit more from the help of national contact points (NCPs). Around 20% of all HE respondents said they drew on support from NCPs. Among Pillar 1 respondents such a share was smaller, around 17%. NCPs were established as part of the H2020 Framework, with the goal of providing guidance, practical information and assistance on all aspects of participation in Horizon Europe. It is worth noting that the FP already allocates a specific budget for NCPs through the relevant National Authorities. Encouraging more participants to make use of these already-funded NCPs could enhance resource efficiency.*

5.3. Coherence

Conclusion 1: Study evidence finds that overall, Horizon Europe provides a mix of complementary actions that contribute to higher-level strategic objectives by supporting different types of research and collaborative activities, target groups, geographical areas and/or fields of intervention. The MSCA and ERC continue to produce significant complementarities by contributing to the overarching objective of advancing researchers' careers and producing excellent science, while supporting researchers at different career stages and differing levels of seniority. Different FP programme parts complement each other by supporting the same topic areas/fields of research while utilising different instruments and types of activities supported. Complementarities and synergies between different programme parts are also evidenced by project-level collaboration. In some programme parts (particularly Research Infrastructures and WIDERA projects) a significant share of projects is planning joint collaborative activities (e.g. mutual conferences, joint dissemination activities, workshops, joint publications, etc.) with other projects funded under Horizon Europe.

Strong complementarities and synergies between different actions under Horizon Europe are also demonstrated by evidence on continuity, whereby a Horizon Europe project is built on research activities carried out under a previous FP (e.g. FP7 or H2020). The share of survey respondents indicating that their project is a continuation of research activities carried out under previous FPs (H2020 or FP7) ranged from around 60% of INFRA beneficiaries and 37% of ERA thematic priority beneficiaries, to around 5% of MSCA PF fellows. An example of good practice is the synergies between EIC and ERC projects, whereby 25 out of 42 recipients of the new EIC 'Transition' funding originated from research funded by the ERC[242].

Lesson learned 1.1: *Building on the demonstrated success of project continuity between ERC and EIC, it is recommended that future FPs integrate additional pathways to enhance continuity and synergies between different programme parts. To achieve this, it is recommended to develop additional dedicated funding paths or mechanisms within future FPs that are tailored and designed to facilitate the continuity of projects across different programme parts. These pathways should emphasise and help to exploit the synergies stemming from the transition of successful projects from one FP component to another, e.g.*

[242] https://erc.europa.eu/news/erc-funded-research-wins-most-new-eu-innovation-grants.

with a goal to advance the TRL of specific technologies or assist in the career advancement of beneficiary researchers.

Lesson Learned 1.2: In order to further increase complementarities, it is recommended to improve the visibility and navigability for potential applicants of the various different funding calls and programme parts. Some interviewees indicated that, for example, the participation of RIs in other parts of the FP could be increased significantly by providing more guidance on exploring relevant calls.

Conclusion 2: Study evidence shows that different actions supported under Horizon Europe (Pillar 1 and WIDERA) are coherent and produce significant synergies with regard to national/regional funding schemes and other EU funding instruments. Out of the 21 EU programmes/funds foreseen in Annex IV of Regulation (EU) 2021/695 establishing Horizon Europe, 13 show synergies (Erasmus+, DEP, LIFE Programme, Creative Europe, COSME (2014-2020), SMP, ISF, EMFAF, ESF+, CEF, INNOVFUND, ERDF and RRF), while in 8 cases no evidence of synergies was found[243]. Moreover, all types of synergies foreseen by the regulation were observed – albeit to a varying degree, such as complementary funding, combined funding (Teaming), alternative funding (SoE) and transfers.

Different programme parts under Horizon Europe are complementary and, in some cases, produce synergies with regard to EU instruments, particularly the **Erasmus+ programme**: evidence shows that collaborative networks established under Erasmus+ often serve as platforms for collaborations under Horizon Europe. Furthermore, synergies between Horizon Europe and the **Cohesion Policy funds** are evidenced through their joint support for the activities of FP projects, facilitated by co-funding instruments such as the MSCA COFUND, Teaming, and Excellence Hubs.

Synergies between Horizon Europe and other R&I funding instruments are also exemplified by Horizon Europe beneficiaries **mobilising additional funds from other national/regional or European funding programmes**. In addition, the study shows that the SoE remains an important instrument to support those applications that have not been successful under Horizon Europe funding calls.

Lesson learned 2.1*: It is recommended to provide more clarity for potential programme beneficiaries and the wider public regarding the complementarities and differences between various EU funding instruments that support ecosystems, networks and alliances. More specifically, it is advised to improve communication on the differences and synergies between the 'European Excellence Initiative' for capacity building in HEIs, and other EU capacity building instruments (e.g. Erasmus+ Key Action 2). Furthermore, it is recommended to better emphasise the distinct opportunities offered by Excellence Hubs, Digital Innovation Hubs, and Regional Innovation Valleys, to avoid confusion among potential beneficiaries. For this purpose, issuing a joint communication identifying the distinct value provided by different instruments should be considered.*

5.4. EU added value

Conclusion 1: Horizon Europe delivers significant **EU added value by financing research projects characterised by greater scale, scope and scientific complexity than those typically funded at national or regional level.** Compared with Horizon Europe, project

[243] CAP, EU4Health, Union Space Programme, NDICI and IPA III, Integrated Border Management Fund, Just Transition Mechanism, Euratom and European Defence Fund.

applications made to alternative funding sources are generally of a smaller scope in terms of research (sub)areas covered and are less complex/diverse in terms of the research methods envisaged.

In addition, Horizon Europe continues to support types of research that could not be funded at national/regional level, in particular collaborative actions that involve multiple organisations from different countries. This study finds that the majority of unsuccessful Horizon Europe applicants surveyed across all programme parts (except for the ERC) did not apply to alternative sources of funding to implement the activities proposed in their Horizon Europe application. This may be explained by the few alternative funding opportunities (e.g. national/regional funds, grants from international organisations, etc.) available for these types of actions, indicating the EU added value of Horizon Europe support.

Study evidence confirms that, like H2020, Horizon Europe offers substantial EU added value in terms of contributing to some of Europe's critical strategic R&I objectives. The FP actively contributes to the promotion of attractive research careers and to the balanced circulation of research talent in Europe, as well as to the promotion of international cooperation, access to top-level research infrastructures and fostering EU-level competition for research funding. All of these are key components contributing to the development and advancement of excellence in scientific research in Europe. Furthermore, its ability to pool resources and expertise makes Horizon Europe a more suitable instrument to address societal challenges such as climate change, ageing and the digital transition, compared with national initiatives.

Lesson learned 1.1*: International cooperation and mobility opportunities for researchers remain central to Horizon Europe's EU added value. It is suggested that the next FP should continue to prioritise sustained investment in support actions that enhance the international mobility of researchers, recognising its role in promoting knowledge exchange, talent retention and fostering excellence in research. Cross-border collaboration activities should also prioritise the diversity of consortia, in particular by promoting cross-border, cross-sectoral and interdisciplinary collaboration between partners.*

5.5. Relevance

Conclusion 1: The **policy mix of top-down and bottom-up approaches** is generally considered **relevant** to achieving the objectives set for Pillar 1**.**

It is **important to combine a challenge-oriented approach with sufficient room for 'blue-sky' research in order to be ready for future challenges**. Curiosity-driven research is considered essential to stay at the forefront of research in the world and to develop emerging fields. At the same time, society and policymakers prioritise particular societal issues or themes. Yet, researchers ask that such **top-down opportunities are not too prescriptive.**

With respect to bottom-up approaches, a gap in terms of collaborative bottom-up opportunities has been identified. The study on relevance of H2020 concluded that excellence-driven collaborative research played a rather minor role in Pillar 1 of H2020. Given the continued focus on challenge-driven approaches in Horizon Europe and the relative stability, this remains a valid conclusion.

Lesson learned 1.1: *Although the importance of challenge-oriented research is not questioned, it is recommended to* ***continue balancing top-down research with 'blue-sky' opportunities*** *in order to remain competitive and at the forefront of new approaches and emerging topics. With regard to top-down approaches,* ***stakeholder consultation to define relevant topics, as well as sufficient flexibility within these topics****, are considered good*

practices to allow for the creativity of researchers and to enable researchers to embark on novel research approaches or paths[244]*. With respect to bottom-up approaches, the gap identified in terms of collaborative bottom-up opportunities for research suggests the need for an* ***exploration of ways to strengthen the collaborative bottom-up opportunities****, in balance with other approaches and in line with the limited total size of the instrument.*

Conclusion 2: As in H2020, the excellent science Pillar under Horizon Europe supports many projects in the field of Natural Sciences. In addition, preliminary evidence for Horizon Europe on the fields of science funded and the SDGs covered in projects point to the relevance of the research produced under the FPs.

Yet, since it is too early to assess the eventual contribution made by Horizon Europe to prominent topics, the findings for H2020 show that **ERC** is (with a few exceptions) one of the programme parts that led to the largest number of publications in these prominent topics[245]. In an international context[246], **the EU has a few prominent topics** (such as Higgs Bosons) **to which it is a strong contributor** in comparison with other key knowledge producers[247]. H2020, especially ERC and the MSCA, were important drivers for research on specific astronomy topics compared with other international knowledge producers[248]. While this confirms the strength of the programme parts that focus on basic research in driving the production of scientific publications on prominent topics, programme parts that focus on more specific topics (defined in a top-down manner) are also demonstrated to contribute substantially.

Conclusion 3: Interdisciplinarity was further encouraged under Horizon Europe (especially in Pillar 2 on Global Challenges and Industrial Competitiveness) and **many stakeholders agreed that interdisciplinarity should be strongly incentivised**[249]. In interviews, ERC PIs indicated that interdisciplinarity is appreciated and that the size of ERC grants allows them to attract more diverse profiles into the research team. However, it has been underlined by interviewees that this type of research is not always 'automatically' desired but should depend on the topics and the relevance of interdisciplinarity. In addition, more than half of the successful survey respondents agreed that there are sufficient funding opportunities for interdisciplinary research[250].

In a similar vein, it is the ambition of the European Commission to better **integrate SSH and SSAH.** This is found to be important in addressing complex societal challenges, and it is important that research and innovations are developed from the perspective of societal and

[244] See Annex 3, Benchmark Study of SNSF and Benchmark Study of UKRI.
[245] The concept of 'prominent topics' refers to important topics in terms of momentum and visibility. To calculate a topic's prominence, the study team combined three metrics into an average constituting its prominence score: citation counts, Scopus view counts and Average CiteScore. For more information, see Annex 6 to this study and Case Study 9 on the impact of the Framework Programmes on creating high-quality new knowledge.
[246] For more information, see Annex 6 to this study (research trend analysis) and Case Study 9 on the impact of the Framework Programmes on creating high-quality new knowledge.
[247] The analysis is based on the set of publications from the EU overall and from the main international knowledge producers, including the EU-27, the United Kingdom, China, Japan, South Korea and the United States.
[248] Ibid.
[249] e.g. League of European Research Universities (LERU) (2023). LERU key messages for the current and future European R&I Framework Programmes.
[250] Survey of Horizon Europe beneficiaries, conducted May-July 2023.

cultural acceptance. While several steps have been taken in this direction under Horizon Europe[251], it has been argued that the implementation still shows room for improvement.

Lesson learned 3.1: Spurring interdisciplinarity and the integration of SSH or SSAH *into projects can be very beneficial in creating high-quality and impactful knowledge, addressing grand challenges and ensuring social acceptance. It is thus a* ***pathway along which efforts should be continued,*** *while continuously giving consideration to the relevance and added value of this approach to certain topics. For instance, further information and guidance on the integration of SSH and SSAH could help researchers better understand the expectations and added value thereof, better valorise the full potential of SSAH throughout the project, and inform and encourage research communities to work together.*

6. Annexes

Annex 1: Analysis and findings per programme part

Annex 2: Case studies

Annex 3: Benchmarks

Annex 4: Evidence table

Annex 5: Literature and information sources

Annex 6: Data and findings from the quantitative research track

Annex 7: Survey questionnaires and data

Annex 8: Interview register

[251] e.g. using a flagging system for call topics that are relevant to SSAH, including an SSAH component in evaluations, and appointing SSAH experts to evaluation panels.

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The study presents lessons learned and recommendations for policy on Excellent Science under Horizon Europe. This is one of several support studies feeding into the European Commission's interim evaluation of the European framework programme for Research and Innovation Horizon Europe.

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