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Evaluation study on the external coherence and synergies of Horizon 2020 within the European research and innovation support system

Final Report

Independent Expert Report

Research and Innovation

Evaluation study on the external coherence and synergies of Horizon 2020 within the European research and innovation support system

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EUROPEAN COMMISSION

Evaluation study on the external coherence and synergies of Horizon 2020 within the European research and innovation support system

Final Report

2023

Directorate-General for Research and Innovation
Horizon 2020

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List of abbreviations

BBI	Bio-based Industries
BRG	Better Regulation Guidelines
CAP	Common Agricultural Policy
CCI	Cultural and creative industry
CEF	Connecting Europe Facility
CEITEC	Central European Institute of Technology
cPPP	Contractual Public-private partnership
COFUND	Co-funding initiative
CS	Case study
CS2	Clean Sky 2
CSA	Coordination and support actions
CSP	Concentrated solar power
COSME	Programme for the Competitiveness of Enterprises and small and medium enterprises
DESI	Digital economy and society index
DIH	Digital Innovation Hub
DGs	Directorate-General
DG RTD	Directorate-General Research and Innovation
EAFRD	European Agricultural Fund for Rural Development
ECSEL	Electronic Components and Systems for European Leadership
EDIH	European Digital Innovation Hub
EEN	Enterprise Europe Network
EIB	European Investment Bank
EIC	European Innovation Council
EIF	European Investment Fund
EIT	European Institute of Innovation and Technology
EJP	European Joint Programme
ELI	Extreme Light Infrastructure
EMFF	European Maritime and Fisheries Fund
EpoSS	European Technology Platform on Smart Systems Integration
EQ	Evaluation question
ERA	European Research Area
ERAC	European Research Area and Innovation Committee
ERA-NET	European Research Area network
ERC	European Research Council
ERDF	European Regional Development Fund
ERICs	European Research Infrastructure Consortia
ERRIN	European Regions Research and Innovation Network
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructure
ESIF	European Structural and Investment Funds
ESS	European Spallation Source
EU	European Union
EuroHPC	European High-Performance Computing
FCH2	Fuel Cells And Hydrogen 2
FET	Future and Emerging Technologies

FP	Framework programme
IA	Innovation Actions
ICT	Information and communication technologies
IMI2	Innovative Medicines Initiative 2
INNOSUP	Innovation in SMEs programme
IPCEI	Important Projects of Common European Interest
JPI	Joint Programme Initiative
JTI	Joint Technology Initiative
JU	Joint Undertakings
H2020	Horizon 2020
KET	Key enabling technology
KIC	Knowledge and Innovation Communities
KPIs	Key performance indicators
LEIT	Leadership in Enabling and Industrial Technologies
LIFE	Programme for the Environment and Climate Action
MSCA	Marie Skłodowska-Curie Action
MFF	Multiannual financial framework
MoU	Memorandum of Understanding
MS	Member State
MLE	Mutual Learning Exercise
NCPs	National contact points
NGO	Non-governmental organisation
NOP	National Operational Programmes
OP	Operational programme
P2P	Public-public partnerships
PADR	Preparatory Action on Defence Research
PCP	Pre-Commercial Procurement
PPI	Procurements of Innovative Solutions
PPP	Public-Private Partnerships
R&I	Research and Innovation
RDI	Research development and innovation
RDP	Rural Development Programmes
RI	Research infrastructures
RIA	Research and innovation actions
ROP	Regional Operational Programmes
S2E	Stairway to Excellence
S3	Smart Specialisation Strategies
SESAR	The Single European Sky ATM Research
SGA	Specific Grant Agreement
SME	Small and Medium-sized enterprises
SoE	Seal of Excellence
SSERR	Support Services for Exploitation of Research results
TI	Technology infrastructure
ToR	Terms of reference
TRL	Technology readiness level

Glossary of key terms

This study focuses on external coherence, and this section provides **clarity on the key terms that are used for its assessment**. These are presented in the table below.

Table 1. Terms and definitions related to external coherence

Term	Definition
Synergy	Synergy occurs when the sum of (expected) results of programmes/initiatives as a whole is greater than the sum of the parts (1+1>2).
Complementarity	Complementarity occurs when the sum of (expected) results of programmes/initiatives as a whole is the same as the sum of the parts (1+1=2). Complementarity is distinct from synergy in that it does not require interaction between the two entities or processes, nor does it require the outcome of this interaction to be greater than the value of their individual effects. Complementarity assumes distinct operations or spheres of responsibility, non-contradiction of outcomes, and also a common goal to which all efforts are directed.
Coherence	Coherence concerns the quality of being logically integrated and consistent. It implies clear goals, and consistency in applying multiple policy or programme efforts towards achieving that goal in a non-contradictory way. This does not automatically equate with interaction between entities or processes but only requires that outcomes do not undermine efforts from other spheres.
Coordination	Coordination is a mechanism or process by which information is shared about different policy/programme/project resources, goals, processes, and timelines so that efforts should not undermine or duplicate each other. It can occur across or between EU, Member State or sub-national levels.
Gap	A situation where policy initiatives or instruments do not cover relevant policy areas in terms of their objectives, target groups, eligibility criteria or desired outcomes.
Overlap	A situation where policy initiatives or instruments cover similar areas in terms of their objectives, target groups, eligibility criteria or desired outcomes.

Going further than the above general terms, for conceptual clarity, we adopt in this study the following **synergy typology**. While many more fine-grained categorisations exist in various conceptual frameworks, we find that these five represent the most conceptually distinct mechanisms of how synergies are achieved in practice.

Table 2. Synergy typology adopted in this study

Term	Definition
Cumulative (also combined or simultaneous) funding synergies	Cumulative funding synergies bring together different funding streams (including both shared and directly managed funds) in the same project, single action or a group of inter-dependent actions or operations. Example: A research institution receives ERA Chair grant funded by H2020 and uses ESIF support to finance the costs non-eligible under H2020, e.g. upgrade of research infrastructure.
Successive (or pipeline) funding synergies	Successive synergy refers to collaboration where projects/initiatives build on each other's results/resources. Within this type, there is a differentiation between: • **Upstream synergy**, which occurs when regional/national level initiatives pave the way for joint efforts to apply for H2020 Example: National investments to construct a new research infrastructure coupled with ERDF support to R&I skills, enables the participation of a leading national research team in a H2020 project consortium. • **Downstream synergy** aimed to enhance the take up of H2020 and other research results towards the market. Example: A beneficiary from a H2020 project receives national and private funding opportunities to continue further experimental development, prototyping and demonstration of the developed technology solution.
Concurrent (or parallel) synergies	Concurrent synergy refers to projects/initiatives that complement each other, e.g., combining funding or other types of support. The positive complementary interactions are contemporaneous rather than sequential. Example: One participant of a H2020 project is involved in a concurrent project that uses ESIF support to develop methods of importance to the H2020 project aims. The two projects are legally separate, but concurrent synergies are developed through the targeted, parallel use of funds.

Strategic synergies	Strategic synergies are characterised as planned synergies through aligning policy objectives, synergy-enhancing implementation rules and requirements. Example: The LIFE programme's regulation foresees an extra point for proposals that plan to take up results generated through H2020 research projects, building a synergy-enhancing rule at the programming phase.
Operational synergies	Operational synergies refer to interactions regarding concrete ways to implement the collaboration, including financial and non-financial aspects. This collaboration can be intentional or incidental. A special case of operational synergy is substitution synergy which occurs when successfully evaluated H2020 proposals are subsequently funded by other sources (e.g. Seal of Excellence). Example: EIT Knowledge and Innovation Communities organise informal collaboration and networking events to reach out to national and regional authorities in charge of smart specialisation strategies (S3). The events help to identify areas where KIC expertise can support national S3 priority activities.

1. Introduction to the evaluation

1.1. Introduction and structure of the report

This **final report** provides the results of the 'Evaluation study on the external coherence and synergies of Horizon 2020 (H2020) within the European research and innovation support system'. Commissioned by the Directorate-General for Research and Innovation (DG RTD), the study was implemented in the period April 2021-September 2022 by a consortium consisting of Ecorys, EFIS Centre, Visionary Analytics, and Carsa.

The report begins by briefly introducing the evaluation framework (objectives, scope, methodology), while further details are provided in annexes. It then presents answers the set of evaluation questions and concludes with an overall assessment and identification of areas for improvement. The report is structured as follows:

- The objectives, scope, methodology and limitations of the study (Section 1)
- An assessment of the external coherence of specific H2020 elements (Section 2)
- Overall assessment of the H2020 external coherences and possible areas for improvement (Section 3)

1.2. Objectives of the study

The Horizon 2020 programme was the main EU instrument to support research, and innovation (R&I), building on the experience of the previous seven Framework Programmes (FP). The Regulation that established the programme for the period 2014-2020[1] foresaw that the Commission should conduct an ex-post evaluation of the programme. This study will feed into this ex-post evaluation.

The objective of this study is to evaluate the **external coherence of H2020 in relation to the rest of the R&I policy environment,** as well as identify evidence of and learn from successful and less successful **examples** of synergies on the levels of programming and implementation of projects. Furthermore, the analysis aims to identify **obstacles/constraints** hampering synergies between H2020 and other programmes.

The principle that H2020 programme shall seek synergies with other programmes and instruments is embedded in Regulation (EU) No 1291/2013. The Regulation states that H2020 "should develop close synergies with other Union programmes in areas such as education, space, environment, energy, agriculture and fisheries, competitiveness and SMEs, internal security, culture and media"[2] and the programme "should develop closer synergies, which may also take the form of public-public partnerships (P2P), with international, national and regional programmes that support R&I"[3] More specifically the legal setup of the Framework Programme underlines that its funding should be implemented in a complementary manner to EU programmes such as the European Structural and Investment Funds (ESIF), the Common Agricultural Policy (CAP), the Programme for the

[1] Regulation 1291/2013/EC establishing Horizon 2020
[2] Recital 32 of the Horizon 2020 Regulation
[3] Recital 39 of the Horizon 2020 Regulation

competitiveness of enterprises and small and medium enterprises (COSME), the Erasmus+ Programme and the Life Programme.

According to the Better Regulation Guidelines (BRG), the "evaluation of coherence involves looking at how well or not different interventions, EU policies or national/regional/local policy elements work together"[4]. Synergy is understood as complementary efforts involving two or more policies, programmes, or projects to achieve greater impact and efficiency[5], as well as higher quality and quantity of investments than it would be possible individually. This may involve the combination of different types of research, innovation and/or competitiveness support, or continuing the support of innovative ideas across programmes to ensure they are efficiently brought to the market. The focus of the study is at EU programme level while also covering synergies with the national level.

1.3. Scope of the study

The study scope has four main dimensions: **thematic, geographic**, **temporal**, and **evaluation scope**.

Thematic scope: the study considers all activities conducted under the H2020 programme (2014-2020). The internal coherence of these activities (i.e., their effective and efficient coordination within the programme itself) is not considered[6], and the focus is exclusively on external coherence. More specifically, external programmes and initiatives are deemed relevant when they cover the following functions of the **European R&I support system**:

- Support for research and innovation activities;
- Set-up of regulatory and policy framework;
- Support to market formation, deployment and use of R&I solutions;
- Support to R&I skills and human capital development;
- Provision of infrastructures;
- Support to entrepreneurship, SME growth and internationalisation;
- Support for knowledge diffusion.

The list of relevant programmes and initiatives included in the evaluation is as follows:

Programmes **under the 2014-2020 MFF:**

- Common Agricultural Policy and Rural Development (CAP Pillar I and II);
- Competitiveness of Enterprises and SMEs (COSME);
- Connecting Europe Facility (CEF);
- Copernicus;
- Creative Europe;
- Erasmus +;
- EU Health Programme;
- Euratom Research and Training Programme;
- European Funds for Strategic Investments (EFSI) and relevant EIB instruments;
- European Structural and Investment Funds (ESIF) – the European Regional Development Fund (ERDF); the European Social Fund (ESF); the Cohesion Fund; the European Agricultural Fund for Rural Development (EAFRD); the European Maritime and Fisheries Fund (EMFF);

[4] See: https://ec.europa.eu/info/sites/default/files/br_toolbox-nov_2021_en_0.pdf
[5] See: https://ec.europa.eu/regional_policy/sources/docgener/guides/synergy/synergies_en.pdf
[6] It is covered by a separate study commissioned by DG RTD.

- GALILEO and EGNOS;
- Preparatory Action on Defence Research (PADR);
- Programme for the Environment and Climate Action (LIFE).

Programmes **outside the 2014-2020 MFF**:

- Important Projects of Common European Interest (IPCEI);
- Innovation Fund and NER300 programme (its predecessor);
- Other programmes in EU Member States or associated countries at national, regional, or local level or implemented by private actors or charity initiatives;
- Research Fund for Coal and Steel.

This very wide thematic scope of the evaluation has been the biggest challenge for the evaluation. H2020 covers various elements (e.g., skills, research infrastructure, SMEs), practically all key policy segments (including the twin transition[7] and health), and a large variety of tools (grants, financial instruments, partnerships, synergy initiatives like the COFUND, etc.). Many of the programmes for which we explore potential synergies with H2020 initiatives have been the subject of dedicated evaluations (e.g. the mid-term evaluations of the Connecting Europe Facility[8] and the Erasmus+ programme[9]), including on external coherence. This study makes use of such evaluations and adds to them a portfolio analysis and insights from case studies. Nevertheless, the breadth of H2020 undoubtedly also affects the depth of the answers to the evaluation questions.

Geographic scope: the geographic scope is EU28 (the EU Member States for the period 2014-2020, including the UK) and associated H2020 countries. The text and data mining covers all countries, and the case studies draw on examples and interviewees from many different EU and non-EU countries (with a substantial focus on EU28).

Temporal scope: the study considers the whole period covered by the H2020 programme (2014-2020).

Evaluation questions scope: The evaluation questions related to the assessment of the external coherence and synergies of Horizon 2020 within the European research and innovation support system are presented in Table 3. To ensure a logical narrative, we start by providing answers to the evaluation question (EQs) on H2020 positioning (EQ1). Then we present the findings on specific H2020 support related to market uptake, skills, research infrastructure, and financial instruments, in particular, for SMEs (EQ3-EQ6). Subsequently, the report presents findings on the process of ensuring external coherence (navigability – EQ7, coordination mechanisms – EQ9, and the H2020 approach for ensuring different types of synergies – EQ8). Lastly, as required in the ToR, we conclude with findings on the three thematic policies (green, digital, health in EQ10) and a summary of the conclusions on the external coherence of H2020 (EQ2).

[7] The term refers to the reinforcing relationship between the green and digital transition

[8] COMMISSION STAFF WORKING DOCUMENT Accompanying the document Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the mid-term evaluation of the Connecting Europe Facility (CEF) {COM(2018) 66 final/2} Available at: https://ec.europa.eu/info/sites/default/files/mid-term_evaluation_cef_swd_2018_44_1.pdf

[9] Mid-term evaluation of the Erasmus+ programme (2014-2020) Accompanying the document REPORT FROM THE COMMISION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF REGIONS Mid-term evaluation of the Erasmus+ programme (2014-2020) {COM(2018) 50 final}. Available at: https://ec.europa.eu/info/sites/default/files/m-t_evaluatio_erasmus_swd_2018_40.pdf

Table 3. Overview of evaluation questions (EQ)

Theme	Overall question	Section
1. H2020 positioning and role	What gaps is Horizon 2020 filling within the overall European research and innovation support system?	2.1
2. Coherence of H2020 activities in the EU landscape	What is the coherence (linkages, synergies/complementarities, overlaps, obstacles, constraints) of the activities of Horizon 2020 within the overall European research and innovation support system?	All sections, summary in Section 3
3. Roll-out and deployment of H2020 results	How does complementarity with other EU/national/regional actions support the market-driven uptake, roll-out and deployment of Horizon 2020 R&I results once the projects are completed?	2.2
4. Complementarity of H2020 support in fostering skills, higher education and research career development	To what extent are the EU and national programmes, funds and initiatives supporting skills, higher education and research careers' development working in complementarity with Horizon 2020 towards the reinforcement of the European research and innovation system?	2.2
5. Combination of H2020 and place-based approaches to R&I support for research infrastructure	To what extent are the EU and national programmes, funds and initiatives supporting the reinforcement of regional, national or European capacities and infrastructures (including for testing, experimentation and demonstration) working in complementarity with Horizon 2020 towards the reinforcement of the overall European research and innovation system?	2.2

6. Funding complementarities in support of R&I activities	To what extent are the EU and national programmes, funds, financial instruments and initiatives supporting entrepreneurship and SME growth working in complementarity with Horizon 2020 towards the reinforcement of the overall European research and innovation system?	2.2
7. Navigability, readability and clarity of EU R&I funding landscape	To what extent do different types of stakeholders find their way (in terms of ease of access to information, its clarity and navigability) on where to go for specific R&I related support needs in the EU?	2.3
8. What synergy mechanisms worked in practice and what can be learned for future Horizon Europe	To what extent did Horizon 2020 approach to fostering synergies with other programmes work in practice, e.g. alternative funding (Seal of Excellence), complementary/combined (e.g. Teaming) and cumulative funding, sequential funding, and capacity building and market uptake activities, partnerships with Member States, etc.?	2.5
9. Coordination of policy design, implementation and follow-up; how policy learning was organised	How is coordination ensured between different initiatives (among EU initiatives and between EU initiatives and national/regional ones) at the level of policy design, policy implementation and follow-up?	2.4
10. Contribution of the framework conditions in the EU to green/digital transition and health	To what extent is the H2020 external coherence supportive in leading the transitions towards a 1) greener, 2) digital, and 3) healthier future?	2.6

1.4. Brief description of the methodology

The study followed the standard evaluation stages (structuring, data collection, analysis, and reporting – see Figure 1). The evaluation started with the **Structuring (Inception stage)** that consisted of validating the proposed approach with the European Commission, including via scoping interviews (see Annex 1 for a list of interviewed organisations).

At the core of the **Data collection** were 13 synergy case studies, seven fictional and three system case studies (see Annex 3 for a list). For every case study we performed desk research and interviews: on average 3-5 per synergy case study and 7-8 per in-depth case study (see Annex 1 for a full list of interviewed organisations). The interviews were complemented with horizontal desk research and data mining (see Annex 2 for more details).

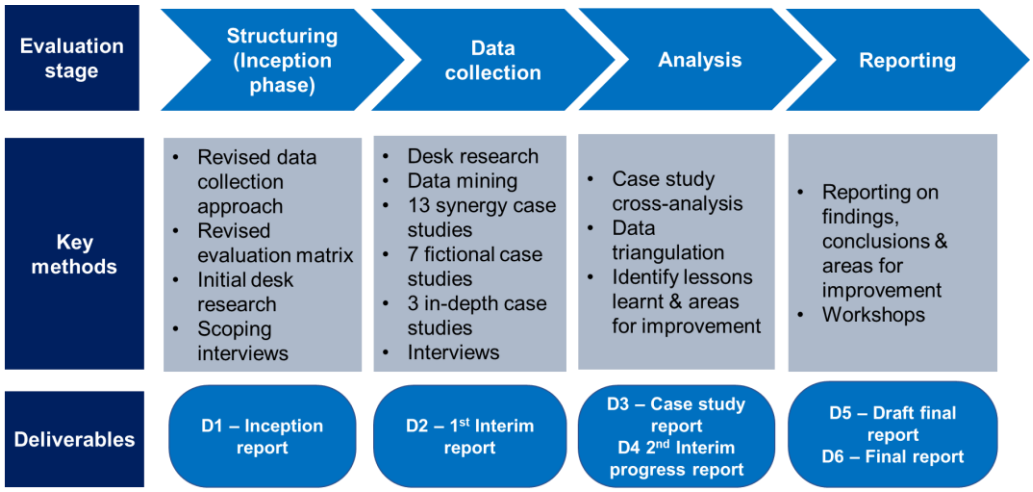


Figure 1. Overall approach

For the **Analysis**, we relied on the extensive inputs gathered from the data collection stage and on triangulating data from different sources and databases (see Annex 2, which presents the data analysis) to answer the evaluation questions, identify valuable lessons learnt, and potential areas for improvement.

The last stage, in chronological order, was the **Reporting**, which entailed the compilation of all findings, conclusions and recommendations in a concise report. As a part of this stage, we discussed the evaluation findings of the draft final report (submitted at the end of June 2022) in a **validation workshop held on 13 July 2022**.

1.5. Limitations

Following the performance of the abovementioned data mining, desk research, and case studies, we conclude that the three methods provide sufficient coverage and input for answering the evaluation questions. The link between the methods and the evaluation questions is presented in Table 4.

Table 4. Overview of evaluation questions

EQ	Data mining	Data research	Case studies
1. H2020 positioning and role	☒	-[10]	☒
2. Coherence of H2020 activities in the EU landscape	☒		☒
3. Roll-out and deployment of H2020 results	To a limited extent	☒	☒
4. Complementarity of H2020 support in fostering skills, higher education and research career development		☒	☒
5. Combination of H2020 and place-based approaches to R&I support		☒	☒
6. Funding complementarities – grants, debt, equity – in support of R&I activities	☐	☒	☒
7. Navigability, readability and clarity of EU R&I funding landscape	☐	☒	☒
8. What synergy mechanisms worked in practice and what can be learned for future Horizon Europe	☐	☒	☒
9. Coordination of policy design, implementation and follow-up; how policy learning was organised	☐	☒	☒
10. Contribution of the framework conditions in the EU to green/digital transition and health	☒	-[11]	☒

To identify potential external synergies between H2020 and R&I projects financed through other means, different projects were linked together based on beneficiaries and keywords. While this approach is methodologically sound, available information from different programmes on beneficiaries and projects was not uniform. Thus, we had to employ natural language processing techniques to facilitate the links. This is a limitation given that natural language processing does not provide exact answers and hence sometimes, **some projects might have been linked incorrectly**. In addition, some correct links might identify overlaps between projects rather than links. To mitigate this, a subset of data was checked manually and appropriate modifications to the methodology were made. Nevertheless, given that the

[10] The question is covered by the desk research for EQ 3-9
[11] The desk research for EQ10 is included in the respective case studies

project analysed over one million projects from many EU, national, and regions, programmes a full robust check of the data was impossible. Further limitations to the data analysis include:

- **EuroSciVoc keywords maybe assigned arbitrary**, which is often the case when coding research and projects. Naturally, this also affects the establishment of potential links between projects.
- Even more importantly, the programmes for which we have performed the linking **only cover the 2014-2020 period**, which precludes the identification of links across different programming periods.
- The data mining/analysis at the national level was performed for **five different national and regional R&I initiatives across the EU**[12]. Even if the initiatives were selected for the analysis to ensure a relatively diverse view of national funding in the EU, they cannot be deemed representative of the large variety of national/regional initiatives across the EU.

Considering all the above limitations, as repeatedly mentioned in this report, the findings based on the data analysis should be treated with caution. They aim to indicate (e.g., the possible links and the room for further increasing the links between initiatives) rather than to measure the extent of synergies or overlaps.

To a certain extent, the desk research coverage is a mirror image of the application of the data mining method. **Desk research** focused on finding insights/evidence in the literature **on the more specific evaluation questions rather than the cross-cutting ones**. The literature review provided useful information that fed into answering the evaluation questions (e.g. on the rationale for other EU/national programmes and in particular evaluations of other EU programmes, which also explored the criterion of external coherence). However, it should be noted that the reviewed sources (see Annex 4 and 5) provided **mostly normative findings** on how synergies should work, rather than in-depth assessments of external coherence-related issues.

The main mitigation strategy in terms of addressing the above challenges was the case study methodology, which has been the backbone of this evaluation. The **case studies** (which inform this final report) **have focused on providing concrete examples** of what worked and what did not in terms of external coherence and ensuring it. They have included desk research, but above all, they draw heavily from input provided by stakeholders (see Annex 1). For the purposes of tracing evidence, in this report we have provided specific references to the case study numbers. As stated in the case study report, the findings of the case studies provide a good understanding of the various mechanisms of H2020 external coherence and existing synergies, gaps and overlaps. They are also comprehensive in terms of the coverage of evaluation questions, geography, and programmes. Nevertheless, the key challenge with case studies is presenting **comprehensive rather than only anecdotal case-based insights**. The study team addressed this challenge in the following ways:

- Triangulating (where possible) with findings from the data analysis and the desk research;
- Crossing case study (CS) findings stemming from different perspectives: specific sectors of support (e.g. CS5, which focused on skills), processes (e.g. CS7 focussing on cooperation mechanisms), and an overarching policy perspective (e.g. the system case studies in the fields of green transition (CS21), digital transition (CS22), and improving health (CS23)). This allowed the intertwining of similar findings coming from different perspectives. Where relevant, the text refers to the case study numbers and where

[12] DFG (German Research Foundation), (ii) ANR (French National Research Agency) and similar institutions in France, (iii) Croatian Science Foundation (HRZZ), (iv) National Science Centre (NCN) of Poland and similar institutions, and (v) the Swedish Research Council, Swedish innovation agency Vinova, and similar

needed (e.g. when the CS is referenced for the first time, or when its topic is not self-evident) it also provides clarification on the scope of the case study.

The study involved the performance of **more than 130 interviews** altogether. The list of interviews (see Annex 1) includes:

- A combination of **EU and national level actors;**
- A **large variety of stakeholders** such as universities, research centres, associations, regional authorities, ministry representatives, programme managers, National Contact Points, different DGs of the EC, and the EIB;
- Interviewees at **relevant positions** for the type of information inquired (heads of units, directors, coordinators, etc.).

Thus, the interviewees cover **all main stakeholder groups and provide sufficiently representative views for the purposes of the case studies and the study.**

In conclusion, the applied evaluation methods provide good coverage in terms of both evaluation questions and EU/national programmes. The methodology focused on case studies that provided real examples of synergies (or lack of them), which were coupled with desk research, data analysis, and the performance of numerous interviews with various stakeholder groups. Considering the breadth of the H2020, the **methodological approach** followed for this evaluation of the external coherence of H2020 **has been consistent and logical** and allowed the evaluation team to reach robust conclusions. In cases where the information is insufficient, we have flagged this in the text.

2. Assessment of the external coherence of specific H2020 elements

2.1. Gaps filled by the H2020 programme

Key findings:

- Financing transnational R&I activities and networks based on the key criteria of excellence has been the main role of Horizon 2020 in the European R&I landscape. Like previous Framework Programmes, **H2020 continued to fill an important policy gap through its pan-European approach** and the scale of R&I support in addressing societal challenges.
- H2020 has been an important support for novel research activities due to the **programme's role in promoting a degree of freedom and originality** for the funded projects (especially ERC and MSCA)[13].
- H2020 has had a **strategic and coordinating role in shaping the overall European research and technology infrastructure landscape**.
- The **emphasis of the programme to provide support across the entire R&I value chain**, including close-to-market activities, has played the most important role with respect to transnational projects in cross-cutting challenge areas (e.g., green innovation, Industry 4.0, raw materials). The programme allowed to scale-up projects quicker and enable longer-term and more sizeable funding amounts than it was possible at national level individually.

This section draws together evidence on the role and positioning of Horizon 2020 within the overall European R&I support system. It elaborates on the policy gaps that the Horizon 2020 scope of action fills vis-à-vis the coverage of other European, national and regional initiatives. Furthermore, the section outlines the identified contribution of H2020 to the main functions of the R&I system.

The Framework Programme remains the **sole EU programme supporting transnational R&I activities and networks,** including through partnerships with Member States, businesses, and foundations, based on the **key criteria of excellence**. In the period 2014-2020, nearly €80bn of funding was available through H2020 with more than 35,000 projects financed (see Annex 2). Transnational projects accounted for more than 70% of the total funding, while the remaining 30% were dedicated to monobeneficiary schemes.[14] Its **pan-European approach, the scale of support and strong networks of R&I players** are aspects that are regarded by the interviewed beneficiaries as playing a unique role in the European R&I support system. H2020 allows the creation of broad and large-scale project consortia with European and international partners, which helps to boost the quantity and quality of research undertaken. Stakeholder interviews indicate that even in countries where other funding instruments support similar types of activities in specific areas (e.g. support for green innovation in Sweden, Denmark, and Germany, support for agri-food in Italy), participation in H2020 is still attractive in terms of the international context of projects, the network of excellent players it brings together and opportunities to share expertise in this

[13] This is evident to a smaller degree in the national support programmes.
[14] Based on the data on H2020 projects and beneficiaries retrieved on 15/02/2022 from data.europe.eu: https://data.europa.eu/data/datasets/cordish2020projects

network (CS1: Deployment of green innovation, CS8: Coherence in support to agrifood value chains).

Support to R&I activities at TRL 1-6

The 'Excellent Science' Pillar of Horizon 2020 aims to reinforce and extend the excellence of the Union's science base and to consolidate the European Research Area (ERA) to make the European R&I system more competitive globally. It supports basic science and collaborative research to extend Europe's capacity for advanced and paradigm-changing innovation. The beneficiaries recognise **that H2020's role in promoting fundamental and novel research activities is significant due to the degree of freedom and originality** enabled by the programme (CS8: Coherence in support to agri-food value chains; CS16: Fictional case on a fish farmer). Participation in these prestigious funding schemes adds value to the beneficiaries as it increases their credibility in the eyes of other players and promotes their centrality in international expertise networks in specific R&I topics (CS3: Complementary financing with Cohesion policy at project level, CS8: Coherence in support to agri-food value chains).

That said, the **role H2020 plays vis-à-vis national programmes in support of fundamental research projects varies across thematic fields and across countries**. For example, the analysis of the individual Member State health research funding systems showed that in countries like Sweden and Germany, which offer significant national funding opportunities for basic research on health, researchers tend to rely more on and apply for national funding rather than EU funding due to the simpler, less complex application process and lower time investment needed. At the same time, limited national funding resources for basic research, e.g., in the case of Spain, encourage more active participation in H2020 opportunities (CS23: R&I system case on health). These circumstances occasionally can lead to funding displacement effects, e.g., the area of concentrated solar power in Spain (CS1: Deployment of green innovations), yet this effect is not observed in all countries with more limited funds and across all R&I thematic areas. The data mining results exploring the most frequently appearing keywords in H2020 projects and funding programmes of five selected MS provided indications that health topics (e.g. bacteriology, immunology) appear to be relatively more dominant in national programmes. In contrast, topics related to the twin transition (e.g. climate change, renewable energy, computational intelligence) are more prominent in H2020 projects (see details in Annex 2).

Support for R&I skills and human capital development

The free circulation of researchers and knowledge enables better cross-border cooperation in the ERA, building a critical mass of continent-wide competition. Another angle for the promotion of excellent science is H2020 support for the **advancement of researcher careers, mobility, and talent circulation**. H2020 has provided support to individual researchers through the European Research Council (ERC) and Marie Skłodowska-Curie Actions (MSCA), and R&I networks for knowledge exchange. Knowledge and Innovation Communities (KICs) of the European Institute of Innovation and Technology (EIT) targeted the development of entrepreneurial and innovation skills in cross-cutting societal challenges by introducing a pan-European model for the knowledge triangle integration[15]. Horizon 2020 also aimed to reinforce human capacity in low R&I performing countries (e.g. through ERA Chairs). All these initiatives complement a complex national landscape of support for R&I

[15] European Commission (2017) Evaluation of the European Institute of Innovation and Technology (EIT). Final Report. Available: https://education.ec.europa.eu/document/evaluation-of-the-european-institute-of-innovation-and-technology-eit-final-report

skills and capacities. Hence singling out distinct policy gaps that H2020 bridge in these efforts is not straightforward.

Concerning MSCA, the programme is positioned in such a way that it often serves as the steppingstone for many academics to gain the necessary R&I knowledge to start their research career and become world-class researchers. While other fellowship schemes exist at national level, as well as support for researcher mobility, the existing initiatives are often relatively small in scope and scale (CS5: Skills). H2020 schemes present an additional opportunity for researchers to pursue their research and skills development regardless of the funding available in their home countries. Moreover, the fact that **MSCA and the ERC grants do not prioritise any research area, allows applicants with a bright research idea in any field to apply and potentially obtain funding.** This advantage is not evident in the investigated national scholarship schemes (i.e., Croatia, Denmark) (CS15: Support for young researchers).

Provision of research and technological infrastructures

The 'Excellent Science' pillar also includes activities to provide Europe with outstanding and accessible **research infrastructures (RIs)** as part of an integrated European research and technology infrastructure landscape. The **integration and interconnection of national research infrastructures and reinforcement of European research infrastructure policy** and international cooperation are the main policy gaps that H2020 funding has filled. The strategy-led approach of the European Strategy Forum on Research Infrastructure (ESFRI) has enabled more focused disbursement of H2020 funding promoting development of pan-European RIs and more efficient and open use of national RIs. The consequent and substantial investment in RIs over the last 20 years is considered one of the highlights of the ERA[16]. While RI construction and operation are funded from a wide range of European, national and regional sources, **the support for priority investments identified in ESFRI Roadmaps has played an important role in shaping the overall European research and technology infrastructure landscape** (CS6: Infrastructure and R&I; CS21: R&I system case for green transition).

Support to market formation, deployment and use of R&I solutions

Horizon 2020 invested in activities across the entire R&I value chain, including support for the development, demonstration and market uptake of innovative solutions through co-creation, SME support and public procurement. At higher Technology Readiness Levels (TRL)[17] H2020 included such initiatives as the European Innovation Council (EIC) Fast Track to Innovation and EIT KICs. TRL 7-9 are, in principle, considered a part of the competitive market and are usually not supported by national or regional funding[18] due to the for-profit nature of the businesses behind them. In the field of Industry 4.0 stakeholders recognise that **H2020 plays a relevant role as, given its European dimension, it has the potential to quickly scale-up projects and enable longer-term and more sizeable funding amounts** (CS10 on Industry 4.0). The role of H2020 in promoting the creation of new value chains has also been underlined as an aspect that cannot be accomplished by each region working independently (e.g., CS2 on complimentary financing with Cohesion policy in mining industry, CS8 on agri-food value chains).

[16] E.g. by decision-making bodies such as DG R&I, DG REGIO, JRC, ESFRI

[17] Technology Readiness Levels (TRL) are a type of measurement system used to assess the maturity level of a particular technology. Each technology project is evaluated against the parameters for each technology level and is then assigned a TRL rating based on the projects progress. There are nine technology readiness levels. TRL 1 is the lowest and TRL 9 is the highest.

[18] State Aid rules limit the type of close-to-market projects that can receive public funding

The H2020 funding for TRL 7-9 is also an important element for incentivising participation in the programme. The analysis of selected MS (Sweden, Germany, Spain and Poland) health innovation funding schemes suggested that innovation and implementation are less funded in the national funding programmes, which support mainly basic research[19]. **Focus on implementation and deployment of innovation in H2020 was seen as one of the most important complementarities and added values of participating in H2020** (CS23: R&I system case on health).

According to the study on Mainstreaming Innovation Funding in the EU Budget, H2020 investments in aspects such as support for the diffusion of innovation, support to innovative firms and exchange of knowledge and information in comparison with aggregated funding invested by ERDF are considerably smaller[20], yet the funded projects are different in nature. **H2020 projects are primarily technology and innovation-centric and often transnational, whereas other programmes (ERDF, EFSI, CEF Telecom, COSME) supported predominantly local or regional projects, incremental innovations and R&I infrastructure** (CS2 on complimentary financing with Cohesion policy, CS6 on Infrastructure and R&I, CS9 on transport, infrastructure and mobility, CS10 on Industry 4.0).

Support to entrepreneurship, SME growth and internationalisation, including seed and growth financing

Horizon 2020 supported the launch and scale-up of innovative start-ups, SMEs and mid-cap firms with breakthrough potential to create new markets with financial instruments. This was mainly supported through the EIC pilot initiative, as well as blended finance for innovators under the InnovFin actions and support to companies (incl. mentoring and coaching) provided by the EIT KICs. Results from interviews suggest that the most common way for SMEs - especially smaller ones - to set up an R&I project is still to subcontract a research group or use their own funds. In general, **national, and regional instruments are perceived by entrepreneurs as more suitable for the incubation phase, whilst national and European schemes become more important in the expansion phase** (CS14 on an individual entrepreneur with an innovative idea).

H2020 prioritised the creation of knowledge that would later be brought closer to market with other schemes or instruments, creating successive synergies, with projects building on each other and developing technologies that get closer to market with other instruments. The **structural cooperation between the EIT and EIC** aiming to share data and intelligence on innovative start-ups and SMEs they support has been recognised as a good practice that **addresses the main bottlenecks for start-up and SME scale-up and growth – sequential logic in the design of support instruments** (CS10 on Industry 4.0, CS14 on an individual entrepreneur with an innovative idea).

2.2. External coherence of key R&I support system elements

This section assesses external coherence by covering four key R&I support system elements: market uptake; skills; research infrastructures; and financial instruments. Before analysing these elements one by one, the next paragraphs present general findings based on the data analysis.

[19] Based on data mining results

[20] Delors Institute (2019) Study requested by the BUDG Committee of the European Parliament, Mainstreaming Innovation Funding in the EU Budget

The data analysis suggests that approximately 20% to 30% of the H2020 projects from various disciplines[21] shared at least one beneficiary and had a similar thematic focus (based on keyword analysis)[22] with EU-initiative projects[23] beyond the H2020 framework.
Since there is no benchmark, or other similar analysis using the same methodology, these estimates cannot be interpreted unequivocally. Nevertheless, the analysis suggests that **most H2020 projects were not found to be connected to projects outside of H2020**,

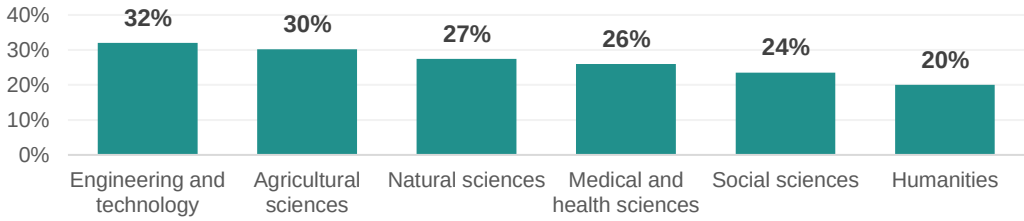


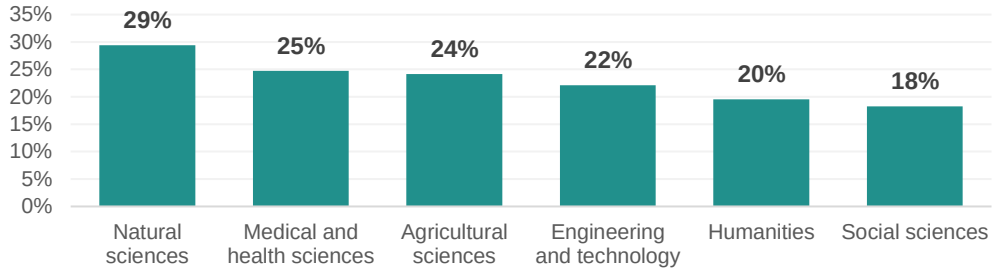
Figure 2. Percentage of H2020 projects from different scientific fields connected (based on sharing at least one beneficiary and keywords) to projects funded through EU programmes other than H2020

Source: Own estimates based on information on projects funded through different EU initiatives

which indicates that there is **still room for growth in improving synergies** between H2020 and non-H2020 initiatives.

Additional insights can also be derived from evaluating the connections of H2020 projects from different thematic disciplines to national/regional projects. As can be seen in Figure 3, using both H2020 and national databases yields a very similar result at national level in terms of possible connections between H2020 and national research projects. The detected possible links are also in the 20-30% range with humanities/social sciences showing fewer links than the other disciplines. An explanation for the diversity between the disciplines is beyond the scope of this study, but the results at national level **also suggests potential for increasing the synergies between H2020 projects and national R&D projects**.

[21] A list of the reviewed disciplines and the potential percentage of links based on the data analysis: Engineering and technology (32%), Agricultural sciences (30%), Natural sciences (27%), Medical and health sciences (26%), Social sciences (24%), Humanities (20%).
[22] The linking was done by, first, linking projects from H2020 and projects from other programmes if they share at least one beneficiary. This provides initial insights on possible links between H2020 and other programmes, but it does not necessarily indicate any synergies or overlaps. Hence, to refine these links, projects that did not share any keywords were decoupled. Keyword linking was done, when possible, using EuroSciVoc keywords as the majority of H2020 projects have several of these keywords assigned to them.
[23] Projects financed from the following initiatives: European Structural Investment Funds (ESIF), Health Programme, Connecting Europe Facility (CEF), Research Fund for Coal and Steel (RFCS), LIFE, Common Agricultural Policy (CAP), and Creative Europe (CE)



Source: Own estimates based on data from different national research organisations and H2020

Figure 3. Percentage of H2020 projects from different scientific fields connected (based on sharing at least one beneficiary and keywords) to projects funded through national/regional programmes

Further insights, including based on the analysed data, on specific R&I support system elements, are presented in the following sections.

Synergies/complementarities, overlaps in the support system for market-driven uptake, roll-out and deployment of Horizon 2020 R&I results

Key findings:

- **There is fragmented evidence on the extent to which H2020 results are rolled-out and taken up** by industry, policy makers, hospitals, NGOs and other research users depending on the type of beneficiaries, innovation dynamics and framework conditions in specific thematic areas, and the advancement of particular national R&I support systems.
- **One of the main challenges is the amount of information available on the exploitable results of H2020 projects and the consistency of this information.** On the one hand, there is a wealth of research findings and data produced by many projects. On the other hand, the information that is published on project results is often incomplete and inconsistent due to objective reasons (e.g., pending patent applications) or the lack of understanding of what type of information is useful for result users (researchers, companies, financing institutions).
- While stakeholders share less confidence that H2020 facilitates the roll-out and deployment of R&I results effectively, the programme **does provide good 'signalling effects' about the quality, relevance and potential of supported projects facilitating access to finance from financial institutions.**
- There seems to be **poor knowledge among H2020 stakeholders about the EU-wide exploitation support services**. While stakeholders recognise such services as the Innovation Radar and the Horizon Results Platform, their use appears to remain sporadic.
- While national and regional authorities recognise the importance of commercialisation and uptake of R&I results (e.g. in improving agri-food production and healthcare systems), **H2020 project outcomes do not appear to be widely used as a source for opening up prospects for innovation deployment** at national and regional level.

- Involving national and regional public authorities in the exploitation of H2020 results requires dedicated communication activities and engagement commitments. **H2020 results often lack the maturity and scalability to transfer the outcomes directly into the realities of national agri-food, healthcare and other sectoral policy-making systems**. The most effective deployment of results stems from the initiatives where national/regional authorities are either directly involved or properly informed about the aims at the start of the H2020 project.

The beneficiaries of H2020 funding are expected to engage in spreading and expanding the impact of insights collected through the supported activities beyond the end of the projects. In this line, H2020's legal basis, outlining the rules of participation, states that "Each participant that has received Union funding shall use its best efforts to exploit the results it owns, or to have them exploited by another legal entity..."[24]. This section provides findings on the external coherence of H2020 with respect to the exploitation of results.

H2020 exploitation activities can include a wide array of activities covering a broad range of areas. See Figure 4 for various types of exploitation pathways. It is important to recognise that some H2020 instruments are designed to complete the innovation cycle through other EU programmes as deployment vehicles, while other low TRL activities feed research and SME programmes. H2020 funds a broad range of activities at various innovation steps, with various thematic focuses and end goals (e.g. technical, socio-economic or citizen engagement).

Figure 4. Types of exploitation pathways for various stakeholder groups

Source: Own elaboration

[24] Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" and repealing Regulation (EC) No 1906/2006

EU programmes

The analysis of policy documents and recent programme evaluations point out that there is much potential to roll out H2020-funded research and innovation through other EU programmes, e.g., CEF Digital, Copernicus, Transport, Energy, EU Health, LIFE, Cohesion policy instruments (ERDF, ESF, EAFRD), etc., thanks to the complementarities between the programme objectives. For example, Horizon 2020 predominantly supports the early stages of the innovation chain, while CEF enables technological deployment throughout the infrastructure[25] (also confirmed by CS9: Coherence in support to transport, infrastructure and mobility sector). The LIFE programme works as an instrument to help 'close-to-market projects' and has been instrumental in supporting green innovations and cleantech solutions across Europe (CS1: Deployment of green innovations). LIFE programme's regulation stipulates that it should encourage the uptake of the results of environmental and climate-related research and innovation carried out under Horizon 2020[26]. During the funding award process, an extra point is granted to LIFE proposals that plan to take up results generated through EU-funded research projects. Hence there is a **synergy-enhancing rule built into the programme design that helps programmes to operate in a mutually reinforcing manner.** Also, the objective of the EU Health programme is to facilitate the deployment of research results (CS2 on R&I system case on health).

While this "potential [for the roll-out of results] is acknowledged in regulation preambles and reports it is still underexploited [in practice].[27] Overall, case studies indicate that there is **fragmented evidence of the extent to which H2020 results are taken up by industry, policymakers, hospitals, NGOs, and other research users.** The scale of uptake and exploitation of H2020 results are closely linked to the type of beneficiaries, innovation dynamics and framework conditions in specific thematic areas and the advancement of national R&I support systems. The case studies explored the deployment of H2020 results more closely in three thematic areas – green innovation, agri-food and Industry 4.0.

In the area of green innovation, the examined examples from Denmark, Germany, Spain, and Sweden indicated that H2020 results achieve market roll-out, however, this largely depends on the **beneficiary having a well-established network of private and public partners**. Hence **a cluster or an organisation that includes stakeholders working close to the market can assist in the take-up and exploitation of H2020 results**. Such an example of Kalundborg Symbiosis in Denmark showcased H2020 funding synergies with funding programmes from Nordic Innovation, ERDF, Region Zealand, Interreg (CS1 on green innovations).

The case study on agro-food sector in Italy examined evidence of successive and downstream funding synergies with projects building on each other and developing technologies that get closer to the market with the support of regional and national funding schemes (EARDF, national funds from sectoral ministries, sector-specific regional initiatives). H2020 promotes the flow of ideas from basic and applied research to experimental development and marketability. The case study underlined that **due to H2020, agri-food research centres in Italy were able to establish public-private partnerships and even offer technical assistance to private companies in exploiting the research results.** Hence, H2020 is regarded as the initiator of projects subsequently sponsored by other

[25] Commission Staff Working Document (2018) Mid-Term Evaluation of the Connecting Europe Facility (CEF), SWD(2018) 44 final

[26] Regulation of the European Parliament and of the Council No 1293/2013 on the establishment of a Programme for the Environment and Climate Action (LIFE) and repealing Regulation (EC) No 614/2007

[27] EC (2019) Mainstreaming Innovation Funding in the EU Budget: Budgetary Affairs. Study carried out by Delors Institute, pp: 11

programmes, e.g., the National Operational Programmes, Rural Development Programmes, Regional Operational Programmes (CS8: Coherence in support to agri-food value chains).

In the area of Industry 4.0, stakeholders have emphasised that the commercialisation of R&I results is a problem that should not necessarily be ascribed to only H2020, but rather to the overall European R&I system. Clearly, **not all results of H2020 projects can be brought forwards to the market**, and not all resources put into R&I can translate into usable products. Moreover, **existing resources, which could be useful to bring SMEs closer to potential clients, are not always advertised enough**. For instance, many H2020 projects in the field of Industry 4.0 lead to the creation of a platform or marketplace, and many are now available online. However, manufacturing companies are often not interested in online services (either because they do not need them or because they are unaware of the benefits they entail). Therefore, many of these platforms are nowadays unused as the companies they were directed to are unaware of the benefits or of the existence of the advanced digital technologies that the EC strives to push forward (CS10 on Industry 4.0).

While this study detected pockets of success stories when it comes to the deployment of H2020 results, there is a general observation that **it is difficult for all partners to focus on direct commercial exploitation of the innovations produced**. For example, not-for-profit research centres and universities are less interested in commercial exploitation, as it is not their core mission (CS3 on complementary financing with Cohesion policy and CS8 on support to agri-food value chains). Some public research institutions cannot participate in TRL8-9 and are not allowed to work with risk capital, hence excluding certain other types of funding and are more dependent on grants or working directly with industry (CS1 on green innovations). Commercial exploitation of innovations also needs specific skills and industrial expertise that are not always available (CS3 on complementary financing with Cohesion policy). Beneficiaries are not always prepared to tackle technology transfer issues, intellectual property management and how the commercial exploitation of the results can be reconciled with open science (CS8 on support to agri-food value chains and CS10 on Industry 4.0).

While H2020 covers all TRLs, including those closer to the market, the general sentiment of the interviewed beneficiaries is that the resources available for TRL 8-9 are not sufficient. Hence, **when it comes to research commercialisation and deployment of R&I results after H2020 funding, other support avenues frequently become more important than the instruments provided by H2020** (CS1 on green innovations and CS10 on Industry 4.0). Private funding initiatives and the use of financial instruments are important sources for individual companies working in the area of Industry 4.0. It is recognised that dedicated pan-European initiatives such as the EU Public-Private Partnerships (PPPs), including Joint Undertakings (JUs), and support from other European schemes such as ICT Innovation for Manufacturing Small & Medium Enterprises (I4MS), which successfully supported SMEs in developing new projects after the end of H2020, play a significant role in research commercialisation (CS10 on Industry 4.0). From H2020 initiatives, the European Institute of Technology and Innovation (EIT) and H2020 INNOSUP have been acknowledged as important elements in fostering deployment and market uptake (CS3 on complementary financing with Cohesion policy, CS10 on Industry 4.0, CS21 on R&I system for green transition). While stakeholders share less confidence that H2020 effectively facilitates the market-driven uptake, roll-out and deployment of R&I results, it does **provide good 'signalling effects' about the quality, relevance and potential of supported projects facilitating the access to finance from financial institutions**, such as EIB (CS7 on cooperation and coordination for R&I, CS16 on a fish farmer in need of existing research and innovative solutions).

One of the main problems for market deployment is the amount of information on the exploitable results of H2020 projects and the consistency of this information. On the one hand, there are substantial research findings and data produced by many projects, both under H2020 and other funding programmes. This information is dispersed across the EU and not always available for all funding programmes. On the other hand, the information published on project results is often incomplete and inconsistent for objective reasons (e.g., pending patent applications) or because the project participants do not know what information would be useful for the users of results (researchers, companies, financing institutions). Also, there are no common standards, requirements or understanding of what level of detail is appropriate to inform about the results of an R&I project in a sufficient manner for the wide audience of stakeholders.

BOX 1: Mapping thematic connections of ICT project results through a Topic Tree approach

A good practice to address the abundance of information is the Topic Tree project[28] developed by National Contact Points (NCPs). NCPs in the ICT field addressed the problem of the lack of information on the exploitable results from other projects and partners by creating an online tool that shows thematic connections between different ICT-related projects under Horizon 2020 and illustrate how well different topics have been covered or where the research is at. The Topic Tree will be continued with Horizon Europe funding (CS22: R&I system case on digital transition). The use of online topic mapping tools, similar to the existing Horizon 2020-Interreg synergies tool[29], could be explored to better detect avenues for deploying H2020 results.

Recognising the need for systematic and specific support for exploitation, during the H2020 funding period, **the EC has launched a range of EU-level support instruments** that address this gap, such as Support Services for Exploitation of Research results (SSERR), European Intellectual Property Helpdesk, Open research Europe platform, EIB/ECFIN project portal, Horizon Results Platform, Innovation Radar and Horizon Results Booster. While this range of support services is accessible to H2020 beneficiaries, it appears limited information is publicly available on the full reach and relative success of these measures that would allow inferring more about the general achievements in the efforts of roll-out and deployment of H2020 results. For example, EC statistics from March 2022 state that so far, the Horizon Result Booster, which was launched in 2020, has engaged 170 experts across 685 projects and 701 assignments, of which 300 are completed[30]. The support has been provided to 1,939 beneficiaries. The most frequent project types receiving the services have been Research and Innovation Actions (RIA) (258), Innovation Actions (148) and Coordination and Support Actions (68). These key performance indicators (KPIs) are of importance for monitoring the overall implementation of the initiative, but it appears **no data is collected in relation to the realised synergies of Horizon Results Booster with other EU programmes**.

The interviews conducted suggest a poor knowledge of the EU-wide exploitation support schemes. Stakeholders are aware of the existence of some of these H2020 measures targeting market-driven uptake, such as the Innovation Radar and the Horizon Results Platform. Yet, **the use of these measures is sporadic and frequently interviewees were not able to comment on their effectiveness** (CS8 on support to agri-food value chains).

[28] https://www.ideal-ist.eu/topic-tree
[29] Horizon 2020-Interreg Synergies Mapping tool: https://webgate.ec.europa.eu/dashboard/sense/app/984fb9e1-b5ad-44ee-b380-c7da695cfd6e/sheet/371667d5-31a8-4cbb-b4ca-ece4bbcc02a8/state/analysis
[30] https://www.horizonresultsbooster.eu/News/newsItem?title=Horizon%2BResults%2BBooster%2Breaches%2B300-completed%2Bservices%2Bmilestone

Overall, the H2020 dedicated support schemes have a rather limited role in facilitating coherence of the support system for market-driven uptake of H2020, except for the Horizon Results platform (CS16 on a fish farmer in need of existing research and innovative solutions).

The suboptimal use of H2020 dissemination and exploitation platforms is also evident in the uptake of H2020 results in policy making. For example, in the case of cybersecurity policy, there is a **lack of awareness about H2020 project implementation and result valorisation in dedicated policy areas**. **The uptake of R&I results into policymaking is particularly successful when projects have been designed with a focus on policy relevance**. The main challenge observed in H2020 is that projects usually work on a very specific technical solution, aiming to address R&I objectives. Due to the lack of results maturity and scalability, the project outcomes and deliverables cannot be easily transformed into the EU regulatory framework, applicable to all Member States and their different contextual settings. **The uptake of the H2020 results at the EU policy level is also challenging due to internal work processes and heavy programme management**. For instance, in the European Commission, different individual experts and teams work on policies and H2020 projects. It is difficult to connect the expertise and keep a continuous knowledge exchange, especially due to a very high number of individual H2020 projects (CS4 on the use of H2020 results to shape cybersecurity policies).

National programmes

While specific examples of how H2020 results are rolled out and deployed through the support of dedicated national-level programmes are scarce, there is some evidence of successful initiatives being carried out. For example, the Czech Republic has implemented national and regional schemes for the Seal of Excellence holders that has helped SMEs to develop feasibility studies and market validation plans (see Box 2 for details). However, it should be noted that interviewees holding the SoE certificate indicated that it is difficult for SMEs to keep the results gained during participation in Horizon 2020 sustainable as funded projects tend to be short and the awarded budgets are relatively small to bring results to the market. (CS2 on H2020 Seal of Excellence).

BOX 2: Horizon 2020 Framework Programme. National and regional schemes implemented in the Czech Republic

Alternative funding synergies have been implemented since 2017 in the Czech Republic, where the country introduced one national and one regional scheme for Seal of Excellence holders. The national scheme for the SME Instrument was designed for Phase 1 SoE holders who were able to apply for a maximum of 55% of the total costs. The total time to grant was 40 days. In 2017, total of 4 calls were launched with 9 projects being funded.

In respect of the regional scheme, the holders were invited to apply for the SME Instrument Brno programme where successful applicants received a grant of €50k in addition to business coaching to support local SMEs develop feasibility studies and creating a market validation plan. The SME Instrument Brno programme was run by the South Moravian Innovation Centre. In total, two calls were launched with 9 projects were funded.

Studies point out areas where **more dedicated coordination between the EU and national/regional level is arguably reinforcing synergies**. For example, in the area of energy and transport innovation, the EU regions have an opportunity to join the Coal Regions

in Transition Platform[31]. As the development of eco-innovative sectors is one of the two main objectives of the Platform, those regions are more likely to be aware of the possibility of creating synergies with the EU-funded research results[32], especially in rolling out and deploying new technologies and innovations. Also, strategic alignment in policies and plans promotes such coherence. For example, Member States submitted to the European Commission their Integrated National Energy-Climate Plans for the year 2030. "This is likely to ensure a better understanding of national and regional use of EU funding for innovation as Article 25 requires all EU Member States to provide the European Commission with information on climate change-related innovation"[33].

While representatives from public authorities, or more specifically decentralised health authorities (CS20 om public health authorities in need of a breakthrough innovative solution), **recognise the importance of seeking application of R&I results, H2020 has not been widely used as a source for opening up such prospects for innovation deployment**. In the public health sector even the projects that are implementing new healthcare interventions through national or regional settings struggle with the parallel action of engaging health authorities, communicating their results and bottlenecks to the R&I providers. The most effective projects are usually those in which the regional authority is either directly involved or properly informed and engaged in the preparation or starting phase of H2020 research projects. **Co-design in research processes is essential in order to improve the adoption of research results** (CS20 on public health authorities in need of a breakthrough innovative solution).

Areas for possible improvement

More synchronised criteria among the EU programmes for proposal evaluation to promote downstream and upstream synergies: One way to promote the uptake and exploitation of R&I results, could be the use of extra points in the evaluation of proposals that include results from other EU-funded projects, working as an incentive to apply for follow-up funding. In the LIFE programme evaluation, extra credit is given to proposals that include results from H2020. If previous association with H2020 (or vice versa) would be regarded as favourable in the award scoring, that would provide additional incentive for beneficiaries to seek funding synergies bottom-up.

Adopting the lessons learned from the pilot call from the Interreg Central Europe programme "Capitalisation through coordination" as a model for better coordination of synergies and H2020 result deployment: The pilot call was launched in 2019 and addressed the need to increase the impact of existing transnational cooperation results in central European regions, in coordination with other EU-funded projects. The aim was to improve access of regions and cities to excellent H2020 research results in order to better address their territorial challenges. The pilot activity concluded that strengthening the impact of R&I and Interreg project results requires active support for the project holders. Capacity-building measures (e.g. trainings, one-to-one consultations) and matchmaking opportunities (e.g. events, newsletters, digital fora, databases) set up by DG RTD and the Interreg CE Programme within the fourth call, increased the knowledge of stakeholders about existing R&I and Interreg results that could fit specific needs of certain regions and target groups[34].

[31]The Initiative, established in 2017 as Platform for Coal Regions in Transition, helps European countries, regions, communities and workers to take on the challenge of diversifying the economy for required economic diversification of a clean energy transition.

[32] EC (2019) Mainstreaming Innovation Funding in the EU Budget: Budgetary Affairs. Study carried out by Delors Institute

[33] Ibid, p.103.

[34] European Commission and Interreg Central Europe (2020) Capitalisation through coordination across EU funds. Lessons learned from an experimental call for proposals, available at: http://interreg-central.eu/Content.Node/discover/CE-lessons-learned-coord-2020.03.pdf

Similar initiatives could be replicated between H2020 and other Cohesion policy funding programmes.

Improvement in the dissemination means, channels and format of H2020 project results: One of the main problems is the amount of information available on the exploitable results of H2020 projects and the lack of its consistency. To improve searchability, it would be important to adopt more common standards to promote a shared understanding of the necessary level of detail to inform about R&I project results a wider audience and stakeholder groups. Horizon Results platform should be more visible and user-friendly. More systematic and regular information exchanges on H2020 results would also benefit policymakers working in relevant thematic areas. To avoid that communication efforts remain only in thematic silos, a more horizontal approach should be promoted, e.g. by the creation of online topic maps that help stakeholders to orientate in the ways results connect to various topics. The use of more accessible dissemination channels (e.g., video material) for reaching national and regional actors, e.g., public health authorities, could be explored.

Continued involvement of decision-makers at different levels in the co-design of R&I strategies and in co-creation of research results: More dedicated coordination between the EU and national/regional level helps reinforces synergies as it allows to better embed synergy enhancing rules into policy and programme designs. As observed by stakeholders, H2020 project results are not widely taken up by regional authorities as a Europe-wide source for exploring new knowledge and innovation opportunities and drive their application in the local context. This underlines the importance of fostering the involvement or at least better association of such actors in the co-creation of research projects themselves.

Synergies/complementarities, overlaps in the support system for skills, higher education and research careers' development

Key findings:

- The key H2020 instrument for building skills and research careers' development – the Marie Skłodowska-Curie actions (MSCA), demonstrates **overall complementarity with EU programmes, in particular with Erasmus+** (considering that it provides much broader mobility support than MSCA) **and ESIF** (which focuses on infrastructure that can be used by the researchers)**, and with national programmes** (due to their generally smaller and country-centred approach as compared to MSCA).
- The **MSCA COFUND is an example of a successful attempt to create synergies** with EU/national/regional level initiatives, in particular with ESIF and Erasmus+. This is illustrated by various examples, confirmed by the interviewees, and by the data analysis, which shows that participation in MSCA COFUND, on average increases participation of organisations in ESIF (primarily ERDF) projects by over 100%. EIT initiatives are also a useful tool for creating synergies in upskilling, e.g. by providing different forums (workshops, lectures, events) for industry, academia, and European institutions, and allowing them to discuss funding opportunities and collaborations.
- Nevertheless, according to interviewees, the majority of **existing synergies are unintended** rather than a result of formal and institutionalised attempts to connect programmes/projects.

The Council Decision establishing Horizon 2020 underlines the need for activities aiming at 'building competence in the long term, focusing strongly on the next generation of science,

systems and researchers, and providing support for emerging talent from across the Union and from associated countries'.[35] The following two subsections address two key questions: if EU/national programmes and H2020 are working in a complementary fashion, and if there are ways for improvements in the skills support system. Furthermore, in Annex 6, we provide a 'map' of the support system for skills, higher education and research careers' development.

EU programmes

Marie Skłodowska-Curie Actions (MSCA)[36] (a key H2020 instrument for skills and careers' development) were the most numerous H2020 projects in the 2014-2020 period (more than 11 thousand projects, amounting to more than 7 billion EUR[37]), which makes ensuring external coherence for these actions very important. **The estimated percentage of MSCA projects that were linked, based on matching beneficiaries, to other, non-H2020, EU initiatives in the 2014-2020[38] period is 29%** (the average was calculated by adding the MSCA linked projects and dividing by the total number of MSCA projects). The overall percentage is comparatively low. However, this is mainly because MSCA-IF, which contained 9,852 projects, only had 22.1% of them linked to non-H2020 projects (e.g., HEALTH, LIFE, ESIF, CAP, etc.) shifted the balance to the lower side.

Considering the large number of MSCA projects (over 11 thousand), the results indicate that **around three thousand MSCA projects can be linked with other EU schemes**. In addition, almost 40 thousand organisations participate in H2020, of which over 7,816 (around 20% of all beneficiaries) participate in MSCA and around 6,600 (16.5%) were linked with projects financed not through H2020. MSCA beneficiaries were particularly active under the following three EU programmes: RFCS (48% projects linked to MSCA projects), HEALTH (30%), and LIFE (22%). MSCA was the most weakly linked to CAP (8,9%), CE (5,9%), CEF (4,7%), and ESIF (2,6%). Only the RIA exhibit higher percentage of projects linked to projects financed through non-H2020 programmes than MSCA in terms of totals. RIA also has a high percentage of 74.3%. However, MSCA-ITN has a larger percentage of 76.7% beneficiaries that also received funding from non-H2020 initiatives (e.g., HEALTH, LIFE, ESIF, CAP, etc.), while MSCA-RISE is also not far behind with 68.1%. Hence, even though the **results do not show explicit complementarities** (least of all because the same beneficiary does not mean that projects complement and build on each others' results), **they certainly hint at such a possibility** (considering all limitations of the data mining/analysis presented in section 1.5).

The case study analysis (see CS5 on skills) concludes that **MSCA is highly synergetic with the Erasmus+ programme**. Both programmes offer mobility, training, and career development opportunities for students and researchers, which allows individuals to build the R&I skill sets that they can later use to successfully carry out research and innovation projects. These mobility opportunities often allow building research networks between

[35] 2013/743/EU: Council Decision of 3 December 2013 establishing the specific programme implementing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decisions 2006/971/EC, 2006/972/EC, 2006/973/EC, 2006/974/EC and 2006/975/EC Text with EEA relevance

[36] MSCA provide grants for all stages of researchers' careers (from doctoral candidates to highly experienced researchers) by encouraging transnational, intersectoral and interdisciplinary mobility. The MSCA aim to ensure excellent and innovative research training as well as attractive career and knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers. Researchers under the MSCA receive funding on the condition that they move from one country to another to broaden or deepen their competencies. For more information, HORIZON 2020 WORK PROGRAMME 2014 – 2015 3. Marie Skłodowska-Curie Actions. (European Commission Decision C (2014)4995 of 22 July 2014)

[37] Based on 15/02/2022 H2020 project and beneficiary data retrieved from data.europe.eu

[38] European Structural Investment Funds (ESIF), Health Programme, Connecting Europe Facility (CEF), Research Fund for Coal and Steel (RFCS), LIFE, Common Agricultural Policy (CAP), and Creative Europe (CE)

organisations, fostering cooperation in H2020 and other projects, including projects related to education, research, and innovation. Cooperation opportunities are further strengthened by different MSCA and Erasmus+ initiatives that explicitly build networks between organisations, such as Partnerships for Innovation/Cooperation, European Universities Initiative, MSCA Staff Exchanges, and others. Beyond general skill-building and cooperation, given the similarities and connectivity between Erasmus+ and MSCA, the know-how collected when bidding for an Erasmus+ project also often is very useful for organisations when bidding for an MSCA project, and vice versa.

The desk research reaches a similar conclusion. The Erasmus+[39] interim evaluation concludes that there **is a high complementary between Erasmus+** and other EU policies and programmes relevant to education, training, youth and sport, including **Horizon 2020**. The H2020 interim evaluation of MSCA[40] also reports that the majority of stakeholders interviewed for the evaluation **reinforced the message that MSCA is coherent with Erasmus+[41]** (which provides broad mobility and cooperation opportunities in higher education, but also school, adult, youth, and sport) **and ERDF** (which focuses on enhancing R&I infrastructure and capacities to develop R&I excellence, and promoting centres of competence), complementing them without significant overlaps. The Erasmus+[42] interim evaluation also concludes that there **is high complementarity between Erasmus+** and other EU policies and programmes relevant to education, training, youth and sport, including **Horizon 2020**. More than **27% of the respondents to the H2020 Interim evaluation consultation pointed out that Horizon 2020 and Erasmus+ complement each other**. This is the highest percentage among the reviewed EU initiatives (ESIF, the LIFE programme, EFSI, COSME, CEF, CAP). The guidance on ensuring synergies between MSCA and Erasmus+ actions in the area of higher education[43] also provides several examples of synergies. These examples include three alliances funded by the European Universities Initiative (UNA EUROPA, EUTOPIA, CIVIS), which have reached funding synergies by becoming beneficiaries of COFUND projects. The guidance document also illustrates synergies between MSCA-Innovative Training Networks and Erasmus+ Strategic Partnerships or Erasmus Mundus Joint Master Degrees. The EU-US Young Leaders Seminar is another example of a synergy between MSCA, Erasmus Mundus and Fulbright-Schuman programmes.

However, it should be noted that H2020 and Erasmus+ were also considered to be the most overlapping when compared to other EU initiatives (9.4%[44] of respondents to the Interim evaluation consultation identified overlaps). **Interviewed experts also mentioned that there might be some overlaps between MSCA and Erasmus+.** This might include funding similar mobility initiatives between the same institutions, which would bring diminishing returns. However, experts did not see this as an issue given that there is a huge number of applications to both programmes. In other words, potential overlaps are sometimes welcomed by organisations that did not succeed in MSCA as it allows them to relatively easy apply to similar funding opportunities in Erasmus+, and vice versa. However, **in cases of already successful organisations, this might create an issue of path dependency. This is a situation when organisations that are already successful in MSCA, and other EU**

[39] Mid-term evaluation of the Erasmus+ programme (2014-2020), Brussels, 31.1.2018 SWD(2018) 40 final
[40] European Commission, Directorate-General for Education, Youth, Sport and Culture, Souto-Otero, M., Humburg, M., Franke, J., FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions (MSCA): final report, Publications Office, 2017, https://data.europa.eu/doi/10.2766/103174
[41] More information on the Erasmus+ 2014-2020 programme is available at: https://www.eacea.ec.europa.eu/grants/2014-2020/erasmus_en
[42] Mid-term evaluation of the Erasmus+ programme (2014-2020), Brussels, 31.1.2018 SWD(2018) 40 final
[43] European Commission, Directorate-General for Education, Youth, Sport and Culture, Synergies between the Marie Skłodowska-Curie Actions and Erasmus+ in the area of higher education, Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2766/958920
[44] See Figure 37 of Annex I of the Commission Staff Working Document Interim Evaluation of HORIZON 2020.

programmes, continue to be successful and highly integrated into the ERA, while organisations and institutions without a proven track record find it difficult to access. On the one hand, this can be considered a good thing as it allows high-level institutions to share their know-how on specific topics with researchers at the early stages of their careers. On the other, it can also prevent some smaller or less well-networked institutions from receiving needed help and support, as well as taking away some network opportunities from them that might lead to future synergies.

It is also important to note that **even though there is evidence that MSCA is synergistic with Erasmus+ some interview representatives believe that the majority of existing synergies are unintended**. More specifically, interviewees highlighted that MSCA allows individuals to travel abroad and gain the necessary knowledge to become high-level researchers. However, as MSCA is a bottom-up initiative, where universities and other organisations themselves select who they want and for what position, it is often a "luck of a draw" if these individuals will be utilised in projects financed through other EU programmes or national/regional initiatives. The Erasmus+[45] interim evaluation also mentioned that according to stakeholder input, **the formal and institutionalised attempts to connect the major programmes targeted at universities were very limited, and there is room (and demand) for creating more synergies**.

The MSCA COFUND**[46]** is an example of a deliberate attempt to create synergies with EU/national/regional initiatives. According to the EIROforum[47], it is an instrument that creates the environment for synergies between regional, national and international mobility programmes at both PhD and post-doctoral levels, while fostering in-coming, out-going and re-integration mobility[48]. **Through the COFUND initiative, MSCA is considered to have created many synergies with ESIF and Erasmus+**. The analysis in CS5 demonstrates that participation in COFUND, on average increases participation of organisations in ESIF (primarily ERDF) projects by over 100% in two years after the COFUND project starts. The MSCA interim evaluation also concludes that synergies with ESIF through the COFUND action have materialised and can be illustrated by various examples[49] (see the textbox below). Regions and Member States may support COFUND projects on subjects included in their Smart Specialisation Strategies and operational programmes and top-up the EU contribution with Cohesion policy funds[50].

[45] Mid-term evaluation of the Erasmus+ programme (2014-2020), Brussels, 31.1.2018 SWD(2018) 40 final

[46] For more information on the COFUND, HORIZON 2020 WORK PROGRAMME 2014 – 2015, Marie Skłodowska-Curie Actions, Available at: https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-msca_v1.1_en.pdf

[47] It should be noted that most members of the EIROForum (European Intergovernmental Research Organisation forum) themselves such as CERN or EMBL are active in MSCA projects as coordinators or partners, but also in other projects on large-scale research infrastructures in Europe, which creates fertile ground for synergies.

[48] EIROforum Position Paper on the Next Framework Programme "FP9", p.8, available at: https://www.eiroforum.org/wp-content/uploads/20171115_position-paper-FP9.pdf

[49] For instance, EUR9.5 million were awarded to the Welsh Government to set up a fellowship programme for 90 experienced researchers recruited from abroad. The programme is supported by an EU contribution through MSCA-COFUND, the ERDF as well as by various regional sources of support, including the Welsh government.

[50] For more information, see: https://cordis.europa.eu/programme/id/H2020_MSCA-COFUND-2020

BOX 3: Example of synergies between MSCA-COFUND and ESIF - Aarhus University, Denmark[51]

In 2017 Aarhus University successfully established a fellowship program through the COFUND financial instrument titled AIAS-COFUND II[52]. This bottom-up programme fosters research and innovation by inviting researchers in the early stages of their career from all scientific fields to do research at their premises, and by providing multidisciplinary training programmes, state of the art facilities, research career development, and more. In addition to this, Aarhus University in 2019 also launched an ERDF financed project titled Science for Society 2.0 (ERDF, 20201838), which is a continuation of Science for Society 1.0 and which tries to increase growth and innovation in the Øresund/Kattegat/Skagerrak region by bringing more researchers into this area by building a strong research ecosystem[53]. This project, hence, could be considered as being synergetic with the COFUND one given that it shares goals with it and the ecosystem created through COFUND might also be used in the ESIF financed project. In addition, given that Science for Society 2.0 also fosters the creation of real solutions, this can also be considered as a downstream synergy. There are also several other examples of downstream synergies coming from Aarhus University, as it also received ESIF funding for the following projects that try to create solutions on how to mitigate the negative climate effects on the North Sea Region: North Sea Wrecks - An Opportunity for Blue Growth (38-2-13-18), Genetic tools for Ecosystem health Assessment in the North Sea Region (38-2-22-18), Joint Monitoring Programme for Ambient Noise North Sea (38-2-10-17), and several more.

Another example of an MSCA COFUND project is the SoMoPro project from South Moravia[54], which achieved sequential synergies. The project addressed research topics in line with domains defined in regional S3, used ERDF to fund research infrastructures and complemented it with the funding for researchers' attraction and training obtained from MSCA COFUND. Two MSCA COFUND projects on quantum technologies and immunology have as the beneficiary the European Grouping of Territorial Cooperation "Eucor – The European Campus"[55], co-financed by the Interreg VA Upper Rhine Programme of ERDF. Beyond ERDF, other projects that received co-funding from the European Social Fund and/or from regional funds include the REP-EAT project[56].

H2020 also fosters education and skills development in R&I through ERA-NET Cofund scheme[57], ERC grants[58] and, the Future and Emerging Technologies actions[59]. These initiatives rarely focus on R&I development directly, but they indirectly support it by focusing on high-level research, scholar mobility, research network building, and so on. This, in turn,

[51] The synergy was established based on information on H2020 and ESIF projects, as well as additional desk research.
[52] AIAS-COFUND II Fellowship Programme. Information available at: https://cordis.europa.eu/project/id/754513
[53] About the project: Science for Society 2.0, available at: http://scienceforsociety.se/about/
[54] For more information: https://www.jcmm.cz/projekt/somopro_en/about-project
[55] For more information: https://www.eucor-uni.org/en/
[56] For more information: https://ec.europa.eu/regional_policy/rest/cms/upload/07102019_093252_WS619_Germana_di_Falco.pdf
[57] More general information on the ERA-NET Cofund is available at: https://www.era-learn.eu/support-for-partnerships/cofunded-p2p/era-net-cofund
[58] For more see: https://erc.europa.eu/funding/starting-grants
[59] For more see: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/future-and-emerging-technologies

might lead to know-how and knowledge exchange between organisations. Data on links, to some extent, supports this, as, on the one hand, around 67.9% of ERA-NET projects were linked to non-H2020 projects. However, on the other hand, 20.1% of ERC projects were linked to non-H2020 projects. It should be noted that to a large extent this could be explained by the fact that ERA-NET projects, on average, have around 27 participants, while ERC has a bit more than 1, which in turn might limit synergies.

In addition, looking in particular at the ERA-NET Cofund actions under H2020, its analysis in 2016[60] concluded that activities such as training and mobility schemes, capacity-building activities or activities related to research infrastructures are less implemented in ERA-NET Cofund actions. The assumption is that this may be because they do not correspond to the main objective of the instrument despite the importance of such activities for improving the situation, especially in less-performing countries. As confirmed by interviewees for this evaluation, it should be noted that **the majority of the synergies in the education/skills sector manifest themselves through the** MSCA, while the above-mentioned H2020 initiatives (including the ERA-NET Cofund) more rarely foster education and skills development of researchers, at least directly[61].

Another positive example for creating synergies regarding upskilling are EIT initiatives. The EIT is meant to incentivise KICs "to engage in cross-KIC work in areas which offer a strong potential for synergies, e.g. via joint professional development courses, joint research activities, masters or PhDs degrees or cross-KIC mobility between academia and business"[62]. Based on an analysis of initiatives throughout the EU, the EIT evaluation found many commonalities between the approach of national initiatives and the EIT, in particular in relation to knowledge transfer policy, which presented opportunities for complementarity[63]. At the same time, the EIT model's emphasis on entrepreneurship and education sets it apart as this was found to be less common in the national comparators. The evaluation case studies support these findings and confirm that the EIT and its KICs contribute to creating synergies between national and EU-level initiatives. In particular, the integration of higher education and skills formation is an integral part of the activities of KICs, hence it is a specific instrument that attempts to support the entire 'knowledge triangle'[64] (CS13: Coherence and synergies between the EIT Regional Innovation Scheme and smart specialisation strategies). Examples of how the EIT FOOD encouraged synergies between agri-food innovations from industry, academia and European institutions are the EIT FOOD Government Executive

[60] Analysis of ERA-NET Cofund actions under Horizon 2020. Final report of the expert group. Luxembourg: Publications Office of the European Union, 2016

[61] Nevertheless, there are some examples of projects funded through these initiatives in the area of R&I education that might have produced some synergies, e.g., a downstream synergy observed with the Champalimaud Foundation, Portugal, which is described in CS5.

[62] DECISION No 1312/2013/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Strategic Innovation Agenda of the European Institute of Innovation and Technology (EIT): the contribution of the EIT to a more innovative Europe

[63] EC (2017). Evaluation of the European Institute of Innovation and Technology (EIT). Final Report. Luxembourg: Publications Office of the European Union, 2017. Available at: https://education.ec.europa.eu/document/evaluation-of-the-european-institute-of-innovation-and-technology-eit-final-report

[64] For more information on the 'knowledge triangle' see: EIT (2012). Catalysing Innovation in the Knowledge Triangle. Practices from the EIT Knowledge and Innovation Communities. Available at: https://eit.europa.eu/sites/default/files/EIT_publication_Final.pdf

Academy[65] and the EIT Regional Executive Academy[66] (CS13) and the example outlined in the textbox below (CS16 on fish farming).

BOX 4: Example of a synergy between EIT, crowdfunding, and ERDF initiatives in the aquaculture sector

Consorzio Gargano Pesca participated with other four partners in the EIT Food project AGAPE-skillset.[67] AGAPE is a collaborative platform for the EU aquaculture sector, Artificial Intelligence (AI) based, bringing an innovative model of interaction among stakeholders, promoting the transition from the ordinary aquaculture market to a circular economy approach based on re-skilling processes. The project supported the initial skilling activities, and later the consortium continued them with crowdfunding and own financial resources. As part of the outcomes of the EIT project the consortium also created a start-up company AI4skills. The company is now an EIT best practice. It is incubated and receives support from the ROP-ERDF of the Lazio region.

The synergies between MSCA and the EIT are also worth mentioning. Going forward, Horizon Europe encourages synergies between the MSCA and the European Institute of Innovation and Technology (EIT), especially through its Knowledge and Innovation Communities (KICs). Existing synergies between MSCA participants and KICs (e.g. EITs Climate, Digital, Food, Health, InnoEnergy, Raw Materials) build on shared intersectoral mobility objectives for enhancing the training of researchers and the transfer of knowledge from academia to the non-academic sectors. It also builds on complementarities in the expertise, knowledge of their respective communities and main stakeholders[68].

National programmes

The participants in the interviews for this evaluation (see CS5) generally found that **MSCA is synergistic with many national and regional programmes**, as it helps researchers at the early stages of their career to gain relevant knowledge on how to conduct high-level research, which can then be used to carry out high-impact research under initiatives at the national level. The case studies interviewees emphasised that coherence at the national level is facilitated by the fact that Member States often have similar research goals.

The synergistic effects nurtured by the COFUND approach with EU programmes are also observed with national programmes. An example of the MSCA COFUND approach is the Pegasus 2 programme[69], which aims to exploit co-funding synergies between EU

[65] EIT Food implements the Government Executive Academy (GEA), which brings together government representatives from most RIS countries and experts working in the field of agri-food innovations from industry, academia and European institutions. This is a week-long training programme that offers insights into challenges related to food system innovations and regulations through interactive workshops and lectures. Participants are introduced to the EIT Food activities and encouraged to exchange opportunities for synergies.

[66] The Regional Executive Academy aims to explore the potential of collaboration between the EIT Community, regional authorities and R&I stakeholders. In 2021, the Regional Executive Academy was organised in Hungary and aimed to explore the existing and potential collaborations between EIT, KICs, national and regional authorities, industry, and further Hungarian stakeholders to jointly implement the S3 in Hungary. During the two-day event the participants exchanged information on technological innovations, discussed good practices, as well as barriers, in strengthening innovation ecosystems and focused on national, transnational, and EU funding opportunities for collaborations within the priorities of Smart Specialisation Strategies in Hungary.

[67] https://agape-skillset.com

[68] For more information, see: 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, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2766/42217

[69] See: https://cordis.europa.eu/project/id/665501

actions financed via the MSCA (for early-stage researchers and experienced researchers' mobility) and regional/national level programmes (in this case the FWO[70]).

The scope of some initiatives at the national level is similar to MSCA (support the mobility of students, post-doctorate fellows, and researchers, with a focus on improving their research capabilities), which **creates some overlaps[71]**. However, **the interviewees did not consider that this is a problem**, because such national initiatives are often much smaller in scope, and their application success rate is often low, similar to MSCA, which had a success rate of 14% in 2020[72], meaning that there is a large number of young researchers who could still benefit from such initiatives. Also, **national grants often focus on attracting young researchers to their countries rather than sending them to high-level institutions abroad** to strengthen their research capabilities. This is a bit different from MSCA, which focuses more on improving the skills of young researchers across the EU. In addition, **many existing initiatives are often relatively small in scope**. For example, in 2021 the Swedish Future Research Leader initiative (Framtidens Forskningsledare), which supports young researchers by funding their projects and also providing them mobility opportunities, granted only 19 applications out of 225.

Areas for possible improvement

Further use of the COFUND approach and EIT initiatives: The COFUND initiative provided many examples (described in the previous pages and also in the MSCA interim evaluation) of synergies between MSCA, ESIF and Erasmus+, which calls for continued use of this approach. As described in CS5, organisations that participated in an MSCA COFUND project increased their participation in ESIF projects by around 114% two years after their participation. As noted above, EIT initiatives are also a useful tool for creating synergies in upskilling, e.g. by providing different forums (workshops, lectures, events) for industry, academia, and European institutions, and allowing them to discuss funding opportunities and collaborations (as illustrated by the EIT FOOD).

Need to improve the afterlife of the H2020 projects through better dissemination of their results and tools that were created during their implementation: This could help researchers in different fields to have a better understanding of what was already created and build on it, fostering synergies. To some extent, this already exists in the form of the CORDIS website[73], which provides information on the results of projects and the overall Open Access Policy[74]. Similarly, the OpenAIRE[75] website also has an extensive catalogue of results created from H2020 projects. However, based on interviews and academic literature, (e.g. Imker et al., 2021[76]) such data is relatively rarely reused. Hence, **more needs to be**

[70] See: https://www.fwo.be /
[71] Examples of national researcher mobility schemes from Spain, France, Austria, Estonia, Poland, and Sweden are provided in CS5.
[72] See: https://rea.ec.europa.eu/system/files/2021-06/MSCA-IF%20Webinar%20Masterfile%20presentations.pdf
[73] See: https://cordis.europa.eu/
[74] See: https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science/open-access_en
[75] See: https://www.openaire.eu/open-science-europe-overview
[76] Imker, H. J., Luong, H., Mischo, W. H., Schlembach, M. C., & Wiley, C. (2021). An examination of data reuse practices within highly cited articles of faculty at a Research University. The Journal of Academic Librarianship, 47(4), 102369.

done in order to disseminate the results of H2020 and to ensure that the data are FAIR (Findable, Accessible, Interoperable, and Reusable)[77].

Synergies/complementarities, overlaps in support for reinforcement of R&I capacities and infrastructures

Key findings:

- **H2020 research infrastructure (RI) funding activities are considered complementary to other schemes** as they offer an international dimension not available through other support instruments and are also associated with spill-over effects, e.g. in terms of skills, networks and positioning.
- **Most synergy mechanisms in support of RIs are identified between H2020 and the ERDF**. While ERDF (together with national funding and EIB instruments) has mostly been used for the construction of RIs, as well as training of scientific and technical personnel, H2020 funds have played an important role in ensuring open access to facilities and RI strategy development.
- The **use of ERDF funding to complement H2020 and other national and regional RI investments has not always been easy** or systematic. Many scientific communities were not used to working with public authorities traditionally managing structural funds. The national management of ERDF has also complicated the alignment of investment in distributed RIs across Member States.
- **A major obstacle to synergies is a lack of sufficient financing at national level**. The project-driven nature of ERDF and H2020 has sometimes also led to interruptions in funding streams due to the defined funding cycles of European schemes and an absence of sufficient national support.
- **Barriers to synergies in support of research and technology infrastructures also include various legal issues**, such as limited flexibility in the eligibility criteria of national funding schemes not allowing European Research Infrastructure Consortia (ERICs) to participate in national calls, as well as hindrances in terms of procedural and accountability aspects of funding management.

As set out by the programme regulations, one of the objectives of the Horizon 2020 'Excellent Science' pillar is to provide Europe with outstanding and accessible research infrastructures (RIs) as part of an integrated European research and technology infrastructure landscape. In this section we address the issue of complementarities between EU, national, regional and interregional approaches in support of research and technological infrastructures and highlight lessons learned for Horizon Europe.

EU programmes

The last two decades have seen an unprecedented development of European RIs. The main emphasis has been placed on consolidating, opening, integrating and interconnecting RIs in Europe. The Framework Programme has contributed to more efficient and open use of national research infrastructures and more effective national policy-making guided by the

[77] For more on the FAIR principles and how H2020 promotes them see: https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf

strategy-led approach of the European Strategy Forum on Research Infrastructure (ESFRI)[78]. Horizon 2020 activities have also aimed to increase the innovation potential of European RIs by opening up their services for industry and other stakeholder use and promoting R&D partnerships with the industry[79]. Fostered by the periodic ESFRI Roadmaps, there has been an ambitious investment agenda in RIs of over €24b over the past 20 years, with €2.48b being invested under H2020[80]. This is widely considered one of the highlights of the ERA.
While Horizon 2020 supported the establishment of new infrastructures (design and preparatory phase) and further promoted advanced scientific communities, the capital investments and support for RI operational costs are the responsibility of the Member States. Due to the large investments needed over the entire life cycle, seeking funding synergies and directional coherence in other forms of support are an obvious aspect of RI governance. Therefore, a **synergy approach to European funding is a key assumption to satisfy the financial needs of RIs throughout all of their life-cycle periods and safeguard the long-term sustainable development of their capacities.**

To be able to achieve the ambitious European targets (e.g., twin transition, Horizon Europe missions), European researchers and businesses need access to world-class RIs and technology infrastructures (TIs), which are integrated at EU, national and regional levels and which offer coherent and complementary services to the research and business communities (e.g. demonstrators, pilot lines, testing facilities, etc.). Under Horizon 2020, the EU has invested some €1.2b in relevant projects supporting TIs81. However, **the development of the RI landscape, as well as access to RI services, is significantly more advanced than is the case of TIs**, due to both the strategic priority setting process, through the ESFRI Roadmap, and the significant effort at the EU and Member State levels to open up national facilities and laboratories to international users.

The EU investment in RIs and TIs is considered overall coherent with many of the main EU thematic policies (e.g., environmental policy, public health policy, development policy, cultural and media policy and industrial policy) and their respective implementation programmes[82]. **H2020 RI initiatives are quite distinct in their objectives;** thus, no major overlaps are observed.

Most synergy mechanisms are identified with the ERDF. Synergies with ESIF have been defined as a strategic objective from the launch of H2020 as the programme regulation outlined that "coordination with the cohesion funding sources will be pursued to ensure synergies and a coherent approach for the development of the research infrastructures"[83]. It is underlined by multiple EU bodies that alignment between H2020 RI initiatives and ERDF represents a real opportunity for synergistic benefits to European RIs and regional development[84]. In the 2014-2020 programming period, the ERDF invested around €16b for building or upgrading research and innovation infrastructures, including many TI, and around €21b for R&I support services that foster the exploitation and development of technologies, in particular by SMEs[85]. Furthermore, through the development of Smart Specialisation

[78] EC(2011) Proposal for a Council decision establishing the Specific Programme Implementing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020), COM(2011) 811 final
[79] For general information on RI: https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures_en
[80] https://sciencebusiness.net/news/call-additional-eu4b-investment-european-research-infrastructures
[81] EC (2019) Technology Infrastructures, Commission Staff Working Document
[82] Source: EC (2017) Interim evaluation of Horizon 2020, Staff Working Document, Annex 2
[83] Council Decision of 3 December 2013 establishing the specific programme implementing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decisions 2006/971/EC, 2006/972/EC, 2006/973/EC, 2006/974/EC and 2006/975/EC (Text with EEA relevance) (2013/743/EU)
[84] among them, DG R&I, DG REGIO, JRC, ESFRI
[85] EC (2019) Technology Infrastructures, Commission Staff Working Document

Strategies (S3) that include regionally anchored RIs it was expected this would sizeably contribute to closing the gap between innovation leaders and modest and moderate innovators. ESFRI identified investment in RIs as a method for increasing regional competitiveness and thus cohesion between the different European countries and regions.[86] The ERDF can also be used to support the upgrading of RIs in which recipients of H2020 funds are conducting projects[87].

BOX 5: Examples of synergies between H2020 and ERDF for investment in RIs

One of the most visible and referenced examples of implementing such funding synergy with ERDF in practice is Extreme Light Infrastructure (ELI-ERIC), which is a laser facility hosted by two Eastern European countries - Hungary, Czechia[88]. ELI-ERIC is pioneering a novel funding model combining the use of EU Framework Programme (FP7 and Horizon 2020) funds for the preparation, ERDF for the construction, and member contributions for the operation of the facilities[89]. The regional competitiveness argument and use of ERDF have also been prominent in the implementation of the European Spallation Source (ESS) project in Lund, Sweden. ESS is a multi-disciplinary research facility based on the world's most powerful neutron source. Up to date, ESS has received funding from 13 H2020 projects and uses that in complementarity with ERDF and grants from a broad range of other regional, national and international programmes[90]. Another example of RI combining H2020 and ERDF funding is CEITEC with 12 core facilities equipped with cutting-edge technologies in nanotechnologies and life material sciences. Located in the South Moravia Region, Czechia, CEITEC has implemented its strategy and activities with funding coming from multiple sources, including
Horizon 2020 and ESIF[91].

Nevertheless, evidence suggests that the use of ERDF funding to complement H2020 and other national and regional RI investments has not always been easy. **Gaps in complementarities have been driven by the fact that scientific communities were not used to working with the national and regional management authorities of ESIF programmes**. Member States have adopted a variety of tactics to exploit complementarities between RI funding and ESIF, some of which have not been particularly systematic[92] and the ESIF implementation during 2014-2020 is not perceived as very impactful when complementing Horizon or national funding (CS6: Infrastructure and R&I). In the case of ELI-ERIC – a research infrastructure distributed across two countries - the bilateral nature and separate governance of ERDF led to misalignments in the timeline of the separate facilities and a lack of commitment by non-host countries to establish unifying governance and scientific interface to future users.

[86] ESFRI (2020). Making Science Happen.A new ambition for Research Infrastructures in the European Research Area A new ambition for Research Infrastructures in the European Research Area ESFRI WHITE PAPER 2020. Available at: https://www.esfri.eu/sites/default/files/White_paper_ESFRI-final.pdf
[87] EC (2018) Mutual Learning Exercise: Widening Participation and Strengthening Synergies: Summary Report, Horizon 2020 Policy Support Facility
[88] The third facility using ERDF funding is built in Romania, but this facility is not yet part of ELI-ERIC
[89] EC (2017) Sustainable European Research Infrastructures - A call for action. Commission Staff Working Document - Long-term sustainability of Research Infrastructures.
[90] https://europeanspallationsource.se/grant-involvement#horizon-2020
[91] https://www.ceitec.eu/research/
[92] EC (2017) Interim evaluation of Horizon 2020, Staff Working Document, Annex 2

Another concrete funding synergy mechanism is with the financial instruments of the European Investment Bank Group (EIB and EIF). The cooperation between the EIB and the European Commission under H2020 led to the launch of 'InnovFin – EU Finance for Innovators' initiative. Since 2014, InnovFin promotes access to finance for innovative businesses and entities in Europe, especially for those that by their nature are riskier and harder to assess than traditional investments[93]. Synergies with the InnovFin instrument have been established for the construction and major upgrades of five pan-European RIs[94]. The EU-backed loan agreements were signed by the EIB and the European Organization for Nuclear Research (CERN) to finance the High Luminosity Large Hadron Collider (HL-LHC) project, the world's largest and most powerful particle accelerator (up to €228.2m). Other examples are the EIB loans for the European Synchrotron Radiation Facility-Extremely Brilliant Source (ESRF-EBS) (€65m), European Spallation Source (€100m), Extreme Light Infrastructure (€33.8m), and COST (€100m)[95].

As outlined in CS6 on infrastructure and R&I that investigated the external coherence and synergies in the case of a distributed RI CERIC-ERIC, **the funding landscape from the EU sources for RIs seems to be focused on short-term projects (when funded through H2020 and ERDF), in many cases with gaps between them or without national funding.** This represents a barrier to achieving RI's long-term sustainability. Recently ESFRI was called on to "analyse funding approaches across different countries in view of collecting good practice examples and stimulating improved national and European funding for RIs. Such an approach should include the mix of various funds, be it regional, national or European, in synergy"[96]. Such a **comprehensive overview that reflects the external coherence of support to RIs at the European landscape level is very relevant for shaping future approaches to synergies.**

With respect to technology infrastructures (see CS10 on Industry 4.0)**, the relevance of mapping and coordination of investment at European level is underlined.** Regional governments are very interested in supporting such infrastructures as demonstrators and testbeds as their presence is very attractive for industry, especially smaller companies, and serves as an additional incentive for businesses to consider relocation to the region. Such regional competition creates misalignment and duplication of efforts already at a national level. The situation becomes even more complex when coordination is taking place at European level. Yet, **the added value of conducting this kind of mapping and prioritisation activity at the EU level would be high as TIs are very expensive**.

National programmes

While H2020 RI and TI initiatives are instrumental in integrating and interconnecting facilities of pan-European relevance, most frequently the capital investment into purchasing equipment, coverage of RI operational costs and funding of R&D projects are the responsibility of the Member States that prioritise investments based on national RI roadmaps. Overall, the support to RI facilities across their life cycle and type of activity is an amalgamation of European, national, interregional and regional funding streams[97]. As an

[93] https://eufundingoverview.be/funding/innovfin-eu-finance-for-innovators-initiative-launched-by-the-european-investment-bank-group-eib-and-eif

[94] EC (2017) Sustainable European Research Infrastructures - A call for action. Commission Staff Working Document - Long-term sustainability of Research Infrastructures.

[95] Ibid.

[96] The Slovenian Presidency Conference: "New European Research Area – Towards a Responsible Knowledge- Driven Society of the 3rd Millennium", Conference summary report and recommendations, 26-27 October 2021

[97] EC (2017) Sustainable European Research Infrastructures - A call for action. Commission Staff Working Document - Long-term sustainability of Research Infrastructures.

illustration, the review of possible funding synergies for a distributed RI CERIC-ERIC98 outlined a highly **complementary picture among various funding streams** (see example in Table 5). Horizon 2020 support is instrumental predominantly for strategy and policy development aspects, training of scientific and technical personnel, ensuring open access, as well as support to join R&D activities. **H2020-funded activities are considered complementary to other schemes as they offer an international dimension not available at national level** (CS8 on support to agri-food value chains) **and are also associated with spill-over effects, e.g., in terms of skills, networks and positioning** (CS6 on Infrastructure and R&I).

Table 5. Example of funding sources per type of RI activity

Activity	Possible funding sources
Development of infrastructure	ERDF, EIB, national funding
Ensuring open access to facilities	National funding, Framework Programme (mainly for pilot activities)
Training of scientific and technical personnel	National funding, Framework Programme, ERDF, Territorial Cooperation
Strategy and policy development	Framework Programme, Territorial Cooperation
Operational and coordination costs	National funding
Joint R&D activities	Framework Programme, Territorial Cooperation, ERDF, national funding

The **major obstacle to synergies is the lack of sufficient financing at national level** (CS6 on Infrastructure and R&I and CS8 on support to agri-food value chains). There are instruments that fund RI activities or other initiatives for a period of years; however, the majority are short-term (1-2 years). One-time capital investment into RIs is not sufficient[99] to ensure long-term sustainability. Rather, a financing plan should cover the full lifecycle of a RI (incl. provisions for decommissioning or major re-building). The role of national funding (in a synergistic combination with other sources) is crucial.

Beyond funding aspects, there are multiple practical hurdles (see CS6 on infrastructure and R&I) for the implementation of synergies in support of RIs, including differences in the legislation among EU Member States. For example, **limited flexibility in the eligibility criteria of national funding agencies does not allow ERICs[100] to participate in national calls**. If ERICs were eligible for national funding sources, this would dramatically change the funding landscape opportunities. Also, national procedures are a significant barrier. Funding

[98] https://www.ceric-eric.eu

[99] The Slovenian Presidency Conference: "New European Research Area – Towards a Responsible Knowledge- Driven Society of the 3rd Millennium", Conference summary report and recommendations, 26-27 October 2021

[100] The community legal framework for a European Research Infrastructure Consortium (ERIC) is a specific legal form to facilitate the establishment and operation of research infrastructures with European interest.

of RIs nationally in many countries heavily depends on ERDF co-financed programmes. The observation of the interviewed stakeholders is that **the deadlines for the use of structural funds are tight, and the disbursing of allocated money into the system goes very slowly**. Different timelines for applications to the national and EU funds are also part of this procedural barrier. In cases where there is an opportunity to combine some national funds with ERDF, there is an issue with different administrative systems for the project implementation. In combination with national administrative requirements, this doubles or even triples the burden on beneficiaries.

It is also important to highlight that national funding decisions are not always made in a coherent manner. For example, when / if national funding for RIs is linked to the national RI roadmaps, the **updates of the national roadmaps are not happening simultaneously across the EU and in parallel to the update of the ESFRI roadmap**, making alignment between national funding sources difficult (CS6 on infrastructure and R&I). A similar issue was highlighted by the Copernicus Interim evaluation, which concluded that there was a need for greater involvement of Member States at the national and regional development of services and applications and closer coordination with H2020 innovation[101].

Moreover, national funding agencies are usually reluctant to fund cross-border activities (as they focus on the national level), thus making H2020 or regional funding the main sources for transnational access (TNA) to RIs. Transnational access is the key activity allowing the full use of RI facilities located in different countries. So far, TNA has been funded through the Horizon 2020 projects or as part of the core RI funding (like in CERIC-ERIC). **Funding, however, is not done in a consequent manner** (i.e., some RIs had gaps in years between the projects, thus essentially stopping TNA). When TNA stops, this stops the development and growth of the RI user community (CS6 on infrastructure and R&I).

Areas for possible improvement

Shifting focus to addressing barriers that hamper the implementation of synergies: RIs have been included as an important investment priority at both the EU and the Member State level, including the national programmes, H2020 and Horizon Europe, ESIF and the EU Recovery and Resilience Facility (RRF). Hence, there is strong political support and pre-conditions for coherent investments in RIs. The attention should be placed more on how to implement synergies in practice – an aspect that still hinders the overarching policy aims. These include such obstacles as ERICs not being eligible to participate in national calls, divergent accountability requirements among programmes that doubles or even triples the burden to RI beneficiaries and gaps in the sequence of funding projects.

Dissemination of explanations on potential funding sources and pay-outs for RIs and TIs: Regarding Horizon Europe, a particular emphasis needs to be placed on explaining the calls which are not explicitly targeting RIs but where these organisations can bring value. On the regional level, the use of funding sources that perhaps are less familiar right now to potential beneficiaries (e.g., Central Europe Initiative, Three Seas Initiative, European Investment Fund for technology transfer) can be used more extensively in the future.

Promotion of harmonisation of the ESFRI Roadmap and national RI roadmaps: More alignment between the ESFRI Roadmap and national RI roadmaps would be favourable for increasing coherence and synergies and thus reinforcing common strategic objectives for RIs at European level. It could also be useful for policy-makers to discuss past lessons learned

[101] EC (2017) Interim evaluation of Copernicus. July 2017. Available at: https://www.copernicus.eu/sites/default/files/2020-05/ET0417742ENN.en_.pdf

from the calls linked to the national RI roadmaps and – more and more – national ERA Roadmaps/Action Plans, since they form the basis for funding on a national level.

Strengthened national RI capacities as a pre-condition for successive synergies with EU-level programmes: National funding streams could be better aligned with the European strategies and priorities, e.g., by adopting the ESFRI Roadmap and acknowledging the role of RIs and TIs in the development of S3. A national strategic planning process can be used to create a tailor-made framework with favourable conditions for coordinated use of all funding instruments in support of research and technology infrastructures.

Synergies/complementarities, overlaps with financial instruments, in particular for SMEs

Key findings:

- Horizon 2020 financial instruments (InnovFin actions) are **broadly coherent in design with other EU funds and financial instrument schemes** supported by COSME, EFSI, ESIF, CEF, and CCS GF.
- Nevertheless, **in practice, SME research projects are often "one-off" in nature**, rarely leading to additional projects through other EU initiatives (only around 10% of projects financed through SME Instruments were connected to non-H2020 projects in 2014-2020). At national level, the data show even smaller percentage of links between H2020 and national programmes.
- The **main challenges** typically faced by SMEs in ensuring synergies are related to: difficulties investing the resources required to apply for EU funding; insufficient access to networks; high barriers for securing H2020 financing, which leads to the emergence of specialised niche players and difficulties particularly for SMEs in EU-associated countries; insufficient coordination between EU and national schemes supporting innovative companies.

Horizon 2020 targets SMEs by providing both direct financial assistance and indirect support to accelerate their innovation capacity. In the following sections, we present the findings on synergies/complementarities and overlaps of Horizon 2020 and other EU/national financial instruments focussing on SME support[102]. Furthermore, in Annex 6, we provide a 'map' of the R&I support system concerning financial instruments, with a focus on SMEs.

EU programmes

More than 5,500 H2020 projects[103] (third highest number after MSCA and ERC actions), amounting to more than €4 billion have been implemented under the SME Instrument. More specifically, there were 4,233 SME-1 instrument, and 1,500 SME-2 instrument projects, where SME-1 accounted for €0.3 billion, and SME-2 accounted for €3.75 billion. However, the extent to which these projects are found to be interconnected with other EU-financed projects is the lowest among H2020 schemes – the estimates show that **only around 10% of projects financed through the SME Instruments were connected to non-H2020 projects in 2014-2020**. This percentage is consistent across SME-1 and SME-2 instruments.

[102] To avoid repetition of general findings on the external coherence of SME support under H2020, relevant issues regarding the SoE initiative, navigability, commercialisation of results, etc. are covered under the specific evaluation questions, while the sections below focus on financial instruments (InnovFin).
[103] Based on 15/02/2022 H2020 project and beneficiary data retrieved from data.europe.eu.

To a large extent, this can be explained by the fact that the average number of participants in SME projects was one of the lowest – close to 1 per project for both SME-1 and 2. These estimates should not be overinterpreted because of the methodological limitations linked to the approach and databases (further presented in section 1.5 and Annex 1). Clearly, the results are only providing a partial picture for the 2014-2020 programmes, while there could be synergies across programming periods. Nevertheless, the relatively small percentage suggests that there is potential for further synergies that is still untapped. Furthermore, as shown by the data analysis in Annex 2, around 68% of privately owned organisations only participated in one H2020 project, while for higher education institutions this statistic is 34%. These results indicate that **SME research projects are often "one-off" in nature, rarely leading to additional projects through other EU initiatives**. However, these results do not imply that there are no synergies at all. This is because SME research projects might be synergistic with some other non-EU initiatives, such as private investments. Nevertheless, even with such a possibility, these results indicate **further potential in terms of ensuring SME project synergies**. As the following paragraphs show, **this gap is not due to the design of the EU schemes.**

Beyond the SME Instrument, the **EIC Pilot**, which was launched under H2020 in 2018, as an initiative to support breakthrough innovation of top-class innovators, entrepreneurs, small companies and scientists, is considered to have made important steps to improve synergies with the European Structural and Investment Funds fund (ESIF) [104]. According to the EIC pilot evaluation, the Seal of Excellence (SoE) has been an example of effective synergies between the SMEI (and later the EIC Pilot Accelerator) and ESIF.

Exploring the external coherence of Horizon 2020 financial instruments, **InnovFin actions**, aiming to help SMEs, mid-caps, large firms and other types of organisations engaged in R&I gain easier access to loans, guarantees, counter-guarantees and hybrid, mezzanine and equity finance[105], are broadly coherent in design with other EU funds and financial instrument schemes supported by COSME, EFSI, ESIF, CEF, and CCS GF.

Looking specifically into **COSME and H2020 financial instruments, complementarities and synergies between the two have been achieved** through different policy objectives, similar targeting strategies, and different eligibility criteria[106]. From these three aspects, the interim evaluation report of H2020's financial instruments identified the highest **potential for overlaps in regard to targeting strategies for the SME products**, e.g., both the 'Loan Guarantee Facility under COSME and 'SME Guarantee' under InnovFin provide guarantees to SMEs[107]. Considering that in some Member States, financial intermediaries have only applied for COSME or only InnovFin, **this overlapping might not necessarily be negative in practice. Furthermore, the Europe Enterprise Network's (EEN) activities under**

[104] European Commission, Directorate-General for Research and Innovation, Evaluation study on the European Innovation Council (EIC) pilot: final report, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2777/261324. p.69

[105] These instruments are being implemented under the umbrella term 'InnovFin – EU Finance for Innovators', which defines an initiative joined by the European Investment Bank Group (EIB and EIF - European Investment Fund) in cooperation with the European Commission under Horizon 2020. InnovFin consists of a debt instrument and an equity instrument and is broken down into seven products: the SME Guarantee; SME Venture Capital (in 2016 renamed into InnovFin Equity, which is split up into four different components, such as InnovFin Technology Transfer, InnovFin Business Angels, InnovFin Fund-of-Funds, and InnovFin Venture Capital); MidCap Guarantee; MidCap Growth Finance; Large Projects; Energy Demo; and Infectious Diseases. For more information on the InnovFin initiative from the EIB, see https://www.eib.org/en/products/mandates-partnerships/innovfin/index.htm

[106] EC (2017) Interim evaluation of Horizon 2020, Staff Working Document.

[107] European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020's financial instruments: final report, Publications Office, 2018, https://data.europa.eu/doi/10.2777/378692

COSME and Horizon 2020 constitute an example of coherence between different EU initiatives[108]. The conclusion of the COSME interim evaluation is that there is overall coherence between the COSME and Horizon 2020 financial instruments.[109]

Based on the desk research[110] and case study analysis, it can be concluded **that EFSI and InnovFin are considered to be overall complementary to each other**. As an example, EFSI's 'SME Window' is typically used to top up the InnovFin 'SME Guarantee' and the funding is therefore very much synergetic. Strong coherence has also been found between the EFSI 'Equity Instrument' and the InnovFin 'Equity Scheme' since funding is being channelled directly into the suite of four financial instruments of InnovFin Equity. An example of EFSI/InnovFin coherence is the Swedish Northvolt battery manufacturer (see CS7 on cooperation and coordination for R&I). It combined demonstration financing from InnovFin with the EFSI funding to use the latter to establish a factory for green battery cells.

Financial instrument schemes offered under the Structural and Investment Funds (ESIFs) and InnovFin clearly differ from each other in terms of their objectives, geographical coverage and management, even if they may cover the same or very similar target groups. Being implemented under shared management with the Member States, ESIFs schemes often have more general objectives of accelerating access to finance for startups and SMEs, whereas InnovFin targets innovative businesses. In terms of geographical scope, InnovFIn is available for all countries participating in H2020 and ESIFs are only possible to receive in the EU Member States.

As far as coherence between **CEF[111] and InnovFin** is concerned, **these programmes demonstrate high complementarities and clear distinction between each other**. This is mainly due to their different scopes and objectives. Whereas **CEF focuses on cross-border and transnational projects in the transport, energy and telecom sectors, InnovFin does not have transnational requirements.** The InnovFin Energy Demo[112] provides support for national-level instruments in first-of-a-kind energy projects, while CEF Energy provides funding for transnational projects whenever it would be challenging to finance these solely through the private sector.

Regarding **INNOSUP[113]**, an analysis of its external coherence concluded that the programme created an interlinkage with the ESIF, but overall paints **a very mixed picture** regarding the synergies with EU support activities[114]. A more detailed analysis (based on survey and case studies) concluded that there is no overlap with national and regional initiatives, and that **INNOSUP Actions created synergies with other relevant EU or national programmes**[115].

[108] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Mahieu, B., Rosemberg, C., Roman, L., et al., Interim evaluation of the COSME Programme: final report, Publications Office, 2019, https://data.europa.eu/doi/10.2873/87360
[109] Ibid.
[110] For example, this is a general finding of EY (2017) Ad-hoc audit of the application of the Regulation 2015/2017 (the EFSI Regulation): Final Report. Available at https://ec.europa.eu/info/sites/default/files/ey-report-on-efsi_en.pdf
[111] More general information about CEF is available at https://ec.europa.eu/inea/en/connecting-europe-facility
[112] For more information about InnovFin Energy Demonstration Projects, see https://www.eib.org/en/products/mandates-partnerships/innovfin/products/energy-demo-projects.htm
[113] For more information: https://eic.ec.europa.eu/eic-funding-opportunities/european-innovation-ecosystems/innosup_en
[114] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Galdiga, L., Van de Velde, E., Sadlik, A., et al., Evaluation study of and potential follow-up to cluster initiatives under COSME, H2020 and FPI, Publications Office, 2021, https://data.europa.eu/doi/10.2873/977418
[115] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Study on the effectiveness of public innovation support for SMEs in Europe: final report, Publications Office, 2021, https://data.europa.eu/doi/10.2826/7745

The current evaluation of external coherence did not focus on INNOSUP, but interviewees (CS3: on complementary financing with Cohesion policy at project level) considered that an INNOSUP project (MINE.THE.GAP[116]) is a good example of complementarity between different EU projects in the mining industry.

This Culture and Creative Sectors Guarantee Facility Fund (CCS GF)[117] **instrument is also complementary to the InnovFin SME Guarantee Facility** (CS11 on supporting creativity). The two instruments have different objectives but may overlap or complement each other when a company wants to receive support for innovative actions in the area of CCS. Those companies can request funding from one of the two funds, picking the instrument that best fits their needs. However, in most cases, the intermediary might prefer the InnovFin SME Guarantee because it provides capital relief and is an uncapped guarantee.

As noted above, the design of EU schemes is not detrimental to ensuring external coherence between financial instruments, which suggests that there are other **challenges** in increasing the synergies. One of the challenges to achieving synergies between SME projects is that smaller companies **have difficulties investing the resources required to apply for EU funding**, in terms of both time and money. Drawing on the example of manufacturing SMEs (CS10 on the support for Industry 4.0), in general they are not very interested and knowledgeable about public funding opportunities and need to undergo a case-by-case cost-benefit analysis to assess the EU-supported opportunities. At the same time, **companies that successfully applied to H2020 funding are better placed to obtain consecutive funding** either within H2020 itself or with other programmes. The experience accumulated during the process is used in the future and can help reduce the time needed to complete successive applications. According to I4MS[118], start-ups participating in financial support for third parties funding were more likely to later obtain further public and private money, also in the form of financial instruments such as loans, guarantees and equity facility for growth. That suggests that public funding and H2020 are crucial instruments, especially for start-ups, to receive further opportunities and continue developing their business. Other examples from the agri-food sector (CS14) show that **applications for bigger national and EU-level programmes are easier for ICT companies as they are used to a certain level of terminology that can be overly complicated for small SMEs in the agri-food sector.** The technicality of the proposals, the terminology and language barriers are the most common obstacles for agri-food SMEs.

A crucial advantage of H2020 is the **networking aspect, but it puts SMEs without access to such networks in a disadvantageous position**. On many occasions, the first H2020 application is rarely profitable for an SME. Rather, its usefulness lies in the experience developed during the process, and in the fact that SMEs can get in touch with other more experienced companies. This puts them in a better position to later try to obtain funding from private investors, from banks, or from other EU level funding initiatives. A **positive example** mentioned by stakeholders in this context relates to the **Fast Track to Innovation** instrument, an agile project type where a significant number of SMEs could get together and cooperate with bigger and more H2020-savvy companies. This instrument was considered particularly suitable for digital SMEs (CS22 on digitalisation). These opportunities proved crucial to many

[116] https://h2020-minethegap.eu/

[117] The Culture and Creative Sectors Guarantee Facility Fund (CCS GF) was launched in June 2016 as part of the Creative Europe programme. It is managed by EIF on behalf of the EC (mostly by DG CNECT) and aims to improve access to debt financing for SMEs active in CCS. It focuses on two main operations: a free-of-charge first-loss capped portfolio guarantee and a capacity-building scheme. Like other EU Facility Funds, it aims at fulfilling a particular need in the market. Small and medium companies engaged in cultural activities, audiovisual or music industries such as theatres, museums, libraries etc., do not have substantial cashflow from which repayment capacities could be drawn.

[118] I4MS website, available here.

SMEs in acquiring important contacts and obtaining at least part of the know-how necessary to successfully conduct H2020 applications. The importance of such know-how is so high that different stakeholders have observed **the emergence of specialised niche players,** which consistently and successfully apply for H2020 funding and make it a key source of their budgets. Such a trend is likely to further discourage SMEs from trying H2020 applications in the first place.

The evidence gathered (CS12 on EU associated countries, which covers Moldova, Georgia, Serbia, Montenegro, and Ukraine) shows that **there is limited experience in most EU-associated countries referring to business engagement in R&I** (excluding countries such as Norway, Israel, Switzerland, and Iceland). Therefore, these countries try to upgrade their R&I competitiveness mostly through EU Economic Reform Programme[119], but not through H2020. The recent assessment report of ERPs results[120] from Albania, Montenegro, North Macedonia, Serbia, Turkey, Bosnia, Herzegovina, and Kosovo shows that the link between innovative businesses and academia is weak, with insufficient research funding. According to stakeholders from EU-associated countries, there is a high level of competition in H2020, and the programme had an impact mostly in countries with market-oriented industries and **it is difficult for SMEs** in EU-associated countries because SMEs are mostly not research-oriented.

Navigability of SME support and coordination mechanisms are other challenges, which are reviewed in sections 2.6 and 2.7 respectively. An initiative aiming to overcome some of these challenges is the Seal of Excellence - SoE (see further sections).

National programmes

The data analysis of project links at national level provides very similar results to the EU-level analysis. H2020 projects funded through the SME Instruments (incl. SME-1 and SME-2) are the ones that are connected the least to projects financed through national/regional funding schemes. The estimates show that below 1% of the projects funded though the H2020 SME Instrument funding scheme were found to be linked to the reviewed national programmes, which is a very low percentage when compared to other H2020 instruments[121]. Yet, it should be noted that these estimates are based only on data for five countries[122], which does not allow for strong conclusions.

Beyond the available data and SME-1 and SME-2, **in its analysis of the external coherence, the EIC pilot evaluation** reports that according to stakeholders, "the European dimension of the EIC, the sizeable funding, the EIC reputation and the focus on disruptive innovation and breakthrough technologies altogether generate **significant benefits for participants that cannot be delivered by national programmes"**[123]. The EIC pilot evaluation also mentions that even if there were some overlaps, these should not be regarded

[119] The ERPs include a macroeconomic and fiscal policy framework as well as structural reform plans to boost competitiveness and long-term growth. The ERP exercise also aims to help candidate countries and potential candidates develop their institutional and analytical capacities and to prepare them for participation in the EU's multilateral surveillance and economic policy coordination procedures once they become Member States of the EU. Countries involved: the Republic of Albania, Bosnia, and Herzegovina, Kosovo, Montenegro, the Republic of North, Macedonia, the Republic of Serbia, and Turkey

[120] https://ec.europa.eu/info/sites/default/files/economy-finance/ip158_en_0.pdf

[121] For example, 69% of projects from Innovative Medicines Initiative 2 were linked to national programmes, 59% from ECSEL, 55% from RIA, and 54% from ERA-NET and FCH2 were linked similarly.

[122] The estimates are for the following countries: Germany, France, Croatia, Poland, and Sweden

[123] European Commission, Directorate-General for Research and Innovation, Evaluation study on the European Innovation Council (EIC) pilot : final report, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2777/261324. p.69

as a major issue given the existing gaps for innovation financing (a similar finding as for the MSCA-Erasmus+ complementarity reviewed in this evaluation report).
To increase synergies between existing SME support programmes at national and EU levels, the H2020 Work Programme 'Access to Risk Finance'[124] introduced the new '**SME Initiative'**. This unique **hybrid instrument combines resources from ESIF, COSME and H2020, as well as national financing institutions.** It serves as an example of an effort to boost synergies through joint programming and support R&I-driven SMEs and small MidCaps.

When addressing the coherence between H2020 and national-level financial instruments, one of the main challenges is the **insufficient coordination between EU and national schemes supporting innovative companies**. Interviewees consulted within the interim evaluation of H2020's financial instruments mentioned that EIF-backed national guarantee schemes may risk 'cannibalising the market and making existing products uncompetitive, and a stronger focus is needed on assessing the market needs[125]. According to the study requested by the European Parliament's BUDG Committee, **a mechanism is needed to track these national instruments and continuously monitor market gaps.** More detailed mapping and reporting would help to ensure stronger complementarities with the EU-level instruments[126]. Findings from CS7 (on cooperation and coordination) also confirm that coherence with national programmes could be further improved by **working closely together through financial intermediaries in the local markets.**

Similar to the findings at EU level, in terms of navigability, stakeholders still struggle to understand the overall landscape of existing support mechanisms and the exact ways of how the traditional H2020 grants can be combined with other national and EU financial support (e.g., loans, equity, guarantees). As noted in CS8 (on agri-food), in Italy **there is limited awareness about the impact of H2020 on entrepreneurship, SME growth, and internationalisation.**

2.3. Navigability between H2020 and other R&I support initiatives from a stakeholders' perspective

Key findings:

- There are **good examples** of cooperation mechanisms for ensuring external coherence, but also an underlying **need[127] to further strengthen and institutionalise the communication and coordination between the bodies at EU level** involved in the management and implementation of EU R&I support initiatives.
- Similarly, the **mechanisms and actions aiming at ensuring coherence between EU and national initiatives are considered insufficient**. The H2020 **Programme Committees** can be considered a good mechanism for ensuring coherence, but their usefulness in this regard varies across countries. The same goes for **National Contact**

[124] EC (2017) Horizon 2020 Work Programme 2016-2017: 6. Access to Finance. Available at https://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-finance_en.pdf [13/04/2022]
[125] European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020's financial instruments : final report, Publications Office, 2018, https://data.europa.eu/doi/10.2777/378692
[126] Delors Institute (2019) Study requested by the BUDG Committee of the European Parliament, Mainstreaming Innovation Funding in the EU Budget.
[127] As illustrated by studies related to the CEF, Erasmus+, COSME, and the Health programme.

Points (NCPs), which are generally considered as a mechanism that can be used to contribute to synergies between EU and national initiatives, but the role and practices of NCPs across Member States are not consistent.

Ensuring that the European R&I landscape works in a coherent manner, giving access and providing clarity to its users is of crucial importance for ensuring external coherence. This evaluation question, therefore, explores the experience of different types of stakeholders in finding R&I support and ways to make the overall European R&I system easier to understand. Given that this question looks at the overall European R&I landscape, the section does not make a distinction between EU and national navigability, but rather aims to provide an overall assessment followed by suggestions for improvements. Furthermore, in Annex 6, we provide a 'map' of the overall issues identified, as concerns navigability and coordination (see section 2.4).

Navigability of landscape, ease of access and availability of information

A large number of funding schemes. According to previous analyses, the large number of EU programmes, including H2020, has created a very complex ecosystem where researchers and entrepreneurs struggle to find the best options for their specific interests and needs[128]. The independent High-Level Group on maximising the impact of EU Research & Innovation Programmes notes that **the range of funding schemes for R&I across the EU budget is numerous, complex, and not accessible enough**, which leaves companies and innovators lost, not easily knowing where to look[129]. The Interim evaluation of Horizon 2020's financial instruments also found that the large number of R&I funding instruments is difficult for potential applicants to understand, preventing thereby organisations from identifying the calls and instruments that are best fitted to their needs[130]. This conclusion **is largely confirmed by the analysis performed by this evaluation**.

The case studies show that **all types of entities (both from the academia and companies) have difficulties navigating in the complex** R&I support landscape. The complexity of the system is due to the large number of programmes at different levels, all of which have different conditions and requirements (CS22 on digitalisation). For example, CS18 (on cities) shows that even 'seasoned' beneficiaries often comment on how hard it is to navigate and understand the European R&I support landscape. However, the **level of difficulties depends on the** types of current and potential H2020 beneficiaries and their experience. Stakeholders (interviewed for CS1 on green innovation and CS10 on Industry 4.0) **agreed that navigability is generally complicated, especially for entities with no previous experience of H2020 or other support schemes. Researchers and research organisations are considered to be in the best position in this sense, since they have more knowledge about the overall R&I system in comparison to companies** and are more aware of the time and effort necessary to apply for specific schemes (CS22 and CS23 on health). The mushrooming of different EU level initiatives is a way to increase the **flexibility** of the overall R&I system, to make it more adaptable to the needs of the industry, and to increase the availability of initiatives that cater for specific needs. However, it further complicates a system that is already difficult to navigate. The spectrum of instruments and programmes created by the Commission is rather wide and each instrument has its own

[128] ERAC (2017) ERAC Opinion on the Interim Evaluation of Horizon 2020 and preparations for the next Framework Programme
[129] European Commission, Directorate-General for Research and Innovation, LAB – FAB – APP : investing in the European future we want : report of the independent High Level Group on maximising the impact of EU research & innovation programmes, Publications Office, 2017, https://data.europa.eu/doi/10.2777/477357
[130] EC (2017) Interim Evaluation of Horizon 2020's Financial Instruments

funding rates, rules, and requirements, which, for examples, makes the support system complicated for manufacturing SMEs which are trying to develop their I4.0 tools (see CS 10). The range of programme opportunities leaves companies and innovators fairly lost, not easily knowing where to look.[131] Some beneficiaries (see CS7 on cooperation and coordination) still struggle to understand the overall landscape of existing support mechanisms and the exact ways in which the traditional H2020 grants can be combined with other financial support (e.g., loans, equity, guarantees).

Information on project opportunities: The complexity of the R&I support system has been aggravated by **insufficient/non-centralised information for project opportunities**. The EC (2018) MLE report states that organisations and institutions with little experience with FPs are often unaware of the potential benefits of participation and lack sufficient access to information about opportunities and advice about application procedures[132]. According to the stakeholder consultation conducted within the scope of the Impact assessment, the vast majority of stakeholders found "too complex procedures leading to high administrative burden and delays" to be the main obstacle preventing the current programme from achieving its objectives, but they also mentioned "insufficient synergies between the EU programmes/funds" and "difficulty of combining EU action with other public interventions and private finance"[133]. This has been largely confirmed by the interviews performed under this evaluation (e.g. see CS7). As mentioned above, however, the accessibility of information on project opportunities differs among current and potential beneficiaries. Besides, the ease of access to information on funding programmes and tenders managed by the European Commission and other EU bodies is likely to improve in the 2021-2027 programming period with the launch of the Single Electronic Data Interchange Area (SEDIA)[134].

Some large research organizations (REC) and higher or secondary education organisations (HES) (see CS1), **have dedicated support departments and representatives that can help with tracking available EU funding[135]**, with projects proposals and even project management. While organisational capacity is an essential precondition to better navigate the European R&I support landscape and generally larger organisations deal with it better, it was also pointed out that call specifications sometimes are too vague and hamper beneficiaries from understanding the call coverage fully.

According to SMEs interviewed (CS2 on SoE), **the navigability and clarity** of the Seal of Excellence is not working well. Seal **holders lack guidelines on how to exploit the Seal of Excellence certificate** in the best possible way. Linked to this, they also have difficulties identifying EU programmes that support the SoE certificate. The **Community of Practice is seen as a successful method** to share views on the Seal of Excellence, but it is observed that building a European Commission steering committee with representatives from ESIF and different DGs to further coordinate and harmonise the work could bring added value in terms of navigability and clarity between Seal of Excellence and ESIF (CS2).

SMEs (CS10) report that the guidelines, e.g. available on dedicated websites of the European Commission or national governments, are generally not user-friendly and **are not**

[131] European Commission, Directorate-General for Research and Innovation, LAB – FAB – APP : investing in the European future we want : report of the independent High Level Group on maximising the impact of EU research & innovation programmes, Publications Office, 2017, https://data.europa.eu/doi/10.2777/477357
[132] EC (2018) Mutual Learning Exercise - Widening Participation and Strengthening Synergies, Horizon 2020 Policy Support Facility
[133] SWD(2018) 307 final
[134] The portal is available at: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/home
[135] DLR is also represented in Brussels which enables them to meet and talk with EU officials in person. PSA works via national contacts and associations in Brussels. Since they also are so focused on H2020, they are 'in the loop' and constantly monitoring possible funding opportunities.

effective in guiding companies between the different funding opportunities available. **Citizens (CS17) often face challenges in identifying opportunities**, due to language barriers, insufficient understanding of the procedures (e.g., templates, financial requirements, reporting), and networking. **There are differences in the knowledge and available resources between cities on how to navigate and apply for EU funding** (see CS18).

Information on project results: Another difficulty identified by the stakeholders is **the lack of easy access to H2020 results** (e.g. in the cybersecurity domain – see CS4). The existing databases such as CORDIS or H2020 Dashboard fulfil their purpose of providing information about H2020 project findings. However, it is difficult to navigate across these platforms and to extract to what extent and which research results might be policy-relevant (CS22). The national-level interviewees recurringly mentioned the need to have user-friendlier tools that would help policymakers quickly obtain different information about projects and their possible impact on policies. Although some relevant cybersecurity domain-specific tools are already available (e.g., Cyberwatching Radar or Cybersecurity Atlas), national-level policymakers are not familiar with them and their usage in practice. Yet, similarly to the observations on the project opportunities, the level of **difficulties accessing information also depends on the experience of the entities**. More experienced stakeholders (interviewed for CS8) emphasised that the CORDIS portal is very useful for general information on closed or ongoing research projects, as well as the LIFE programme portal and the EIP-AGRI site for operational groups. The Funding and Tender portal is also useful for new funding opportunities, as well as subscribing to dedicated newsletters. The IP Helpdesk also offers interesting online lessons to deepen the topic of intellectual property. Independent research networks are also important in supporting the diffusion of information on the EU R&I funding landscape.

Challenges in navigability create an uneven playing field and niche players: The type of organisation, its size, and experience are distinct factors in the responses during interviews to the issue of how potential beneficiaries find their way around in the EU R&I support landscape. **Smaller organisations find it harder to navigate around the different EU instruments,** while research organisations and higher education organisations, which sometimes have dedicated project funding and administration departments and even EU policy representatives in Brussels, do not see this as an issue (see CS1 and CS22). In countries such as Spain, Portugal or Greece, stakeholders from the mining sector interviewed for CS3 – with extensive experience in H2020 calls and previous FPs as well as in the Interreg Programme - showed a marked preference for H2020 calls rather than for national/regional calls. In addition, as noted by other studies[136] and CS3, cascade funding has proved to be fairly effective, as it created an easier entry point for SMEs. However, in general SMEs[137] face serious challenges in navigating the various EU programmes and they often need additional support (expertise, knowledge and time) to identify the right calls and apply.

According to the ERAC, entering into and maintaining a consistent position in the EU system needs a steady effort which could be difficult and costly to achieve, especially for

[136] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Study on the effectiveness of public innovation support for SMEs in Europe : final report, Publications Office, 2021, https://data.europa.eu/doi/10.2826/7745

[137] This is not to say that all SMEs are in a disadvantaged position. For example, for CS22, the interviewed LEIT-ICT stakeholders explained that the situation with SMEs is not uniform. Although one could say that on average they are in the most difficult position when looking and applying for R&D&I funding, there are some SMEs that are very skilled and successful in getting such funding. In the context of LEIT-ICT, there are digital SMEs that act as a key link of the consortium or a main connector unit of a large company. On the other hand, there are non-digital SMEs, often from the manufacturing sector, that find it extremely difficult to find a suitable funding programme, suitable partners and prepare the proposal.

inexperienced researchers and innovators. The multitude of programmes and lack of sufficient information risks an increase in transaction costs and diluting excellence by favouring competition among those "in the know", excluding those who may be excellent but unfamiliar with the system[138]. Evidence from the case studies shows that research institutions are specialising their research teams in applying for funding: some teams have a track record in participating in projects sponsored by national ministries and they continue to do so, other teams are better at applying for EU funding (see CS8 and CS10).

Areas for possible improvement

Possible solutions to the navigability issues described above (complexity and insufficient information) have been put forward in recent years and include, for example, facilitating access to EU funding for the user by **having harmonised rules for participation across the EU budget and a one-stop-shop for research and innovation funding**[139]. Overall, these suggested solutions are linked to the following areas, which have been confirmed by the evidence gathered during this evaluation.

Overall simplification of initiatives: The case studies confirmed the general need to address the high number of initiatives and the underlying differences between them (e.g. in terms of criteria, funding rates, administrative requirements, verification and reporting requirements), as a way of simplifying the complexity of the R&I support system. These findings confirmed the conclusions of previous analyses. For example, the ERAC notes that numerous sectorial initiatives co-exist outside H2020 in fields such as Health, Justice, Defense, Space-ESA, Environment, Regional Policy, which are managed by their thematic DGs, which can occasionally lead to thematic duplication with H2020 and calls for reducing the number of initiatives with the objective of increasing navigability[140]. The ERAC is convinced that simplification should be further developed to design unified, as much as possible, initiatives that would enable a relevant decrease in the transaction costs associated with the participation in the EU R&I initiatives. The interim evaluation of Horizon 2020 also showed that stakeholders believe that the policy mix of the overall programme should be simplified: the number of instruments should be limited, their intervention logic clearly defined, and complementary/synergies with other instruments well stated[141].

Provision of centralised data on project opportunities: Overall, there is a need for an EU-wide platform (preferably multi-lingual) where beneficiaries can receive an overview of available financial opportunities, what their aim and purpose are, how to use them, eligibility and even information on how to combine them or use them in follow on projects (CS10, CS17, CS18, CS22). It would also be advisable to provide an overview of all the non-financial support available to beneficiaries and how they can support them. Evidence from CS1 and CS23 also support the suggestion for a one-stop shop for innovation funding. In the case of potential citizen applicants, such a one-stop-shop could draw on the experience with the 'EU Citizen Science', which improves access to information and overall navigability[142].

[138] EC (2017) LAB – FAB – APP — Investing in the European future we want
[139] EC (2017) LAB – FAB – APP — Investing in the European future we want
[140] ERAC (2017) ERAC Opinion on the Interim Evaluation of Horizon 2020 and preparations for the next Framework Programme
[141] EC (2017) Interim evaluation of Horizon 2020, Staff Working Document, Annex 1.
[142] Directorate-General for Research and Innovation (European Commission) (2020*), Citizen Science and Citizen Engagement - Achievements in Horizon 2020 and recommendations on the way forward*, available https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/ec_rtd_swafs_report-citizen_science.pdf

Awareness-raising of the benefits of project participation: The MLE[143] suggested several measures and actions that could improve the delivery of timely and relevant information and advice to potential FP participants such as public promotion campaigns alerting researchers and the public at large to the benefits of FP participation and notifying them of the existence of relevant sources of information. As confirmed by CS10, in general, **awareness-raising** activities and communication could be improved to foster synergies. These activities would regard both the existence of synergetic funding opportunities, and the benefits entailed, for example, in embracing digitalisation and Industry 4.0 – often unknown by smaller companies. However, an issue to be tackled is that many players are not interested in sharing their best practices with potential competitors, neither with regards to methodology nor to ways to increase the chances of winning H2020 calls and grants.

Networking is another possible solution to navigating in the complex R&I support system: A crucial aspect in fostering synergies lies in providing *companies* with enough networking opportunities with entities specialised in EU funding, with more experienced companies or with existing and successful consortia (CS10). This has been indicated by interviewees as the single best way to increase the success rate in terms of i) identifying synergetic programmes and ii) successfully applying for them. Some networking opportunities have been indicated as best practices, e.g. DIHs and EDIHs play an important guiding role, together with initiatives such as EEN and the ECCP. According to a recent evaluation, which covered the **ECCP[144], synergies are mainly created with Horizon 2020** and the Smart Specialisation Platform on Industrial Modernisation and EEN, but it also recommends promoting stronger coherence with the Horizon Europe programme.

Further examples of networks are provided in the textbox below.

BOX 6: Examples of networks as a support tool for navigability

Regional authorities could take advantage of network opportunities thanks to the smart specialisation platform, I3 instrument, clusters, DIHs, and partnerships (CS19 on border regional governments). According to interviewees, an *individual* trying to obtain successive funding has considerably higher chances of success in case of connections with a university network (such as in the case of a PhD candidate). In that case, this individual can count on support instruments and guidance from the university itself. Similarly, in the case of *international partners*, their chances of navigating through the different programmes available at EU level are depending a lot on joining a consortium with an expert European member, knowledgeable of the European R&I system. The MLE exercise showed that *governmental participation* in relevant EU-level P2Ps, PPPs and other networks could improve prospects for the participation of indigenous research actors in H2020[145]. An example of an *international network* in support of synergies is Euphresco,[146] a network of organisations that fund research projects and coordinate national research in the phytosanitary area (CS8). *Associations* (e.g. EFFRA, euRobotics, EpoSS and others) provide advice on funding possibilities and create information databases or portals on the projects and their results for their members. They are hugely important for the cross-border

[143] EC (2018) Mutual Learning Exercise - Widening Participation and Strengthening Synergies, Horizon 2020 Policy Support Facility

[144] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Galdiga, L., Van de Velde, E., Sadlik, A., et al., *Evaluation study of and potential follow-up to cluster initiatives under COSME, H2020 and FPI*, Publications Office, 2021, https://data.europa.eu/doi/10.2873/977418

[145] *Ibid*.

[146] https://www.euphresco.net/projects/success

exchange and dissemination of information, across value chain and industry ecosystems (CS22). Another example is European Energy Research Alliance (EERA), which looks to accelerate new energy technology development by cooperation on pan-European programmes and by bringing together more than 175 research organisations (CS21 on the green transition). An example of a *network* aiming to ensure policy coordination and follow-up on a H2020 project (on mining – see CS3) is the last deliverable of the MIREU H2020 project - CoMMER[147] (Council of Mining and Metallurgy Regions of EU), which was officially launched at the end of 2020 and embedded as a Task Force within ERRIN (European Regions Research & Innovation Network)[148], a Brussels-based network of more than 120 regions.

Strengthening dialogue between H2020 and ESIF managing bodies, e.g. via Communities of Practice (CoP)[149]: Complex shared management arrangements could mean more complex implementation rules as shared management arrangements involve additional layers of decision-making, strategies and regulatory requirements in Member States, leading to increased administrative effort and lengthy implementation procedures[150]. Thus, improved governance structures are essential for strengthening performance, in particular, implementing governance structures that deliberately set out to improve communication and coordination between the Managing Authorities responsible for overseeing the implementation of ESIF-supported activities at national and regional levels and those bodies responsible for H2020-related activities[151]. In this regard, the creation of **CoPs**, is seen to be very important when it comes to navigability, clarity and transparency (CS2). For example, SynBLAG, the working group in Germany on synergies between Horizon 2020 and the European Structural and Investment Funds, is considered a successful working group in the partnership agreement with Germany and the EC to discuss synergies between ESI Funds and Horizon 2020. The established Synergy Dialogue Office within the working group presented studies and reports for even better coordination and harmonisation purposes.

Capacity building of applicants as a way of levelling the playing field: As mentioned in the previous sub-section, those already 'inside the system', know how to navigate around the different funding instruments and how to combine them. Hence, it would be useful to have an EU instrument dedicated to capacity building, building up skills and knowledge and assisting how to get into networks, providing a 'steppingstone' into the European R&I support system. A good example in this direction is the Estonian Mobilitas Pluss programme152, managed by the Estonian Research Council, which supports participation in the Horizon programme (directly and indirectly) and is co-funded (83.5%) by the ERDF (CS18 on cities).

[147] https://mireu.eu/system/files/2021-02/CoMMER.pdf
[148] https://errin.eu/
[149] For more information on the concept: https://op.europa.eu/webpub/jrc/communities-of-practice-playbook/assets/cop_online_version_light.pdf
[150] EP (2016) Research for REGI Committee - Maximisation of synergies between European Structural and Investment Funds and other EU instruments to attain Europe 2020 goals
[151] EC (2018) Mutual Learning Exercise - Widening Participation and Strengthening Synergies, Horizon 2020 Policy Support Facility
[152] https://www.etag.ee/en/funding/programmes/mobilitas-pluss/

2.4. Coordination mechanisms for ensuring external coherence

Key findings:

- There are **good examples** of cooperation mechanisms for ensuring external coherence, but also an underlying **need[153] to further strengthen and institutionalise the communication and coordination between the bodies at EU level** involved in the management and implementation of EU R&I support initiatives.
- Similarly, the **mechanisms and actions aiming at ensuring coherence between EU and national initiatives are considered insufficient**. The H2020 **Programme Committees** can be considered a good mechanism for ensuring coherence, but their usefulness in this regard varies across countries. The same goes for **National Contact Points** (NCPs), which are generally considered as a mechanism that can be used to contribute to synergies between EU and national initiatives, but the role and practices of NCPs across Member States are not consistent.

Horizon 2020 was expected to ensure broader horizontal policy coordination enhanced through a single framework integrating research, innovation, researcher training and skills and by explicitly defining links with other policies[154]. This evaluation question focuses on analysing the current mechanisms to ensure coordination between different EU initiatives and those put in place to ensure coordination between EU and national / regional initiatives. We also examine the key actions that are undertaken to foster coherence and complementarity, as well as policy learning activities and their results. The role of public-public and public-private partnerships in deploying synergies and aligning programmes at EU and national/regional level is also explored.

Mechanisms and actions aiming at ensuring coherence with EU initiatives

A definitive assessment of the coordination mechanisms for ensuring external coherence with EU (and national) programmes is very challenging due to the different nature of the programmes, topics, scope, and levels of implementation. In this regard, there is no single mechanism that can be assessed, but rather a multitude of different coordination mechanisms. Evidence from the desk research and case studies **shows good examples of cooperation mechanisms but also an underlying need to further strengthen and institutionalise the communication and coordination between the bodies involved in the management and implementation of EU R&I support initiatives**. Despite the existing mechanisms (illustrated by examples below), they tend to be scattered and **there is a need for a more coordinated and streamlined approach at EU level**.
As illustrated in the next paragraphs, **evaluations of the external coherence of other EU programmes provided positive conclusions on their complementarity with H2020, but did not identify specific coordination mechanisms at EU level that focus on ensuring external coherence**. The findings have been largely confirmed by this evaluation.

The **Connecting Europe Facility** Mid-term evaluation[155] concluded that the fact that for transport and energy, both programmes – CEF and Horizon 2020 – are managed by the

[153] As illustrated by studies related to the CEF, Erasmus+, COSME, and the Health programme.
[154] SWD(2018) 307 final
[155] COMMISSION STAFF WORKING DOCUMENT Accompanying the document Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee

same Executive Agency (INEA) ensures further coherence.[156] However, interviewees (CS9 on transport) – both from the perspective of CEF as well as from the perspective of JUs – recognised that there is no synergy by design, **as there is an insufficiently coordinated approach between the funding programmes**. In the new calls for the CEF tool, there is a specific question on the evaluation form where it is explored if a project submitted has links to Horizon 2020 projects[157]. This will help in an analysis to see whether CEF projects have links to previous projects from other programmes such as Horizon 2020 / Horizon Europe. There are nevertheless **some mechanisms that promote synergies despite the absence of a coordinated approach**. An example of such a mechanism is the **synergy label complementary activities' mechanism** applied by Clean Sky 2 Joint Undertakings (see CS9 for more details).

Evidence from the Mid-term evaluation of the **Erasmus+ programme**[158] suggests that **communication between services in charge of given programmes could be strengthened at EU level.** In particular, no clear example of dedicated coordination tools between EC services were reported in the Erasmus+ Mid-term evaluation, but also in CS3 (on the complementarity with Cohesion policy), which calls for improving the conditions for synergies that would require enhanced coordination at EU level (see CS3 for more details). The Interim Evaluation of the **COSME** Programme[159] does not provide specific examples of coordination mechanisms either.

As concerns coordination mechanisms at the EU level, the Mid-term evaluation of the Third **Health Programme**[160] concluded that the **interservice group**[161] provides the formal structure for coordinating activities, but despite this, some stakeholders engaged during the evaluation felt that the potential synergies between the 3HP and research programmes were not being exploited, and that more efforts were needed to publicise their complementary structures and to increase their coordination. This has been confirmed by interviewees on both Member State and EU level who acknowledged that they have not seen close cooperation between the Health Programme and H2020 (see CS23 for more information). In the context of the Creative Europe Programme, interviewees (CS11) also mentioned the **interservice meetings** organised between different DGs, project coordinators as well as CCIs partners involved in projects, as it helped produce a good overview of funding

of the Regions on the mid-term evaluation of the Connecting Europe Facility (CEF) {COM(2018) 66 final/2} Available at: https://ec.europa.eu/info/sites/default/files/mid-term_evaluation_cef_swd_2018_44_1.pdf

[156] Although a matter rather of internal coherence, the LEIT-ICT experience also confirms that coordination on different H2020 programmes within one DG (DG CNECT) is, unsurprisingly, easier because DG CNECT alone was responsible for ICT/digital topics. It meant that not many people were simultaneously involved, therefore less coordination activities, approvals and communications were necessarily overall, and LEIT-ICT and other programmes stayed efficient and flexible (see CS22 for more information).

[157] As mentioned earlier, in this vein, the LIFE programme awarded additional points in case of synergies with H2020.

[158] Mid-term evaluation of the Erasmus+ programme (2014-2020) Accompanying the document REPORT FROM THE COMMISION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF REGIONS Mid-term evaluation of the Erasmus+ programme (2014-2020) {COM(2018) 50 final}. Available at: https://ec.europa.eu/info/sites/default/files/m-t_evaluatio_erasmus_swd_2018_40.pdf

[159] EC (2017). Interim Evaluation of the COSME Programme. Final Report. Written by Technopolis Group. 14 December – 2017

[160] EC (2017). Mid-term Evaluation of the third Health Programme (2014 – 2020). Final report. Written by Coffey International Development SQW and Economisti Associati. Available at: https://ec.europa.eu/health/system/files/2017-10/2014-2020_evaluation_study_en_0.pdf

[161] According to the Mid-term evaluation, the inter-service consultation mechanism allows other European Commission DGs with relevant expertise to share their views on the annual work programmes, including with the objective of ensuring complementarity of actions by different DGs.

instruments and projects impact, without however, necessarily leading to co-creation and synergies.

A good example, organised at the EU level, is a collaboration between **MSCA, the European Innovation Council, and the European Research Council** with the objective of creating pipelines for deployment in certain thematic areas. As informed by the EC, a pilot has been launched with 1 H2020 MSCA-ITN, 1 H2020 EIC, and 1 H2020 ERC project on material sciences. A meeting has been organised at the end of April 2022 with all participants and EU project officers to discuss potential collaborations and synergy initiatives.

Mechanisms and actions aiming at ensuring coherence between EU and national initiatives

The findings on the mechanisms aiming at ensuring coherence between EU and national financing are very similar to the findings on the mechanisms at EU level – **there are examples of existing mechanisms, but they are considered to be insufficient.**
By and large, the findings from interviews and desk research suggest that the institutional mechanism for taking up H2020 (and other EU programmes') results into national policymaking should be further strengthened, **as national policymakers still lack awareness about H2020 project implementation and result valorisation** (see, for example, CS1 on green innovations, CS4 on cybersecurity, and CS7 on cooperation/coordination). According to the interviewed national-level stakeholders, it would be helpful to have a **more systematic and regular information exchange with H2020 projects**, in this way strengthening coherence between the Framework Programme and national-level policy initiatives and funding mechanisms. Overall, there is a **perceived lack of coordination and harmonisation between different EU initiatives and in their interaction with national funding** (see, e.g. CS10 on Industry 4.0 and CS23 on health). These findings build upon conclusions of previous studies. Notably, some researchers consulted within the scope of the Horizon 2020 Interim evaluation stated that coordination with the national level is not always effective and highlighted the need for a better policy coordination at EU, national and regional level[162]. The Horizon 2020 Interim evaluation found that in some countries it is **difficult to ensure national coordination with Horizon 2020**, notably in R&I systems where the bottom-up approach dominates. The Summary Report on 'Widening Participation and Strengthening Synergies'[163] concurs, stating that there is a **need for "governance structures that deliberately set out to improve communication and coordination** between the Managing Authorities responsible for overseeing the implementation of ESIF-supported activities at national and regional levels and those bodies responsible for H2020-related activities". The ERAC highlighted the need for **more effective communication on R&I achievements towards national policy-makers, stakeholders and citizens**.[164]

Drawing a link to the Seal of Excellence (see also section 2.5), **a good example of a coordination mechanism is the Stairway to Excellence (S2E) project, launched in 2014, which aims at facilitating the coordination between ESIF and H2020**, especially for the EU13 regions and countries (CS7). Under the S2E project, national initiatives are organised with the aim to provide a better understanding of the national innovation ecosystem as well

[162] EC (2017) Interim evaluation of Horizon 2020, Staff Working Document, Annex 1.
[163] EC (2018). Mutual Learning Exercise - Widening Participation and Strengthening Synergies: Summary Report. European Commission. B-1049 Brussels Manuscript completed in September 2018. p.4
[164] ERAC Secretariat (2018) Final report by the ERAC Ad-hoc Working Group on Partnerships on the "Recommendations on rationalising the EU R&I partnership landscape and optimising its coherence"

as to highlight success stories in combining different EU funds. These events have brought together key stakeholders such as national authorities in charge of Regional Innovation Strategies for Smart Specialisation (RIS3), national contact points (NCPs), and selected experts and representatives from business and research organisations. In addition to these national events, S2E produces 'Country Reports' written by independent national experts with the intention of providing a sound understanding of the national characteristics of R&I ecosystems and analysis of policy issues hindering the combination of key EU funding mechanisms.

An existing mechanism, which can be used for ensuring coherence between initiatives both at EU and at national level, are the H2020 Programme Committees. The Horizon 2020 Interim evaluation concludes that in general, in the context of coordination with R&I activities carried out at national level, they played a special role, with Member State involvement in its activities being of special interest and often underlined by these States. This is also confirmed by CS4, CS12 (on EU associated countries), and CS22 (on the digital transformation) findings. However, they also **identify limitations**. One limitation is that usually, the national level representatives involve people working in research ministries – in this way, there is no direct exchange between projects and national experts on particular topics (e.g. cybersecurity experts). Evidence from CS22 suggests that on the operational level, good coordination is achieved by having the same people working in national delegations during Horizon 2020 negotiations and then on national strategies (e.g. Finland) and having very close-woven team with day-to-day contact working on the digital/ICT funding for all types of programmes (e.g. Austria), but notes that this is not the case in all EU Member States. As noted in CS13 (on smart specialisation strategies) and CS23 (on health), even on the national level within the Member States there can be a lack of coordination between different parties and ministries involved, which often do not align with each other and this is then transferred into further difficulties in EU-national interactions. Regarding synergy mechanisms for strengthening R&I policy reforms in the EU Associated Countries, CS12 concludes that there is a need for EU-associated countries to be more active and express their opinion in Programme Committees when FP programmes are prepared. However, it should be noted that this is not an issue related to the existence of the mechanisms, but rather an insufficient use by national authorities**. Thus, H2020 Programme Committees can be considered a good mechanism for ensuring coherence, but their usefulness in this regard varies across countries.**

National Contact Points (NCPs) are generally considered as a possible mechanism to contribute to synergies between EU and national initiatives, but it seems that the role and practice of NCPs across Member States are not consistent. Some of the interviewees praised the role of the NCPs and their networks as a mechanism for distributing information, which helps with the coordination of different initiatives and policies (see CS4, CS12, CS21). An example of a horizontal initiative is the Topic Tree project (also mentioned in section 2.3)[165] by national contact points (NCPs). They addressed the problem of the lack of information on the exploitable results from other projects and partners by creating an online tool that shows thematic connections between different ICT-related projects under Horizon 2020 and illustrate how well different topics have been covered or where the research is at (see CS22). Another example is the Lighthouse initiative by ECSEL.[166] However, **many see the NCP role as a potential mechanism for coordination, rather than a reality in all countries** (CS10, CS17). The NCPs are in a good position to have full information on all funding possibilities in a specific area in a specific country or region. For example, in Austria and Finland (CS22) and Spain (CS23), the NCPs act as contact points for Horizon 2020 and national/regional programmes, and they would be able to give full information on different

[165] See Ideal-ist Topic Tree.
[166] For more information, see the webpage Lighthouse initiatives.

programmes and advise the interested parties on the best fit for them. This is not the case in all EU Member States, and according to the interviewees, in some Member States, the NCPs are more isolated and do not know much beyond the programme, for which they are responsible (CS22 and CS23). In this regard, a common strategy in some countries (e.g. in Ireland, Austria and Estonia) is that one single government body overlooks the funding channels (European as well as national), facilitating the coordination and synergies among all funding pathways (CS7). These findings corroborate the extensive analysis of the NCPs role in ensuring synergies in the JIIP report[167], which concludes that since the NCP mandate does not specifically include the promotion **and generation of synergies[168], H2020 NCPs do not consider that there is a very frequent exchange of information on H2020 structures and rules with the ESIF Managing Authorities, neither with the R&I community**.

Examples of partnership mechanisms in developing synergies and aligning programmes

According to ERAC, **public-public partnerships** (ERA-NETs, EJPs, Art 185 initiatives and Joint Programme Initiatives - JPIs) are a cornerstone for a more coordinated implementation of national and European research programmes, aligning resources and policies on common challenges, **while public-private partnerships** (JTIs and the legal entities - JUs and cPPPs) trigger togetherness and additional investments to develop new technologies, products and services which will give European industry a leading position on world markets[169]. The EC High-Level Group on maximising the impact of EU Research and Innovation Programmes found that the **public-public partnerships** supported by Horizon 2020 co-funding **are building lasting collaborations but appear not to have been influential on Member States' policies and strategies[170]**. According to a 2017 report, the **P2P partnerships** often seem to function in isolation with limited interaction with other relevant initiatives (other partnerships in similar or neighbouring thematic areas).[171] The report concluded that, there is not a firm intention or systematic action to forge a link between P2Ps and PPPs to capture the potential synergies.

Nevertheless, evidence from the case studies provides good examples of ERA-NET Cofund cooperation and knowledge diffusion where the **ERA-NET Cofunds contributed to ensuring coherence between the EU and national research programmes** (see the examples below).

BOX 7: Examples of ERA-NET Cofund actions contributing to ensuring external coherence

- An example of cooperation between EU members and associated countries on delivering synergies with related and complementary initiatives in the sustainable food systems field

[167] EC (2017). Synergies between Framework Programmes for Research and Innovation and European Structural and Investment Funds contributing to the Interim Evaluation of Horizon 2020. Written by the Joint Institute for Innovation Policy (JIIP), September – 2017. Available at: https://op.europa.eu/en/publication-detail/-/publication/d5e5627a-32fb-11e8-b5fe-01aa75ed71a1/language-en

[168] This was also confirmed during the validation workshop within this evaluation study.

[169] ERAC (2017) ERAC Opinion on the Interim Evaluation of Horizon 2020 and preparations for the next Framework Programme

[170] EC (2017) LAB – FAB – APP — Investing in the European future we want

[171] Technopolis Group (2017) Discussion paper - Increased coherence and openness of European Union research and innovation partnerships

is SUSFOOD2 -Sustainable Food production and consumption[172]. Another example of cooperation on digitalisation of agri-food systems with the aim of follow-up on research projects is ICT-AGRI-FOOD[173] (CS14);

- An example under the SC Energy, where wind energy R&D was addressed by both Horizon 2020 and by ERA-Net Cofund actions such as DEMOWIND[174] and where there is also a range of national and regional support measures (including via the ERDF) working to foster deployment and commercial uptake. Another example - the Electric Mobility Europe Cofund looked to further advance electric mobility in Europe by building on the achievements, experiences, networks and results of the previous edition (Electromobility Plus) (CS21);
- ERA PerMed is an ERA-Net Cofund, which is supported by 32 partners from 23 countries and co-funded by H2020 and facilitates alignment between national research strategies, enhances the competitiveness of European players in the PM space, as well as worldwide collaboration[175] (CS23).

The case studies also provide examples of successful **European Joint Programmes** (EJP Cofund) and **JPIs** (see the examples below).

BOX 8: Examples of EJP Cofund and JPIs contributing to ensuring external coherence

- European Joint Programme on Rare Diseases and European Reference Networks (with 24 ERNs that have received complementary support from previous Health programmes as well as Horizon 2020) and the HBM4EU: The European Human Biomonitoring initiative and EJP-RD (CS23);
- JPI 'More Years, Better Lives' (MYBL), which has mobilised 16 EU and non-European countries to work together on a programmed approach to enhance coordination and collaboration between national and international research programmes related to demographic change (CS7). Another example is **JPIAMR: Anti-Microbial Resistance, which** is a global collaborative organisation and platform, including 29 countries to curb antimicrobial resistance (AMR) with a One Health approach.[176] (CS23).

Despite the positive examples, however, the JPI evaluation[177] indicates that in general JPIs **have failed to establish an effective coordination mechanism**. Most importantly, this is due to the lack of political interest at the EU and national levels and Member States' unwillingness to co-invest and cumbersome administrative setups.

[172] See: https://susfood-db-era.net/main/
[173] See: https://ictagrifood.eu/about
[174] See: http://www.demowind.eu
[175] For more information see: https://www.era-learn.eu/network-information/networks/era-permed
[176] For more information about JPI AMR, see: https://www.jpiamr.eu/
[177] EC (2016). Evaluation of Joint Programming to Address Grand Societal Challenges. Final Report of the Expert Group. Available at:
https://www.era-learn.eu/documents/ec-publications/jp_evaluation_final_report.pdf

2.5. Horizon 2020 approach to fostering synergies with other programmes

Key findings:

- **Technical and administrative barriers[178] have hampered the implementation of cumulative funding synergies** in the scope of individual projects, yet synergy mechanisms worked much better in the context of partnership-based instruments.
- **Successive funding synergies, where projects/initiatives build on each other's results/resources, are the most frequent synergy mechanisms** that are successfully implemented by beneficiaries. These are relatively more easily generated by single applicants, whereas partnership-based synergies seem more problematic due to the fact that consortium beneficiaries may be supported by different funds from different countries/regions.
- **The Seal of Excellence is regarded as a promising alternative synergy mechanism** mainly for mono-beneficiary schemes such as the SME instrument, EIC Accelerator, MSCA, also through European partnership frameworks (e.g. JUs).

This section summarises the main findings on how various H2020 synergy mechanisms have worked in practice. As examples of existing synergy mechanisms are sparsely referenced across many sources and relate to diverse parts of H2020, this section summarises key insights across the main synergy typologies outlined in the Glossary of key terms, namely cumulative funding synergies, successive funding synergies, concurrent synergies and strategic synergies, and operational synergies.

Cumulative funding synergies

Cumulative funding synergy is a type of synergy that arises when H2020 funding is combined with other EU, national or regional funding instruments in the same operation, project or initiative (see the Glossary of terms for definitions). The Horizon 2020 Regulation has underlined the importance of this funding synergy, particularly with respect to the widening objective stipulating that "Horizon 2020 shall contribute to the closing of the R&I divide within the Union by promoting synergies with ESIF. More targeted guidance materials to policymakers and implementing bodies have been made available outlining in more technical terms how ESIF and Horizon funds can be used in the same project[179] [180].

According to the H2020 PSF MLE results, "there is generally a **great prospective interest to many national and regional policymakers and R&I actors** [in cumulative funding opportunities] due to the leverage potential of H2020 resources directly complementing national and ESIF-derived funding. Yet, **this type of alignment is also where real and perceived barriers most actively deter the efforts to implement these synergies**"[181].

There are instances where cumulative synergies within a single project have taken place. Especially this is evident in schemes that were designed towards synergistic use of funds to advance 'widening' objectives. Examples from Teaming and ERA Chairs implementation showcase successes in a cumulative combination of funding sources from H2020, national sources and ERDF. Beyond such targeted actions, it appears that beneficiaries of individual

[178] The new EU legislative provisions for 2021-2027 have to a large degree tackled the identified barriers.
[179] EC (2014) Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes: Guidance for policy-makers and implementing bodies
[180] EC (2022) Draft Commission Notice Synergies between Horizon Europe and ERDF programmes
[181] EC (2018) Mutual Learning Exercise: Widening Participation and Strengthening Synergies

H2020 projects do not really strive to combine various funding sources due to the administrative and procedural complexity involved in such efforts (e.g., CS1 on green innovations, CS13 on the synergies between the EIT RIS and S3). Overall, beneficiaries appear to 'stick to what they know best' and what is easier and, in this respect, cumulative funding synergies that merge funding sources for the implementation of a single R&I project are not seen as something desirable or deliberately aimed for (CS1 on green innovations).

Among the main barriers that beneficiaries enlist are technical and regulatory difficulties, such as the need for two separate Grant Agreements with specific implementation modalities, incompatibilities caused by different regulatory frameworks governing the funding sources and mismatches in funding cycles and time to grant, etc.[182] **Other barriers include non-existent or unspecified co-funding rules, divergent eligibility criteria and complexity in accountability structures** as cumulative funding requires aligning not only funds but also the involvement of various stakeholders and organisational mechanisms. Sometimes the "challenges involved in developing joint project proposals, in synchronising, e.g., ESI Funds and Horizon 2020 project application procedures, in coordinating joint management and in taking into account the territorial dimension of ESI Funds" lead to a situation where it is easier to use successive projects than parallel projects[183].

While evidence of cumulative funding synergies appears to be less frequent in terms of individual projects, there are **plenty of examples of cumulative synergies working in the context of partnership-based instruments** as many P2Ps and PPPs involve combinations of funds from different sources: national, regional, private sector, H2020, ESIF. H2020 PSF Mutual Learning Exercise identified outlined how **ERA-NET COFUND** initiatives (that national bodies collectively launch in an area of mutual interest using national funds and ESIF) can attract H2020 funds to cover network support and can include a top-up contribution as long as this does not substitute for national/ESIF contributions[184]. **Joint Undertakings** have also been referenced as successful mechanisms for building synergies. H2020 and ESIF can be used to fund different work packages since these can be treated as separate cost items. Various practices from Bio-Based Industries JU, CleanSky 2 JU, ECSEL JU have been described as successful examples of how cumulative synergies could be attained[185]. Also, the opportunities for cumulative funding were recognised in the original working mechanism of the **EIT KICs** that for complementary activities, which accounted for at least 75% of the budget of a KIC, could combine funds from other sources, including H2020, ESIF and the private sector[186]. The funding model has been in place until 2020.

Moreover, as the ERA LEARN survey among European public partnerships, EOSC regional projects and regional authorities dealing with RIS3 concluded, "creating synergies among different funding sources may already be realised although not in the most visible way" as "governing bodies of R&I partnerships have not particularly been paying attention to combining funds coming from other sources, nor are engaged in exchanging experiences with other partnerships on this subject.[187]" Hence, it might be **an indication that existing**

[182] ERA LEARN (2021) Updated Policy Brief on Synergies between R&I partnerships & European Structural and Investment Funds (ESIF)
[183] Ferry, M. and Kah, S. (2016) Maximisation of Synergies between European Structural and Investment Funds and other EU Instruments
[184] EC (2018) Mutual Learning Exercise: Widening Participation and Strengthening Synergies
[185] JRC (2019) Joint Undertakings – analysis of collaboration mechanisms with ESI Fund and in an S3 context
[186] Delors Institute (2019) Mainstreaming Innovation Funding in the EU Budget: Study requested by the BUDG Committee of the European Parliament
[187] ERA LEARN (2021) Updated Policy Brief on Synergies between R&I partnerships & European Structural and Investment Funds (ESIF)

practices on how cumulative funding mechanisms are applied in partnership-based instruments are not fully reported.

Successive funding synergies

Successive synergy refers to collaboration where projects/initiatives build on each other's results/resources. Within this type of synergy, there is a differentiation between: 1) upstream synergy, which occurs when regional/ national level initiatives pave the way for joint efforts to apply for H2020 and 2) downstream synergy aimed to enhance the take-up of H2020 and other research results towards the market.
Upstream synergies where projects funded through, e.g., Regional Operational Programmes succeed in attracting further H2020 funding appear to be one of the most referenced examples of working synergy mechanisms (CS1, 6, 8, 12, 13, 14). According to survey results from the study on maximising synergies between FP and ESIF, **upstream synergies are easily generated**. The study concludes that in general, it is easier for ESIF beneficiaries to engage in upstream synergies and participate in H2020 calls. This is very much related to the R&I field and concerns academia, research organisations and enterprises (SMEs)[188]. The emergence of 'upstream synergies' is noticeable, through actions that build R&I capacities of actors aimed at participating in Horizon 2020, for example, through research infrastructures, science parks, training, networking actions[189] (CS6: Infrastructure and R&I and CS13). Among the many available instances, the EOSC Pillar Regional Projects also offer a set of examples of upstream sequential synergies, where ESIF investments in infrastructure, e.g., facilitated participation in H2020, including partnerships[190]. With respect to dedicated national efforts for upstream synergies, the Estonian RITA programme is a noteworthy example as it applies a systematic approach to both building capacities as well as supporting Estonian participation in EU and ERA initiatives, including partnerships. In addition, the Estonian OP (2014-2020) provided support for the participation of Estonia in ERA initiatives, the Innovation Union and Horizon 2020.

Also, case examples of successful downstream synergies are frequently outlined by stakeholders (e.g., CS1, 5, 6, 8, 9, 12, 13, 14). H2020 promotes the establishment of a linear process of R&I activity, from basic research, to applied research and experimental development and marketability. Thanks to H2020, research centres are able to establish public-private partnerships and even offer technical assistance to private companies in exploiting the research results (CS5 on Skills and R&I, CS8 on support to agri-food, CS14 on an individual entrepreneur with an innovative idea). Study findings indicate that successive synergies are more easily generated by single applicants, whereas "**partnership-based synergies seem much more problematic** because of the challenge of consortium beneficiaries supported by different funds (e.g., ESIF) from different countries/regions"[191]. More information on the implementation of downstream synergy mechanisms can be found in section 2.2).

Concurrent and strategic synergies

Concurrent synergy refers to parallel projects/initiatives with mutually complementary objectives (see the Glossary of terms for definitions). There can be complementarity through combining funding, for example, separate projects/initiatives find complementarities and

[188] JIIP (2017) Synergies between Framework Programmes for Research and Innovation and European Structural and Investment Funds, Contributing to the Interim Evaluation of Horizon 2020
[189] EC (2017) Interim evaluation of Horizon 2020, Staff Working Document, Annex 2
[190] Delors Institute (2019) Mainstreaming Innovation Funding in the EU Budget: Study requested by the BUDG Committee of the European Parliament confirms this that RIS3 references to "ESF, H2020 and national funding, are quite limited".
[191] Ibid.

jointly fund an initiative. Synergies can also be visible in the uptake of other support mechanisms, for example, through access to research infrastructures, help in preparing pilots, prototypes and demonstrators, help in preparing business cases and market access, etc. For example, **ESIF is used to upgrade research infrastructures in which recipients of H2020 funds are conducting projects** (CS6 on Infrastructure and R&I).
Strategic synergies comprise aspects like **coherence in the overall intervention logic/strategic approach**, e.g., whether the programmes share the same vision of the societal challenge and work in the same direction to tackle this challenge. It also refers to the complementarity in the logics of intervention through aligning policy objectives, synergy-enhancing implementation rules and requirements (see the Glossary of key terms for definitions). As alignment in strategic orientation also provides a favourable environment for the realisation of concurrent synergies, this section comprises findings regarding the **existence of synergy-enhancing rules and conditions** among various programmes and initiatives that are meant to direct activities towards more coherence, as well as any assessment of the effectiveness of such an alignment.

Smart specialisation strategies were envisioned to serve as a vehicle for strategic synergies as they were meant to give more coherence to the use of ESIF, better coordinate with national actions and create synergies with other EU funds. Yet, "synergies with H2020 are limited in practice and references [in RIS3] to other programmes beyond ESIF are rare"[192]. **Strategic coherence is mostly concentrated in those regions with a strong research track record and with effective governance systems and approaches**[193]. The 2014-2020 programming period has led to significant strides towards the erosion of silos and the establishment of dynamic synergy environments[194] in several countries and more synergy-enhancing actions have been planned in other countries. Studies point to an impressive achievement by Ireland and Germany in this regard[195]. Ireland, over the last 30 years, has improved its national R&I performance tremendously from a very low base. In so doing, it has established cross governance communication and coordination structures that are conducive to dynamic synergies. In 2014, Germany launched an ambitious plan to establish a national-regional dialogue concerning synergies between ESIF and H2020. It was a pilot for a tailor-made, multi-level governance model across policies, programmes and projects spanning different research fields, economic sectors and societal challenges. It aspires to drive the 'entrepreneurial discovery' process associated with the development of RIS3 by better managing information flows; supporting the strategic use of EU funds, and customising applicant support services. Other successful examples from Austria, the Czech Republic, Estonia, the Slovak Republic, Slovenia, Spain, Sweden and Wales were also listed[196]. Also, the launch of S3 Thematic Platforms[197] developed jointly by several DGs of the EC and co-created by European regions on a voluntary basis serve as good practice examples of strategic synergies between H2020, projects are to learn from each other, and the OPs funded by ESIF are meant to develop the operational environment and build the capacity (CS3 on complementary financing with Cohesion policy).

[192] Delors Institute (2019) Mainstreaming Innovation Funding in the EU Budget: Study requested by the BUDG Committee of the European Parliament confirms this that RIS3 references to "ESF, H2020 and national funding, are quite limited".
[193] Delors Institute (2019) Study requested by the BUDG Committee of the European Parliament, Mainstreaming Innovation Funding in the EU Budget
[194] Term dynamic synergy is not used to describe a new type of synergy, but instead a virtuous situation in which the occurrence of strategic and operational synergies is expected to occur on a continual rather than a one-off basis
[195] EC (2018) PSF Mutual Learning Exercise: Widening Participation and Strengthening Synergies
[196] Ibid.
[197] Starting in 2015, the EC launched three thematic S3 platforms on Agri-Food, Energy and Industrial Modernisation. For more information see: https://s3platform.jrc.ec.europa.eu/s3-thematic-platforms

European Partnerships such as Joint Technology Initiatives (JTIs) including Joint Undertakings (JUs) and contractual Public-Private Partnerships (cPPPs), represent another opportunity for various European bodies and national ministries and agencies to become involved in strategy development and the pursuit of synergies. Partnerships create opportunities for knowledge sharing, working on common projects and aligning research agendas, thereby offering policy tools to address market failures and improve innovation system capacities.[198]

Concurrent and strategic synergies are visible in the described collaboration mechanisms of Joint Undertakings (JUs). "Within the context of the JUs, synergies can be created not only through the use of ESI Funds in a combined or complementary way with JU project funding but also at a more strategic level, through the alignment of research agendas and S3 priorities"[199]. The various examples showcase that strategic synergies are implemented both in a formal way through agreements, MoUs, etc. but also without prior formal agreements. For example, BBI JU has developed funding synergies with regions and has made use of a collective Memorandum of Understanding (MoU) with a group of Polish regions. The ECSEL JU uses national grant agreements that include a commitment for national funding to be used for participating in calls for proposals from the JU.[200] JU Clean Sky 2 also has established structured synergy opportunities enabling Managing Authorities to fund complementary projects using ESIF.[201] A major factor enabling synergies and complementarities between the JU Clean Sky 2 and the national/regional level is that many EU Member States have indicated aeronautics, aviation, aerospace and correlated areas in their S3 strategies.

In a similar vein, the **EIT KICs have been referenced as initiatives with strong potential for alignment with RIS3**. The original EIT funding model (in effect until 2020) has been a natural driver of synergies as the EIT funds provided, on average, up to 25 per cent of the overall KIC budget. The remaining 75 per cent came mainly from KIC partners but also from other resources including EU, national and regional funding sources[202]. EIT KICs are more similar to ERDF projects than ordinary H2020 projects because they aim to have a lasting impact on changing the industrial structure of places that are not research-intensive. There is similarity in the principles and intervention logic[203]. All EIT KICs must have a strategy for 'outreach' activities, which are encouraged to develop in coordination with regional and local authorities in charge of defining and implementing RIS3[204]. From a strategic point of view there is an excellent potential for systematic strategic synergies, which has been demonstrated by the signing of multiple formal collaboration agreements among the EIT, EIT KICs and national and regional authorities. The EIT RIS Hubs[205] take a place-based approach which is aligned with the local RIS3s and thus a good basis for creating synergies. **Yet, in practice, the EIT KICs and their regional outreach hubs are not yet widely perceived as a natural partner in the smart specialisation process** (CS13 on synergies between EIT

[198] Delors Institute (2019) Study requested by the BUDG Committee of the European Parliament, Mainstreaming Innovation Funding in the EU Budget
[199] JRC (2019) Joint Undertakings- analysis of collaboration mechanisms with ESI Funds in an S3 context
[200] JRC (2019) Joint Undertakings- analysis of collaboration mechanisms with ESI Funds in an S3 context
[201] ERA LEARN (2020) Synergies between European R&I partnerships and European Structural and Investment Funds (ESIF): Good practice catalogue of synergies adopted in Horizon 2020
[202] Technopolis Group (2013) Analysis of synergies fostered by the EIT in the EU innovation landscape. Study commissioned by the EIT.
[203] Delors Institute (2019) Study requested by the BUDG Committee of the European Parliament, Mainstreaming Innovation Funding in the EU Budget
[204] EIT (2017), EIT Regional Innovation Scheme: Implementation Guidance Note 2018-2020, available here: https://eit.europa.eu/sites/default/files/eit_ris_guidance_note_2018-2020.pdf
[205] For more information, see https://eit.europa.eu/our-activities/eit-regional-innovation-scheme

RIS and S3). A contributing factor for this is the fact that most RIS3s have been elaborated before the establishment of the EIT RIS Hubs, which started being put in place from 2016.

Operational synergies

While there are multiple policy frameworks that are aimed to enhance the environment for synergies to emerge (see the previous section), there is mixed evidence to what extent they are implemented in practice (CS 1, 3, 4, 6, 8, 12, 13). The study on maximising synergies between ESIF and other EU instruments notes that "much more attention has been paid to the role of programming in pursuing synergies than during implementation […] The potential for operational synergies to develop is there and it is possible to identify emerging initiatives, but these represent good rather than common practice."[206]
It is also recognised that "while the rules governing [synergies] are simple to understand in theory, **applying them in practice can involve steep learning curves**"[207]. Habit, inertia, lack of background knowledge about other programmes, aversion to risk, as well as legal and administrative complexity are mentioned among those factors that hamper the realisation of operational synergies (CS 1, 2, 5, 6, 8, 10, 13). Overall, "alongside promising synergistic initiatives, compartmentalised or 'silo' type approaches are still common in Member States and regions"[208].

One of the most concrete implementation mechanisms for operational synergies is the **Seal of Excellence (SoE)**. The SoE supports high-quality project proposals to accelerate their research and innovation by applying for alternative funding on the EU and national/regional levels. SoE under Horizon 2020 was awarded to proposals, which applied under the EIC Accelerator (former SME Instrument), EIC Transition, Marie Skłodowska-Curie actions (MSCA) individual fellowships, and Teaming actions. The Seal of Excellence is seen as an initiative that allowed Horizon 2020 to overcome various important gaps, such as **more SMEs receiving opportunities from different funding sources to strengthen research and innovation capacity building in lower-performing regions**. The SMEs that benefitted from the SoE of the EIC Pilot programme and used IPA4SME services **found the action was an excellent opportunity to summarise, reflect on and improve their IP strategy** thanks to the advice received from independent experts. Similarly, as the success rate to the EIC Pathfinder was only 6% in the open call of 2021, the Access2EIC provided an opportunity to the applicants who received the SoE to **learn in-depth about eventual/potential commercialisation of projects outcomes and maximise value proposition** to be prepared for the next time. Moreover, the Access2EIC services also provide a great opportunity for the Seal holders to meet potential investors and partners (CS2 on the Seal of Excellence).

It has also been cited as a good practice example when awarded in the framework of EU partnership instruments. For example, **BBI JU Synergy Label** is a pilot initiative that recognises the value and excellence of Innovation Actions (IAs) proposals submitted to the BBI JU calls for proposals and qualified above the quality threshold. BBI JU works with different funding organisations, including EBRD, EIB, European Circular Bioeconomy Fund, to ensure the recognition of the proposals awarded with the label[209]. A similar mechanism is also established by **JU Clean Sky 2** with well-illustrated external coherence benefits (CS9 on transport, infrastructure and mobility). Stakeholders also highlight that an SoE type of initiative would be valuable in the future to allow excellently rated projects submitted to the

[206] European Parliament's Committee on Regional Development (2016) Maximisation of synergies between European Structural and Investment Funds and other EU instruments to attain Europe 2020 goals
[207] EC (2018) Mutual Learning Exercise: Widening Participation and Strengthening Synergies
[208] European Parliament's Committee on Regional Development (2016) Maximisation of synergies between European Structural and Investment Funds and other EU instruments to attain Europe 2020 goals
[209] ERA LEARN (2021) Policy Brief on Synergies between R&I partnerships and ESIF

EIT to be supported through ESIF funding streams (CS13 on synergies between EIT RIS and S3).

As mentioned in Section 2.3 and in CS2 on SoE, the European Commission has set up a Community of Practice (CoP) specifically aiming to support alternative funding bodies in the implementation of the Seal of Excellence. Up to now, the CoP serves as a platform for the exchange of information and experiences of the initiative and **is regarded as a successful approach to exchange best practices among the funding agencies** and **support the designing of new calls** dedicated to the Seal of Excellence.

Building on the success under Horizon 2020, a Seal of Excellence is a quality label given under Horizon Europe to MSCA Postdoctoral Fellowships or MSCA COFUND proposals with an evaluation score of at least 85 points (out of 100 points), but not having access to funding due to insufficient budget. National, regional or institutional funding programmes can later use it to decide to provide support to these high-quality proposals. Under Horizon 2020, three countries (Czechia, Cyprus, and Lithuania) have decided to invest Structural funds to support the Seal of Excellence scheme of the Marie Skłodowska-Curie Actions Individual Fellowships.

It must be noted that more complementary logics of intervention between EU, national and regional programmes also appear to create **opportunities for ad-hoc synergies** that emerge naturally and in a less planned manner. Various informal collaboration, networking and matchmaking events and planned training initiatives that range from one-off events to more permanent fora of interaction are referenced as useful platforms for unplanned, need-based synergies to be identified (CS13 on synergies between EIT RIS and S3). A survey conducted for the study on synergies between FP and ESIF concluded that instances of incidental rather than intentional synergies are indeed many[210]. While ad-hoc in nature, these synergies may still be "important from a policy perspective because they provide examples of the benefits that result from the sequencing funding activities".[211]

2.6. External coherence of H2020 and the transition towards 1)greener, 2) digital, and 3) healthier future

Key findings:

- **H2020 projects provide good coverage of all three key policy areas: green, digital, health**
- In all three areas the case studies identify a good alignment of H2020 projects to the thematic European policies. Furthermore, there is **evidence that H2020 is supporting the complementarity of policy and regulatory agendas at national and European level**, facilitating the deployment of R&I actions related to the twin transition and the health sector.
- The green system case provides evidence that the organisation of Horizon 2020 funding for the green transition in four societal challenges has helped to increase external synergies with other programmes (notably ESIF and LIFE) that support deployment of R&I results.

[210] JIIP (2017) Synergies between Framework Programmes for Research and Innovation and European Structural and Investment Funds, Contributing to the Interim Evaluation of Horizon 2020

[211] EC (2018) Mutual Learning Exercise: Widening Participation and Strengthening Synergies. Summary Report. European Commission

- **LEIT-ICT is the core**, around which other **digital programmes** at the European, national and regional levels rotate and try to align and synergise with. In particular, at EU level, it is **considered complementary** to CEF, EFSI, ESIF, and EUREKA.
- There is a **strategic willingness to ensure H2020 complementarity and synergies with other EU programmes in the health sector**. ESIF and EU Health programmes are identified as having the closest links to H2020.
- The analysis in all three areas identifies similar **shortcomings:** lack of (collection of) information on exploitable results, programme fragmentation, lack of awareness about suitable funding instruments, insufficient guidance on how to achieve complementarity, and need for further coordination between national and EU levels.

The evolution of R&I policy for transformative change and transition to a long-term sustainable trajectory in the EU has been guided in recent years by three overarching policy objectives: the green transition, digital transformation and resilience. In this last evaluation question, we explore the extent to which the H2020 external coherence is supportive in leading the transitions towards a 1) greener, 2) digital, and 3) healthier future.

Drawing a link to gaps analysed in section 2.1, altogether, the **keywords analysis** (see Annex 2) **shows that H2020 projects have good coverage of all three key policy areas**. One of the most frequently appearing keywords in H2020 projects was “renewable energy” (in 944 projects), but also keywords in the digital field (e.g. “big data”, “software”), and health-related topics (e.g. “public health”, “oncology”, “DNA”, “genomes”, “pharmaceutical drugs”) are rather prominent.

External coherence of H2020 and the green transition

The concept of a green transition is much broader than the actions required to tackle the climate crisis. It extends to all actions or investments that result in reducing environmental impacts and generating physical environmental benefits (renewable energy and energy efficiency, resource (water and materials) efficiency, reduction of contaminants harmful to natural ecosystems and life, etc. The 2019 Communication on the European Green Deal also underlined the need for a socially just transition that should be reflected in policies at EU and national levels212. The EU’s ambition to become the world’s first climate-neutral continent is allied to the need to not only preserve but also restore natural ecosystems, shift to a circular economy and better protect citizens’ health from environmental pollution. Under Horizon 2020213, the R&I landscape for the green transition was addressed by four societal challenges covering: food, transport, environment and energy. The key findings on the external coherence of H2020 actions vis-à-vis the green transition are presented below, while further details are provided in the dedicated case study (CS21).

Synergies with the overall R&I system

The data analysis enabled to identify significant internal to Horizon 2020 synergies with clusters of projects within thematic areas as well as clusters operating at the intersection of the four societal challenges, e.g. energy and transport-related cluster. This points to increased strategic and operational synergies in R&I investments. Similarly, data and interview evidence identifies external coherence of Horizon 2020 with other EU and national

[212] https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en#documents
[213] https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-2020_en

programmes and initiatives. For example, the Horizon 2020 projects under the SC Food addressed the food value chain and its sustainability, food safety, agriculture, waste and bioeconomy and were found to have strong operational synergies with diverse ESIF-funded projects which supported applications in the fields of aquaculture and fisheries, farming and agricultural systems, as well as nutrition, climate change and production systems.

Regulatory and political framework

As illustrated by the case of Spain, EU legislative policy developments on transport and urban mobility policy agenda, there is evidence of **complementarity between policy and regulatory agendas** (e.g. the Intelligent Transport Systems Directive in the field of road transport and for interfaces with other modes of transport) **at national and European level**, facilitating the deployment of R&I results. Indeed, this complementarity between regulatory and R&I policies is illustrated by Horizon 2020 support for electric vehicles, where enabling conditions for deployment, including regulation that need to be addressed, if finance for later-TRL stage developments is to be leveraged.

Support for the market formation, deployment, and use of R&I solutions

The case study examined the energy SC for this system function. Market formation and deployment of R&I results are supported by a broad mix of policies at European and national levels. Nevertheless, interviewees from the energy sector expressed the need for **more R&I funding related to the market roll-out of higher TRL solutions**. An example of a complementary programme to Horizon 2020 funding in the energy field is the EIT InnoEnergy, which acts as a catalyst and accelerator of the energy transition through support to a portfolio of innovators in spanning energy storage, transport & mobility, solar PV, hydrogen, energy efficiency and sustainable buildings. This has been done in partnership with three industrial alliances: European Battery Alliance, European Green Hydrogen Acceleration Centre and European Solar Initiative for photovoltaics. Another example is the InnovFin Energy Demo Projects Facility has enabled the EIB to finance innovative demonstration projects at the pre-commercial stage that contribute to the energy transition (including storage).

Support for R&I skills and human capital development

The support for R&I skills is a key area for the enhancement of the potential for R&I to promote the green transition. A number of complementary programmes to H2020 are developing opportunities for human capital development (for example, providing reliable science-based information to governments and public and private decision-makers; developing new tools, methods and standards to assess the response to climate-related disasters; and creation of climate change networks and ecosystems to ensure creation, development and dissemination of current and new knowledge). Indeed, **programmes** such as ERASMUS+ or EIT Climate-KIC initiatives have helped to further develop skills and competencies for researchers, innovators and/or the general public relevant to the green transition.

Provision of infrastructures

ESFRI and its regular roadmap updates have contributed to shaping clear strategies that support fundamental and applied research and the implementation of R&I projects on the green transition (e.g., energy storage, autonomous vehicles, genetics for food production, etc.). Furthermore, multiple RIs allow projects to use the facilities for testing and prototyping via joint programmes or through specific collaboration agreements. **Alignment of national priorities** (e.g. better alignment of research and technology infrastructures in smart specialisation strategies) has helped to reinforce synergies in the R&I ecosystem. For

example, the Slovenia Research Infrastructure National Roadmap and the Slovenia Smart Specialisation Strategy, identified priorities for national investment in research infrastructures and their contribution to European green transition priorities. Synergies were facilitated by the development of specific national regulations, the creation of Centres of Excellence (e.g., CONOT on low carbon technologies) and prioritising hydrogen fuel niche as a driver at national level in Slovenia for the energy challenge.

Support for entrepreneurship, SME growth and internationalisation

Multiple programmes for incubators and accelerators contribute to the R&I landscape by supporting entrepreneurs towards deploying innovative solutions and opening doors for internationalisation (e.g., COSME projects). For example, the Foodvalley Dutch cluster has brought together a strong network of Dutch agri-food SMEs contributing to the development of innovative solutions for sustainable agriculture practices and the production of healthier food. The work with SMEs contributed to accelerating agricultural and food innovations worldwide, by stimulating cooperation, innovation and business.

Support for knowledge diffusion

This function is overall well covered through multiple collaboration opportunities and networking activities. For instance, projects such as WASTE4Think, SCALIBUR and URBAN-WASTE contributed to knowledge diffusion with emphasis on citizen participation and pilot process with cities and other stakeholders such as SMEs and non-for-profit organisations. While these initiatives contribute to advance on the green transition pathway, complementary programmes on knowledge diffusion helps to consolidate niches (such as waste management) and reinforce networking in the field. For instance, SMART WASTE or INTHERWASTE (funded through ERDF) complemented actions at national level in Greece and increased interregional cooperation for participants in the projects. Furthermore, a crucial role is played by KIC initiatives in different fields. However, interviewees agreed that **even if knowledge and innovation exist, there is still a lack of access to it for some stakeholders** (e.g. in the agricultural field, see the section on SMEs above).

External coherence of H2020 and the digital transition

The EU digital policies that were in effect during the implementation of Horizon 2020 and that arguably shaped the content and orientation of the relevant R&I policies were formulated in the Digital Agenda for Europe[214] of 2010 and the Digital Single Market Strategy[215] of 2015. The importance of the R&I policy was recognised in both as an essential element to achieving the proclaimed goals. The update to the Digital Agenda for Europe[216] of 2012 concluded that more concentrated efforts were necessary in specific themes in order to stay on track, which included more targeted R&I measures on Key Enabling Technologies (KETs). The document identified[217] these KETs as: micro- and nanoelectronics, photonics, robotics, high-performance computing, Factories of the Future, and the Future Internet. The **Leadership in Enabling and Industrial Technologies (LEIT-ICT) is the main source of funding for ICT-**

[214] European Commission (2010). A Digital Agenda for Europe, COM(2010) 245 final/2 of 26.08.2010.
[215] European Commission (2015). A Digital Single Market Strategy for Europe, COM(2015) 192 final of 06.05.2015.
[216] European Commission (2012). The Digital Agenda for Europe - Driving European growth digitally, COM(2012) 784 final of 18.12.2012.
[217] European Commission (2012). The Digital Agenda for Europe - Driving European growth digitally, COM(2012) 784 final of 18.12.2012, p. 12.

related projects in the EU[218]. Furthermore, according to the interviewed stakeholders, **LEIT-ICT is the core, around which other digital programmes at the European, national and regional levels rotate and try to align and synergise with**. Thus, the study focused on LEIT-ICT in its analysis of the way external coherence of H2020 supports (or not) the digital transformation. The key findings are presented below, while further details are provided in the dedicated case study (CS22).

There is a **common agreement that national and other European R&I programmes complement LEIT-ICT** by serving their special niches. For example, national and regional programmes focus on their respective needs, that might be different from the EU-level ones and foster the capacity of national beneficiaries to successfully apply for LEIT-ICT funding. EFSI has provided more of venture-type funding to commercial projects with a high-risk profile. EUREKA is more industry-oriented and has a very high level of SME participation. In the view of the interviewed stakeholders, all existing R&I funding programmes have their own purpose and audience, which has led to a symbiotic coexistence. Even where there are small overlaps between programmes, they are not objectionable because they serve continuity or consistency.

Gaps in the thematic coverage were nonetheless pointed out by stakeholders. **Gaps in funding** were also identified because too wide a thematic range meant the resources were stretched thin, especially in relation to the intended research ambition. Even though, theoretically, all TRLs could be supported under LEIT-ICT, not all exploitable results from lower and mid-TRLs reached high TRLs or the market. The reasons for this are **lack of (collection of) information on exploitable results, lack of awareness about suitable funding instruments and gaps in the thematic coverage across TRLs**.

Synergies with other programmes

By design, complementarities and synergies are expected between LEIT-ICT and CEF. CEF starts off where LEIT-ICT stops: CEF supports the deployment of technology, sufficiently mature projects that proved their feasibility in tests. While direct evidence of continuity (i.e. results from LEIT-ICT project translated to CEF projects) could not be found, this is extremely likely due to the participation of the same beneficiaries in LEIT-ICT and CEF projects.
EFSI and ESIF seem to be complementary to LEIT-ICT, catering for a slightly different audience and different type of projects. The projects funded under EFSI and ESIF (and, to an extent, by CEF) aim to create the necessary foundation for the subsequent diffusion and application of technological solutions produced in LEIT-ICT projects. Specifically, EFSI and ESIF support the deployment of the ICT infrastructure (i.e. broadband) and capacity within the companies (i.e. various measures for digitalisation of companies). In terms of exploiting LEIT-ICT results, it is not clear how far this is possible and taking place, even though theoretically EFSI and ESIF could fund such close-to-the-market projects. **Stakeholders mentioned that for consecutive funding, there is a lack of information on exploitable results; the combination of funding is challenging due to time planning, State aid rules, and bureaucratic problems**.

EUREKA is perceived as an important complementary programme that employs a flexible and bottom-up approach to R&I – by contrast to LEIT-ICT that is more centralised and top-down. It has more light-touch administration and is faster in deploying individual projects. It has a much higher percentage of SMEs. It seems to be more oriented towards the commercialisation of R&D&I as even long-term research projects are expected to come

[218] LEIT-ICT is the second largest pillar (or thematic priority/ programme) under Horizon 2020, after the European Research Council. Over 2014-2021, EUR 7.07 billion in EU net contribution (EUR 11.51 billion in total budget) was spent on LEIT-ICT or 10.45% of the Horizon 2020 financing. Source: Horizon Dashboard

to the market. All this suggests a different audience at EUREKA than at LEIT-ICT, and this finding was partially confirmed by the interim Horizon 2020 evaluation.

Synergies within the policy framework

Similarly to the analysis on the green transition (in the previous section), with the aim of focusing on a specific field, the synergies within the policy framework were examined on the examples of 5G and national R&D&I policies. LEIT-ICT was **highly aligned with the EU's 5G policy**, providing funding for the measures under the EU 5G Action Plan, as explicitly stated in the work programmes and individual calls. The situation is similar to the national R&D&I policies. Stakeholders agreed that **national and regional programmes take the lead from LEIT-ICT and plan accordingly**. The fact that digital transition has been made a priority at the EU level helped a lot with the planning. Operationally, in some countries, the same entities and the same staff that participated in the negotiations of LEIT-ICT were in charge of the planning of national programmes. This leads to a lot of **consistency and complementarity between the EU and national levels**. It has also been noted that, during the planning, a lot of exchange between national level, industry and the EU level occurred so that one could speak of bottom-up influences on LEIT-ICT.
However, some **shortcomings in the coordination and mutual learning** were mentioned by stakeholders as well. The coordination with the ERA has not been fully satisfactory. The exchange of **information between national level, industry and the EU level has not always led to concrete actions**, staying at the level of coordinating priorities.

Market deployment

The commercialisation of exploitable project results remains a challenge despite an apparent abundance of funding programmes. Though more (different) financial instruments are always welcome by stakeholders, important hindrance factors seem to be information-related. Due to the large number of small projects, there is **too much information** for stakeholders to sift through. At the same time, **the information is dispersed** (e.g. across the variety of programmes) and, therefore, not available in one place (or even a few places); individual programmes do not always have resources to keep databases. In addition, there are no common standards on how the project results should be reported, so often the information provided is not sufficient.

Support of SMEs

In the digital/ ICT area of R&D&I, a lot of general funding instruments can be used by SMEs and start-ups, such as the SME Instrument. Also, Innovation Radar and dedicated programmes under the EIT Regional Innovation Scheme can be used. However, the programme EUREKA (especially Eurostars) was deemed even more successful in supporting SMEs than LEIT-ICT. In addition, many Member States have developed dedicated national programmes and initiatives to support the digitisation of SMEs, though countries with a higher DESI ranking seem to have more targeted support.

Navigability of the EU R&I support system

The R&D&I support system is very complex and difficult to navigate, though universities and other RTOs, as well as large companies, are better positioned than other potential beneficiaries. The complexity of the system is due to the large number of programmes at different levels, all of which have different conditions, requirements, etc. The projects' and partners' landscape is also complex due to the very large number of R&D&I projects under LEIT-ICT and other programmes and the lack of instruments providing satisfactory information on them, as mentioned above.

There are many attempts to improve the situation, with major efforts deployed by NCPs. Not only do they try to provide all-round services related to funding application, they also work on creating a better information basis on ICT projects (at least within LEIT-ICT). Thematic associations (e.g. European Factories of the Future Research Association - EFFRA, euRobotics[219], European Technology Platform on Smart Systems Integration - EpoSS) do the same for their members, but often lack resources.

External coherence of H2020 and the transition towards a healthier future

The COVID-19 pandemic exposed the importance of coordinated and well-functioning health R&I systems in the EU. Throughout the years, H2020 has targeted multiple priority areas to help deliver solutions for better health and **Societal Challenge 1 (SC1) Health, Demographic change and Wellbeing** has covered a wide scope of different research areas[220]. In the following pages we present the results of the mapping of the current European R&I system for improved health and the identification of coherence and synergies between Horizon 2020 (H2020) and national / regional / international R&I programmes and initiatives. More details are provided in the dedicated case study (CS23).

Synergies between H2020 and EU level support mechanisms

The analysis of H2020 SC1 Work Programmes showed that **there is a strategic willingness to ensure H2020 complementarity and synergies with other EU programmes**. When looking at the specific synergies that H2020 can have with other EU level programmes, **ESIF and EU Health programmes** are identified as having the closest links to H2020.[221] Both of these programmes have the potential to roll out the results of H2020 funded projects and are particularly relevant in terms of fostering innovation, uptake and deployment of H2020 R&I results in MS at national and regional level. Yet, it is still difficult to evaluate the extent to which synergies between these projects are brought to real life and identify concrete examples in practice. Interviewees on both Member state and EU level **acknowledged that they had not seen close cooperation between Health Programme and H2020 so far**.

Synergies between H2020 and national / regional support mechanisms

H2020 SC1 successfully builds strong links and synergies with partnership activities. Compared to previous framework programmes, a larger budget was allocated in H2020 to R&I areas developed in cooperation with and co-funded by major partners and stakeholders. By supporting P2Ps, including JPIs, the ERA-NET Cofund instrument and Art.185 initiatives, H2020 SC1 fosters **coherence with and alignment of national programmes.** Yet, **as identified by the interim evaluation of H2020, the key weakness in successfully fostering synergies and coherence between EU and national / regional levels remains the lack of a clear overview and streamlined sources of accessible information on how national and regional priorities are set**.
The analysis of the individual MS Health R&I funding systems shows that in countries like Sweden and Germany, which offer significant national funding opportunities, researchers in the health sector tend to rely more on and apply for national funding rather than EU funding due to the simpler, less complex application process and less time investment needed. At the same time, limited national funding resources encourage more active participation in

[219] For more information: https://www.eu-robotics.net/
[220] Under the Societal Challenge 1 Health, demographic change and wellbeing, in total 1,211 H2020 grants were signed (3.4% of total), 13,629 unique organisations were involved in H2020 projects (7.7% of total), and €6.14B funding was received by the project participants (9% of total). Source: H2020 dashboard
[221] Based on the data mining analysis, which served as the starting point of identifying potential links between EU funding programmes, ESIF and Health programmes had the most number of links with H2020.

H2020, if the right conditions are established, such as in the case of Spain that demonstrated increased successful participation in H2020 in recent years.

The analysis of the selected MS (Sweden, Germany, Spain and Poland) also suggested that innovation and implementation are still less funded in the Health national funding programmes that mainly reach basic research. Experts interviewed consider the focus on implementation and deployment of innovation in H2020 as one of the most important complementarities and added values of participating in H2020.

Set-up of regulatory and political framework

When looking at how the EU policy framework aligns with the national regulations, **the thematic coverage and broad priority research areas within Heath R&I supported by H2020, national and EU plans are converging** and cover similar issues (see the textbox overleaf, which explores the link to policies related to the digital transformation of health and the COVID-19 policies).

Box 9: Examples of instruments and H2020 support for digital health and addressing the COVID-19 crisis

A Digital Single Market Strategy for Europe[222] of 2015 stated that e-health services were lacking in the EU but were important to ensure inclusivity. Digital health and care services are also important to complete the creation of the digital single market and enhance the digitisation of the economy and society. Building on the Digital Single Market Strategy, in 2018, the European Commission adopted a Communication[223] enabling digital transformation of health and care systems, especially in the cross-border context. Under H2020, in particular the calls under the priority areas "personalised medicine", "innovative heath and care" and "supporting the digital transformation of health and care" were aligned with the goals of the EU digital policy. The projects funded included concrete applications to digitise healthcare services, under the strict legal requirements of data protection. For example, the H2020 project Digital Health Europe aims to boost innovation and advance the Digital Single Market priorities in healthcare, in line with the European Commission's Communication of 2018.[224]

The Communication on the Global EU response to COVID-19[225] underlined the importance of health-related R&I in tackling the pandemic. "Accelerating research efforts to develop effective treatments, vaccines, therapeutics, and diagnostics" was highlighted as a key challenge. H2020 was quickly mobilised to channel the necessary financial support and R&I activities as outlined in the Communications.[226] In May 2020, the European Commission pledged to invest €1 billion from Horizon 2020 into research and innovation to fight coronavirus (in addition to other funding for R&I

[222] European Commission (2015). A Digital Single Market Strategy for Europe, COM(2015) 192 final.
[223] European Commission (2018). Communication on enabling the digital transformation of health and care in the Digital Single Market; empowering citizens and building a healthier society, COM(2018) 233 final.
[224] Website of Digital Health Europe: https://digitalhealtheurope.eu/overview/
[225] European Commission (2020). Communication on the Global EU response to COVID-19, JOIN(2020) 11 final.
[226] Veron P and Di Ciommo M. (2020). Fit for purpose: The EU's role in global health in the era of COVID-19, Discussion paper No 282: https://ecdpm.org/wp-content/uploads/Fit-For-Purpose-EU-Role-Global-Health-Era-COVID-19-Discussion-Paper-282-ECDPM-October-2020.pdf .

on infectious diseases).[227] Additional H2020 calls for expression of interest were announced to advance research into coronavirus, employ new technologies in epidemiology and healthcare and address low uptake of vaccines. The IMI launched a special fast-track call for the "development of therapeutics and diagnostics combatting coronavirus infections" with additional funding from H2020.[228]

Despite the positive examples above, **a systematic approach and coordination between the EU and different Member States on how these strategic areas should be achieved are often missing**. It has also been mentioned that even on the national level within the Member State there can be a lack of coordination between different parties and ministries involved, which often do not align with each other, making it hard to get a clear picture of all the activities and unified strategy of how to move forward.

As illustrated by the cases below, having policy experts involved from the start of the research projects facilitates bringing research funding and policy dimensions together. One of the noteworthy examples of the efforts to bring policy dimension and develop strategic and priority areas within the field of Personalised Medicine (PM) is the International Consortium for Personalised Medicine (ICPerMed), which aims at coordinating and promoting research along the full value chain to develop and evaluate personalised medicine approaches. Another is the European Human Biomonitoring Initiative (HBM4EU) which brings together leading expertise on human biomonitoring from 24 European Union Member States, Norway, Iceland, Israel, Switzerland as well as the European Environment Agency, and aims to inform policy-making and regulatory implementation for the safe management of chemicals and the protection of all citizens from exposure to chemicals, including vulnerable groups, such as children and pregnant women, as well as of highly exposed groups like workers.[229]

Implementation, roll-out and deployment of research results

While the importance of uptake and deployment of research results has been increasingly recognised, it is an objectively complex and slow process that includes multiple strategical and practical issues that still need to be solved. The EU has a relatively heterogeneous market, with different health systems, policy systems and legal rules, and a broad range of consumer expectations toward technology and socio-cultural differences. Scaling up innovative health solutions and expanding across borders is therefore challenging in the EU[230]. The funding systems can be another obstacle to the uptake of technological changes in the market as innovations aiming to reduce the use of these services may affect the income of healthcare providers.[231] Interviewees for the case study (CS23) suggested the need for a post-project funding tool, which could push projects to translate the results into application based on further funding afterwards. According to them, a more streamlined information and databases created with the implementation focus in mind would help promote the actual use of research results.

[227] European Commission (n.d.). EU funding: Financing initiatives helping to tackle the outbreak of coronavirus: https://ec.europa.eu/info/research-and-innovation/research-area/health-research-and-innovation/coronavirus-research-and-innovation/financing-innovation_en .
[228] European Commission (n.d.). EU funding: Financing initiatives helping to tackle the outbreak of coronavirus: https://ec.europa.eu/info/research-and-innovation/research-area/health-research-and-innovation/coronavirus-research-and-innovation/financing-innovation_en.
[229] https://www.hbm4eu.eu/
[230] Technopolis Group. 2018. AAL Market and Investment Report
[231] ISC. 2018. Policy Analysis of the European Innovation Partnership on Active and Healthy Ageing and its impact in Spain. Achievements and recommendations for the 2016-2020 period

Navigability of the EU R&I support system

While a high amount of transparent information exists about different support opportunities in the EU, as mentioned before, interviewed representatives in the health sector indicated that **the system is not easy to navigate, particularly for smaller organisations**, like SMEs, that do not have the same type of resources and experience like bigger organizations, or those who engage in the interdisciplinary work. Similarly to many of the interviewees also for the other case studies, it was suggested that a one-step tool for identifying all funding opportunities across different programmes by specific research areas would be useful.

3. Conclusions and areas for possible improvement

An overall conclusion on the external coherence of H2020 as a whole would be at best simplistic due to the size and complexity of the programme. After all, at the time of its inception, it was the EU's largest Research and Innovation programme and financed more than 35 thousand projects and 40 thousand organisations via multiple funding schemes and across a multitude of topics ranging from antibiotic resistance to aircraft science. What is clear is that the Framework Programme remains the **sole EU programme supporting mainly transnational R&I activities and networks**, including through partnerships with Member States, businesses and foundations, based on the **key criteria of excellence**. Its **pan-European approach, the scale of support, and strong networks of R&I players** are aspects that are regarded by all the interviewed beneficiaries as playing a unique role in the European R&I support system. Even in countries where other funding instruments supporting research activities are well-established, participation in H2020 is still attractive in terms of the international context of projects, the network of excellent players it brings together, and the vast opportunities to share expertise in this network. The emphasis of the programme to provide **support across the entire R&I value chain**, including close-to-market activities, has played the most important role with respect to transnational projects in cross-cutting challenge areas (e.g., green innovation, Industry 4.0, raw materials).

The data analysis suggests that approximately 20% to 30% of the H2020 projects from various disciplines[232] shared at least one beneficiary and had a similar thematic focus (based on keyword analysis)[233] with EU-initiative projects[234] beyond the H2020 framework. Since there is no benchmark, or other similar analysis using the same methodology, these estimates cannot be interpreted unequivocally. Nevertheless, the analysis suggests that **most H2020 projects were not found to be connected to projects outside of H2020**, which indicates that there is **still room for growth in improving synergies** between H2020 and non-H2020 initiatives. Considering the complexity of the programme, the evaluation has explored four key support system elements, striving to assess the external coherence status and possibilities for improvements: (1) market-driven uptake, roll-out and deployment of Horizon 2020 R&I results (EQ3); (2) skills, higher education and research careers' development (EQ4); (3) reinforcement of R&I capacities and infrastructures (EQ5); and (4) financial instruments, in particular for SMEs (EQ6). All these reviewed elements (detailed below) provide evidence that **synergies and complementarities with the H2020 programme were achieved, but also that there is unexplored potential and barriers to achieving external coherence**.

Assessment of the external coherence of the support system for market-driven uptake, roll-out and deployment of Horizon 2020 R&I results: There is **much potential to roll out H2020-funded R&I through other EU programmes** thanks to the complementarities between the programme objectives. **Synergy-enhancing rules built into the programme design** help programmes operate in a mutually reinforcing manner (e.g., LIFE programme example).

[232] A list of the reviewed disciplines and the potential percentage of links based on the data analysis: Engineering and technology (32%), Agricultural sciences (30%), Natural sciences (27%), Medical and health sciences (26%), Social sciences (24%), Humanities (20%).

[233] The linking was done by, first, linking projects from H2020 and projects from other programmes if they share at least one beneficiary. This provides initial insights on possible links between H2020 and other programmes, but it does not necessarily indicate any synergies or overlaps. Hence, to refine these links, projects that did not share any keywords were decoupled. Keyword linking was done, when possible, using EuroSciVoc keywords as the majority of H2020 projects have several of these keywords assigned to them.

[234] Projects financed from the following initiatives: European Structural Investment Funds (ESIF), Health Programme, Connecting Europe Facility (CEF), Research Fund for Coal and Steel (RFCS), LIFE, Common Agricultural Policy (CAP), and Creative Europe (CE)

Yet the **evidence remains fragmented on the extent to which market uptake and deployment of results are achieved in practice.** One of the main **challenges is the vast amount of information available** on the exploitable results of H2020 projects **and the inconsistency of this information.** There is a lack of common requirements and understanding on the appropriate level of detail to be included in reporting on project results. There appears to be **poor knowledge among H2020 stakeholders about the EU-wide exploitation support services** and their use, e.g., the Innovation Radar and the Horizon Results Platform, remains sporadic. While stakeholders share less confidence that H2020 facilitates the roll-out and deployment of R&I results effectively, the programme **does provide good 'signalling effects' about the quality, relevance and potential of supported projects facilitating access to finance from financial institutions.**

Areas for possible improvement related to achieving further external coherence of the support system for **market-driven uptake, roll-out and deployment of Horizon 2020 R&I results:**

- **More synchronised criteria among the EU programmes for proposal evaluation could promote** the uptake and exploitation of H2020 results. The use of extra points in the evaluation of proposals that include results from other EU-funded projects would provide additional incentive for beneficiaries to seek funding synergies bottom-up.
- More common standards on the reporting of H2020 results would promote a shared understanding of the necessary level of detail and hence **improve searchability of H2020 project results**. To avoid that communication efforts remain only in thematic silos, a more horizontal approach should be promoted, e.g. by the **creation of online topic maps** that help stakeholders to orientate in the ways H2020 results connect to various topics.

Assessment of the external coherence of the support system for **skills, higher education and research careers' development:** The key H2020 instrument for building skills and research careers' development – the Marie Skłodowska-Curie actions (MSCA), demonstrates **overall complementarity with EU programmes, in particular with Erasmus+** (considering that it provides much broader mobility support than MSCA) **and ESIF** (which focuses on infrastructure that can be used by the researchers)**, and with national programmes**. The scope of some initiatives at the national level is similar to MSCA, which creates potential overlaps, but it is not considered by the interviewed experts as problematic as national initiatives are smaller in terms of scope and budget, while some of them have a very low success rate. Furthermore, national initiatives do not have a pan-EU character, which was widely acknowledged by the interviewees as a key differentiator of the H2020 programme. The majority of the synergies in the education/skills sector manifest themselves through the MSCA, while other H2020 initiatives (ERA-NET Cofund, ERC grants and the Future and Emerging Technologies actions) much more rarely foster directly education and skills development of researchers. The **MSCA COFUND is an example of a successful attempt to create synergies** with EU/national/regional level initiatives, in particular with ESIF and Erasmus+. This is illustrated by various examples, confirmed by the interviewees, and by the data analysis, which shows that participation in MSCA COFUND, on average increases participation of organisations in ESIF (primarily ERDF) projects by over 100%. **EIT initiatives are also a useful tool for creating synergies** in upskilling, e.g. by providing different forums (workshops, lectures, events) for industry, academia, and European institutions, and allowing them to discuss funding opportunities and collaborations.

Areas for possible improvement related to achieving further external coherence of the support system for **skills, higher education and research careers' development:**

- Even though there is evidence that MSCA is synergetic with Erasmus+, the majority of **existing synergies are considered by interviewees to be unintended in nature**, which requires more formal and institutionalised attempts to connect the major programmes targeted at universities.
- There is a need to improve the afterlife of the H2020 projects through **better dissemination of their results and tools that were created during their implementation**: To some extent, this need is already addressed in the form of the CORDIS website, which provides information on the results of projects and the overall Open Access Policy. Similarly, the OpenAIRE website also has an extensive catalogue of results created from H2020 projects. However, according to interviewees and academic literature, such data is relatively rarely reused.

Assessment of the external coherence of the support system for **reinforcement of R&I capacities and infrastructures**: **H2020 research infrastructure (RI) funding activities are considered[235] complementary to other schemes** as they offer an international dimension not available through other support instruments and are also associated with spill-over effects, e.g. in terms of skills, networks and positioning. **Most concrete synergy mechanisms in support of RIs are identified between H2020 and the European Regional Development Fund** (ERDF) as it is a strategic objective of H2020 to ensure coordination with the cohesion funding to derive benefits to European RIs and regional development. While ERDF (together with national funding and EIB instruments) has mostly been used for the construction of RIs, as well as training of scientific and technical personnel, H2020 funds have played an important role in ensuring open access to facilities and RI strategy development. Yet **the implementation of these funding synergies has not been easy or systematic**. Many scientific communities were not used to working with public authorities traditionally managing ESIF. The national management of ERDF has also complicated the alignment of investment in distributed RIs across Member States. **A major obstacle to synergies is a lack of sufficient financing at national level** leading to interruptions in funding streams due to the project-driven nature of ERDF and H2020.

Areas for possible improvement related to achieving further external coherence of the support system for the **reinforcement of R&I capacities and infrastructures**:

- Attention should be put on tackling synergy implementation aspects that still hinder the overarching RI policy aims. These include such obstacles as **ERICs not being eligible to participate in national calls** due to limited flexibility in the eligibility criteria, divergent accountability requirements among programmes that doubles or even triples the burden to RI beneficiaries and creates gaps in the sequence of funding projects.
- More **alignment between the ESFRI Roadmap and national RI roadmaps** would be favourable for increasing coherence and synergies and thus reinforcing common strategic objectives for RIs at European level. It could be useful for policy-makers to

[235] As noted above for the skills support system, the interviewees relevant to the research infrastructures shared the same perception of the pan-EU differentiator of the H2020 programme.

discuss past lessons learned from the calls linked to the national RI roadmaps since they form the basis for funding on a national level.

Assessment of the external coherence of the support system for **financial instruments, in particular for SMEs:** Horizon 2020 financial instruments (InnovFin actions) are **broadly coherent in design with other EU funds and financial instrument schemes** supported by COSME, EFSI, ESIF, CEF, and CCS GF[236]. Nevertheless, data suggests **that in practice, SME research projects are often "one-off" in nature**, rarely leading to additional projects through other EU initiatives. More than 5,500 H2020 projects[237], amounting to more than €4 billion total costs have been implemented under the SME Instrument. However, the extent to which these projects are interconnected with other EU-financed projects is the lowest among H2020 schemes – the estimates suggests that **10% of SME Instrument beneficiaries also received financing through other EU programmes in the period 2014-2020**. At national level, the issue is even more pronounced as H2020 projects funded through the SME Instrument are the ones that are connected the least to projects financed through national/regional funding schemes. Similarly to the general data findings presented previously, these estimates should not be overinterpreted, because of the methodological limitations linked to the approach and databases. For example, the results are only giving a partial picture for the 2014-2020 programmes, while there could be synergies across programming periods. Nevertheless, the data analysis indicates that there **is a large potential for further synergies between EU/national programmes in support for SMEs.**

Areas for possible improvement related to achieving further external coherence of the support system for the **reinforcement of R&I capacities and infrastructures**:

- Stakeholders still struggle to understand the overall EU and national landscape of existing support mechanisms and **the exact ways how the traditional H2020 grants can be combined with other national and EU financial support** (e.g., loans, equity, guarantees).
- One of the challenges to achieving synergies between SME projects (e.g. in terms of combining traditional H2020 grants with other national and EU financial support) is that smaller companies **have difficulties investing the resources required to apply for EU/national funding**, in terms of both time and money.

To a large extent the barriers identified above are related **to the overall navigability and coordination mechanisms, both of which are seen as problematic** in terms of achieving external coherence**. The large number of instruments creates a rather complex R&I support framework at all levels (EU, national, and regional).** This complexity is currently aggravated by **insufficient/non-centralised information for project opportunities[238]** and **project results**. At the same time, the challenges in

[236] This finding is clearly confirmed by specific evaluation studies focusing on these instruments, but also evidenced from various examples observed as a part of this evaluation.
[237] Based on 15/02/2022 H2020 project and beneficiary data retrieved from data.europe.eu.
[238] The ease of access to information on funding programmes and tenders managed by the European Commission and other EU bodies is likely to improve in the 2021-2027 programming period with the launch of the Single Electronic Data Interchange Area (SEDIA). Available at: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/home

navigability depend not only on the R&I system itself, but also on the type of stakeholders involved. Navigability is generally **complicated, especially for entities with no previous experience with H2020 or other support schemes. Researchers and research organisations are considered to be in the best position** in this sense, since they have more knowledge about the overall R&I system in comparison to companies. Particularly **SMEs face the most significant challenges** navigating their way to the most suitable support initiative. Thus, **an uneven playing field** is created where niche players are locked "in the know", while smaller and less experienced organisations are less successful in EU/national R&I support schemes.

Further to navigability, there are **good examples** of **cooperation mechanisms** for ensuring external coherence, but also an underlying **need to further strengthen and institutionalise the communication and coordination between the bodies at EU level** involved in the management and implementation of EU R&I support initiatives. Similarly, the **mechanisms and actions aiming at ensuring coherence between EU and national initiatives are considered insufficient**. The H2020 **Programme Committees** can be considered a good mechanism for ensuring coherence, but their usefulness in this regard varies across countries. The same goes for **National Contact Points** (NCPs), which are generally considered as a mechanism that can contribute to synergies between EU and national initiatives. However, since NCPs are set up nationally, the role and practice of NCPs across Member States are not consistent. Evidence from the case studies provides good examples of cooperation and knowledge diffusion where the **ERA-NET Cofunds contributed to ensuring coherence between the EU and national research programmes** (e.g. ERA PerMed). The case studies also provide examples of successful **European Joint Programmes** (EJP Cofund – e.g. OneHealth EJP and the EJP SOIL) and **JPIs** (e.g. 'More Years, Better Lives').

The **Seal of Excellence** (SoE) is also a promising alternative synergy mechanism not only for mono-beneficiary schemes such as SME instrument, EIC Accelerator, MSCA, but increasingly also through European partnership frameworks (e.g. JUs). SMEs that benefitted from the SoE of the EIC Pilot programme and used IPA4SME[239] services found the action was an excellent opportunity to summarise, reflect on and improve their intellectual property (IP) strategy thanks to the advice received from independent experts. The **SoE Community of Practice** set up by the European Commission is regarded as a successful approach to exchange best practices among the funding agencies and support the designing of new calls dedicated to the SoE.

With respect to **H2020 synergy mechanisms** the study concluded that many **technical and administrative barriers have hampered the implementation of cumulative funding synergies** in the scope of individual projects, e.g. the need for two separate Grant Agreements, incompatibilities caused by different regulatory frameworks governing the funding sources, non-existent or unspecified co-funding rules and mismatches in funding cycles and time to grant have been among the obstacles. Yet, **cumulative synergy mechanisms worked much better in the context of partnership-based instruments**. **Successive funding synergies, where projects/initiatives build on each other's results/resources** is the mechanism most frequently implemented by beneficiaries as these have been relatively more easily generated by single applicants. Developing and systematically **strengthening a 'pipeline' effect for project funding from research to deployment** could be beneficial in the future.

[239] For more information: http://www.ipa4sme.eu/

Lastly, **the analysis of the external coherence of H2020 and the transition towards a greener, digital, and healthier future confirmed all the conclusions** presented above, both in terms of achieved external coherence and barriers. The data analysis showed that **projects financed through RFCS, HEALTH, and LIFE are the most connected initiatives to H2020 projects**, due to their similar topics (well-being of individuals and the climate) and the cross-cutting nature of these topics. The keywords analysis (see annex 2) also shows that H2020 projects have good coverage of all three key policy areas. The case studies **demonstrate that H2020 is supporting the complementarity of policy and regulatory agendas at national and European level**, facilitating the deployment of R&I actions related to the twin transition and the health sector. The green system case provides evidence that the organisation of Horizon 2020 funding for the green transition in four societal challenges has helped to increase external synergies with other programmes (notably ESIF and LIFE) that support deployment of R&I results. LEIT-ICT is the core, around which other digital programmes at the European, national and regional levels rotate and try to align and synergise with. In particular, at EU level, it is considered complementary to CEF, EFSI, ESIF, and EUREKA. There is a strategic willingness to ensure H2020 complementarity and synergies with other EU programmes in the health sector. ESIF and EU Health programmes are identified as having the closest links to H2020. Nevertheless, the analysis in all three areas identifies similar **shortcomings**: lack of (collection of) information on exploitable results, programme fragmentation, lack of awareness about suitable funding instruments, insufficient guidance on how to achieve complementarity, and need for further coordination between national and EU levels.

In the table below we map the links between the evaluation questions (EQs), main conclusions / identified areas for improvement, and the respective key evidence.

Table 6. Links between the EQs, main conclusions, identified areas for improvement and evidence base

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
1**. H2020 positioning and role**	What gaps is Horizon 2020 filling within the overall European research and innovation support system?	2.1	H2020 continued to fill an important policy gap through its pan-European approach and the scale of R&I support in addressing societal challenges. Evidence base: Interviewed beneficiaries in most case studies developed under the evaluation, e.g. CS1 on green innovation, CS6 on RI, and CS8 agrifood H2020 has been an important support for novel research activities due to the programme's role in promoting a degree of freedom and originality. Evidence base: On H2020's role in promoting fundamental and novel research (CS8 on agri-food and CS16 on fish farming) On how the participation in H2020 funding schemes adds value to the beneficiaries as it increases their credibility in the eyes of other players and promotes their centrality in international expertise networks in specific R&I topics (CS3 on complementary financing with Cohesion policy at project level and CS8 on agri-food)	
2. Coherence of H2020 activities in the EU landscape	What is the coherence (linkages, synergies/complementarities, overlaps, obstacles, constraints) of the activities of Horizon 2020 within the overall European research and innovation support system?	This evaluation question is included in all other evaluation questions. Thus, it is reviewed in all other themes and sections of the report, while a summary is provided in Section 3.		

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
3. Roll-out and deployment of H2020 results	How does complementarity with other EU/national/regional actions support the market-driven uptake, roll-out and deployment of Horizon 2020 R&I results once the projects are completed?	2.2	There is fragmented evidence on the extent to which H2020 results are rolled-out and taken up by industry, policy-makers, hospitals, NGOs and other research users. Evidence base: Study on Mainstreaming Innovation Funding in the EU Budget "potential [for the roll-out of results] is acknowledged in regulation preambles and reports it is still underexploited [in practice].240 CS1 on green innovation (on evidence that market roll-out largely depends on the beneficiary having a well-established network of private and public partners) CS8 on agri-food (provides evidence that due to H2020, agri-food research centres in Italy were able to establish public-private partnerships and even offer technical assistance to private companies in exploiting the research results) CS10 on Industry 4.0 (on how existing resources, which could be useful to bring SMEs closer to potential clients, are not always advertised enough) While national and regional authorities recognise the importance of commercialisation and uptake of R&I results, H2020 project outcomes do not appear to be widely used as a source for opening up prospects for innovation deployment at national and regional level. Evidence base: CS20 on public health authorities	The interviews conducted suggest a poor knowledge of the EU-wide exploitation support schemes. Evidence base: CS8 on agri-food (on how the use of H2020 measures targeting market-driven uptake, such as the Innovation Radar and the Horizon Results Platform is sporadic and frequently interviewees were not able to comment on their effectiveness) CS16 on fish farming (H2020 dedicated support schemes have a rather limited role in facilitating coherence of the support system for market-driven uptake of H2020 CS4 on cybersecurity (on the lack of awareness about H2020 project implementation and result valorisation in dedicated policy areas)
4.Complementarity of H2020 support in fostering skills, higher education and research career development	To what extent are the EU and national programmes, funds and initiatives supporting skills, higher education and research careers' development working in complementarity with Horizon 2020 towards the reinforcement of the European research and innovation system?	2.2	The Marie Skłodowska-Curie actions (MSCA), demonstrates overall complementarity with EU programmes, in particular with Erasmus+ and ESIF, and with national research programmes. Evidence base: Data analysis - around three thousand MSCA projects can be linked with other EU schemes241. On synergies with the Erasmus+ programme (see CS5 on skills, Erasmus+242 interim evaluation, interim evaluation of MSCA243) and with ESIF (see interim evaluation of MSCA244, examples in textbox 3 and textbox 4)	The MSCA COFUND and EIT initiatives are good examples of a successful attempt to create synergies with EU/national/regional level initiatives. Evidence base: Data analysis in CS5 – MSCA COFUND, on average increases participation of organisations in ESIF (primarily ERDF) projects MSCA interim evaluation (see MSCA COFUND examples in box 5, p.148)

[240] EC (2019) Mainstreaming Innovation Funding in the EU Budget: Budgetary Affairs. Study carried out by Delors Institute, p: 11
[241] As mentioned throughout the report, even if these results do not show explicit complementarities, they certainly hint at such a possibility.
[242] Mid-term evaluation of the Erasmus+ programme (2014-2020), Brussels, 31.1.2018 SWD(2018) 40 final, p.59
[243] European Commission, Directorate-General for Education, Youth, Sport and Culture, Souto-Otero, M., Humburg, M., Franke, J., FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions (MSCA): final report, Publications Office, 2017, https://data.europa.eu/doi/10.2766/103174, p.28, 171, Section 5.5 on External coherence
[244] p.28, 171, Section 5.5 on External coherence

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
			Guidance on ensuring synergies between MSCA and Erasmus+ actions in the area of higher education245, which provides several examples of synergies Interviewees for CS5 on the MSCA synergies with national programmes	Textbox 3 in this evaluation report On the EIT (see EIT evaluation246, CS13, CS16, and textbox 4) Numerous examples provided in section 2.2 The majority of existing synergies are unintended rather than a result of formal and institutionalised attempts to connect programmes/projects. Evidence base: Interviewees (see CS5) Erasmus+247 interim evaluation There is a need to improve the afterlife of the H2020 projects through better dissemination of their results and tools that were created during their implementation. Evidence base: CS5
5. Combination of H2020 and place-based approaches to R&I support for research infrastructure	To what extent are the EU and national programmes, funds and initiatives supporting the reinforcement of regional, national or European capacities and infrastructures (including for testing, experimentation and demonstration) working in complementarity with Horizon 2020 towards the	2.2	H2020 research infrastructure (RI) funding activities are considered complementary to other EU and national schemes as they offer an international dimension not available through other support instruments and most synergy mechanisms in support of RIs are identified between H2020 and the ERDF. Evidence base: Complementarities in terms of design (see the H2020 Council Decision, which highlights the need for coordination with the Cohesion funding sources to ensure synergies and a coherent approach for the development of the research infrastructures248	A major obstacle to synergies is a lack of sufficient financing at national level. Evidence base: CS6 on Infrastructure and R&I CS8 on support to agri-food value chains

[245] European Commission, Directorate-General for Education, Youth, Sport and Culture, Synergies between the Marie Skłodowska-Curie Actions and Erasmus+ in the area of higher education, Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2766/958920, Annex I – Examples of synergies

[246] EC (2017). Evaluation of the European Institute of Innovation and Technology (EIT). Final Report. Luxembourg: Publications Office of the European Union, 2017. Available at: https://education.ec.europa.eu/document/evaluation-of-the-european-institute-of-innovation-and-technology-eit-final-report, p. xviii, 94

[247] Mid-term evaluation of the Erasmus+ programme, p.59

[248] Council Decision of 3 December 2013 establishing the specific programme implementing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020) and repealing Decisions 2006/971/EC, 2006/972/EC, 2006/973/EC, 2006/974/EC and 2006/975/EC (Text with EEA relevance) (2013/743/EU)

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
	reinforcement of the overall European research and innovation system?		Achieving complementarity via the Smart Specialisation Strategy Concept (see ESFRI White Paper249) On using ERDF to support the upgrading of RIs in which recipients of H2020 funds are conducting projects (MLE 2018)250 Textbox 5 on examples of synergies between H2020 and ERDF for investment in RIs CS8 on agri-food (on how Horizon 2020 is complementary to other schemes because it offers an international scale not available otherwise) CS6 on Infrastructure and R&I (on the association of H2020 research infrastructure actions with spill-over effects, e.g., in terms of skills, networks and positioning)	
6. Funding complementarities in support of R&I activities	To what extent are the EU and national programmes, funds, financial instruments and initiatives supporting entrepreneurship and SME growth working in complementarity with Horizon 2020 towards the reinforcement of the overall European research and innovation system?	2.2	Horizon 2020 financial instruments (InnovFin actions) are broadly coherent in design with other EU funds and financial instrument schemes supported by COSME, EFSI, ESIF, CEF, and CCS GF. Evidence base: On the complementarity between COSME and InnovFin - Interim evaluation of H2020 financial instruments251 and Interim evaluation of the COSME programme252 On the complementarity between InnovFin and EFSI – see CS7 On InnovFin's complementarity with ESIF and CEF – desk research on the objectives of the programmes (in Section 2.2 of this report) On InnovFin's complementarity with CCS GF – CS11 on supporting creativity SME research projects rarely lead to additional projects through other EU/national initiatives. Evidence base: Data analysis253 – only around 10% of projects financed through SME Instruments shared at least one beneficiary and had a similar thematic focus with EU-initiative projects beyond the H2020 framework. The	Smaller companies have difficulties investing the resources required to apply for EU funding, while the need for H2020 know-how and access to networks leads to the emergence of niche players that consistently and successfully apply for H2020 funding Evidence base: CS10 on the support for Industry 4.0 CS14 on the agri-food sector CS12 on EU associated countries Insufficient coordination between EU and national schemes supporting innovative companies via financial instruments Evidence base:

[249] ESFRI (2020). Making Science Happen.A new ambition for Research Infrastructures in the European Research Area A new ambition for Research Infrastructures in the European Research Area ESFRI WHITE PAPER 2020. Available at: https://www.esfri.eu/sites/default/files/White_paper_ESFRI-final.pdf, p. 18

[250] EC (2018) Mutual Learning Exercise: Widening Participation and Strengthening Synergies: Summary Report, Horizon 2020 Policy Support Facility

[251] European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020's financial instruments : final report, Publications Office, 2018, https://data.europa.eu/doi/10.2777/378692, p.100

[252] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Mahieu, B., Rosemberg, C., Roman, L., et al., Interim evaluation of the COSME Programme: final report, Publications Office, 2019, https://data.europa.eu/doi/10.2873/87360

[253] Important caveats regarding the limitations of the data analysis are presented in the Limitations section of the evaluation report (Section 1.5) and throughout the whole analysis in Section 2.

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
			estimates show that below 1% of the projects funded though the H2020 SME Instrument were found to be linked to the reviewed national programmes.	Interim evaluation of Horizon 2020's financial instruments254 (on the risk of not considering potential overlaps between InnovFin and national programmes)255 Mainstreaming Innovation Funding in the EU Budget256 (on the need for mapping of financial instruments and continuous monitoring) CS7 on financial instruments
7. Navigability, readability and clarity of EU R&I funding landscape	To what extent do different types of stakeholders find their way (in terms of ease of access to information, its clarity and navigability) on where to go for specific R&I related support needs in the EU?	2.3	The large number of instruments creates a rather complex R&I support framework (at all levels - EU, national, and regional), which hampers the navigability for the different types of stakeholders. Navigability is generally complicated, especially for entities with no previous experience of H2020 or other support schemes. Researchers and research organisations are considered to be in the best position in this sense, since they have more knowledge about the overall R&I system in comparison to companies. Evidence base: On generally held views on the complexity of the R&I support system in Europe - ERAC (2017)257, LAB – FAB – APP258 Interim evaluation of Horizon 2020's financial instruments (on the difficulties for financial intermediaries to understand and identify the most relevant calls for them)259 On the differences of navigability between stakeholders - CS22 on digitalisation, CS18 on cities, CS1 on green innovation, CS10 on Industry 4.0, CS23 on health (all summarised in Section 2.3 of this report)	The complexity of the R&I support system is aggravated by insufficient and non-centralised information for project opportunities. Evidence base: MLE report260, Impact assessment of Horizon Europe261 CS7 (on the general difficulties finding information on opportunities), CS1 (showing that larger organisations have an advantage in tracking EU funding), CS2 (on the navigability of the SoE), CS10 (on SME difficulties with finding guidance), CS17 (on citizens), and CS18 (on cities) - all summarised in Section 2.3 of this report

[254] European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020's financial instruments: final report, Publications Office, 2018, https://data.europa.eu/doi/10.2777/378692, p. 106
[255] European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020's financial instruments: final report, Publications Office, 2018, https://data.europa.eu/doi/10.2777/378692, p. 106
[256] Delors Institute (2019) Study requested by the BUDG Committee of the European Parliament, Mainstreaming Innovation Funding in the EU Budget. p.92
[257] ERAC (2017) ERAC Opinion on the Interim Evaluation of Horizon 2020 and preparations for the next Framework Programme, p.19
[258] European Commission, Directorate-General for Research and Innovation, LAB – FAB – APP : investing in the European future we want : report of the independent High Level Group on maximising the impact of EU research & innovation programmes, Publications Office, 2017, https://data.europa.eu/doi/10.2777/477357, p.16
[259] European Commission, Directorate-General for Research and Innovation, Interim evaluation of Horizon 2020's financial instruments : final report, Publications Office, 2018, https://data.europa.eu/doi/10.2777/378692, p.90
[260] EC (2018) Mutual Learning Exercise - Widening Participation and Strengthening Synergies, Horizon 2020 Policy Support Facility, p.26
[261] SWD(2018) 307 final

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
				The complexity of the R&I support system is aggravated by insufficient and non-centralised information for project results. It should be noted that more experienced stakeholders emphasised that the CORDIS portal is very useful for general information on closed or ongoing research (see CS8 on agri-food). Evidence base: CS4 (on the lack of easy access to H2020 results in the cybersecurity domain) CS22 (on the difficulties to navigate across different platforms in search of project results)
8. What synergy mechanisms worked in practice and what can be learned for future Horizon Europe	To what extent did Horizon 2020 approach to fostering synergies with other programmes work in practice, e.g. alternative funding (Seal of Excellence), complementary/combined (e.g. Teaming) and cumulative funding, sequential funding, and capacity building and market uptake activities, partnerships with Member States, etc.?	2.5	Technical and administrative barriers have hampered the implementation of cumulative funding synergies in the scope of individual projects, yet this synergy mechanism worked much better in the context of partnership-based instruments. Evidence base: EC (2018) Mutual Learning Exercise: Widening Participation and Strengthening Synergies ERA LEARN (2021) Updated Policy Brief on Synergies between R&I partnerships & European Structural and Investment Funds (ESIF) CS1 on green innovations CS13 on the synergies between the EIT RIS and S3 Ferry, M. and Kah, S. (2016) Maximisation of Synergies between European Structural and Investment Funds and other EU Instruments Delors Institute (2019) Mainstreaming Innovation Funding in the EU Budget: Study requested by the BUDG Committee of the European Parliament ERA LEARN (2021) Updated Policy Brief on Synergies between R&I partnerships & European Structural and Investment Funds (ESIF) Successive funding synergies, where projects/initiatives build on each other's results/resources is the mechanism most frequently implemented by beneficiaries as these have been relatively more easily generated by single applicants Evidence base: JIIP (2017) Synergies between Framework Programmes for Research and Innovation and European Structural and Investment Funds, Contributing to the Interim Evaluation of Horizon 2020 CS1, 6, 8, 12, 13, 14	Seal of Excellence is regarded as a promising alternative synergy mechanism mainly for mono-beneficiary schemes such as SME instrument, EIC Accelerator, MSCA, but increasingly also through European partnership frameworks (e.g. JUs). Evidence base: CS2 on Seal of Excellence (including assessment of SoE Community of Practice) ERA LEARN (2021) Policy Brief on Synergies between R&I partnerships and ESIF (on SoE in partnership-based instruments) CS9 on transport, infrastructure and mobility (SoE for JU Clean Sky 2) CS13 on synergies between EIT RIS and S3 (SoE potential for KICs)

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
			Delors Institute (2019) Mainstreaming Innovation Funding in the EU Budget: Study requested by the BUDG Committee of the European Parliament	
9. Coordination of policy design, implementation and follow-up; how policy learning was organised	How is coordination ensured between different initiatives (among EU initiatives and between EU initiatives and national/regional ones) at the level of policy design, policy implementation and follow-up?	2.4	Evaluations of the external coherence of other EU programmes provided positive conclusions on their complementarity with H2020, but **did not identify specific coordination mechanisms at EU level that focus on ensuring external coherence**. *Evidence base:* • **Connecting Europe Facility** Mid-term evaluation[262] (on the usefulness of INEA managing CEF and H2020 actions). • CS9 (on the insufficiently coordinated approach between CEF and H2020, but also synergy label complementary activities' mechanism applied by Clean Sky 2 Joint Undertakings) • Mid-term evaluation of the **Erasmus+ programme** ("no clear example of dedicated coordination tools between EC services was reported")[263] • Interim Evaluation of the **COSME** Programme[264] (no provision of specific coordination mechanisms in the evaluation) • Mid-term evaluation of the Third **Health Programme** (on the usefulness of interservice groups as a coordination mechanism, including on ensuring complementarity[265], but also mentions that the more efforts were needed to publicise their complementary structures and to increase their coordination[266]) Similarly, the **mechanisms and actions aiming at ensuring coherence between EU and national initiatives are considered insufficient.**	There is an underlying **need to further strengthen and institutionalise the communication and coordination between the bodies at EU and national level** involved in the management and implementation of EU/national R&I support initiatives. *Evidence base:* Same as for the lack of coordination mechanism listed in the column to the left. The H2020 **Programme Committees** can be considered a good mechanism for ensuring coherence, but their usefulness in this regard varies across countries. *Evidence base:* • CS4 (on cybersecurity), CS12 (on EU associated countries), and CS22 (on the digital transformation) – on the role and limitations of Programme Committees (summarised in Section 2.4)

[262] COMMISSION STAFF WORKING DOCUMENT Accompanying the document Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the mid-term evaluation of the Connecting Europe Facility (CEF) {COM(2018) 66 final/2} Available at: https://ec.europa.eu/info/sites/default/files/mid-term_evaluation_cef_swd_2018_44_1.pdf, p. 43-44

[263] Mid-term evaluation of the Erasmus+ programme (2014-2020) Accompanying the document REPORT FROM THE COMMISION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF REGIONS Mid-term evaluation of the Erasmus+ programme (2014-2020) {COM(2018) 50 final}. Available at: https://ec.europa.eu/info/sites/default/files/m-t_evaluatio_erasmus_swd_2018_40.pdf , p.60

[264] EC (2017). Interim Evaluation of the COSME Programme. Final Report. Written by Technopolis Group. 14 December – 2017

[265] EC (2017). Mid-term Evaluation of the third Health Programme (2014 – 2020). Final report. Written by Coffey International Development SQW and Economisti Associati. Available at: https://ec.europa.eu/health/system/files/2017-10/2014-2020_evaluation_study_en_0.pdf, p.39

[266] EC (2017). Mid-term Evaluation of the third Health Programme (2014 – 2020). p.82

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
			Evidence base: • CS1 on green innovations, CS4 on cybersecurity, and CS7 on cooperation/coordination (on the need for an institutional mechanism for taking up H2020 results into national policymaking, as national policymakers still lack awareness about H2020 project implementation and result valorisation) • CS10 on Industry 4.0 and CS23 on health (on the perceived lack of coordination and harmonisation between different EU initiatives and in their interaction with national funding) Summary Report on 'Widening Participation and Strengthening Synergies'[267] (on the need for governance structures that deliberately set out to improve communication and coordination)	**National Contact Points** (NCPs), are generally considered as a mechanism that can be used to contribute to synergies between EU and national initiatives, but the role and practices of NCPs across Member States are not consistent. *Evidence base:* • Some interviewees praised the role of the NCPs and their networks as a mechanism for distributing information, which helps with the coordination of different initiatives and policies (see CS4, CS12, CS21). • However, many see the NCP role as a potential mechanism for coordination, rather than a reality in all countries (see CS10, CS17) • Good practices on NCPs' role in contributing to synergies - in Austria and Finland (CS22) and Spain (CS23) JIIP report[268] (on the fact that the NCP mandate does not specifically include the promotion and generation of synergies)
10. Contribution of the framework conditions in the EU to green/digital transition and health	To what extent is the H2020 external coherence supportive in leading the transitions towards a 1) greener, 2) digital, and 3) healthier future?	2.6	H2020 projects provide good coverage of all three key policy areas: green, digital, health. Furthermore, in all three areas the case studies identify a good alignment of H2020 projects to the thematic European policies. There is evidence that H2020 is supporting the complementarity of policy and regulatory agendas at national and European level, facilitating the deployment of R&I actions related to the twin transition and the health sector. Evidence base:	The analysis in all three areas identifies similar shortcomings: lack of (collection of) information on exploitable results, programme fragmentation, lack of awareness about suitable funding instruments, insufficient guidance on how to achieve complementarity, and need for

[267] EC (2018). Mutual Learning Exercise - Widening Participation and Strengthening Synergies: Summary Report. European Commission. B-1049 Brussels Manuscript completed in September 2018. p.4

[268] EC (2017). Synergies between Framework Programmes for Research and Innovation and European Structural and Investment Funds contributing to the Interim Evaluation of Horizon 2020. Written by the Joint Institute for Innovation Policy (JIIP), September – 2017. Available at: https://op.europa.eu/en/publication-detail/-/publication/d5e5627a-32fb-11e8-b5fe-01aa75ed71a1/language-en

Theme	Overall evaluation question	Section in the report	Main conclusions and evidence base	Key lessons learned / possible areas for improvement and evidence base
			System level case studies - CS21 (green transition), CS22 (digital transition), and CS23 (healthier future) The green system case (CS21) provides evidence that the organisation of Horizon 2020 funding for the green transition in four societal challenges has helped to increase external synergies with other programmes (notably ESIF and LIFE) that support deployment of R&I results. As concerns digitalisation, LEIT-ICT is the core, around which other digital programmes at the European, national and regional levels rotate and try to align and synergise with. In particular, at EU level, it is considered complementary to CEF, EFSI, ESIF, and EUREKA (CS22). There is a strategic willingness to ensure H2020 complementarity and synergies with other EU programmes in the health sector. ESIF and EU Health programmes are identified as having the closest links to H2020 (CS23).	further coordination between national and EU levels. Evidence base: System level case studies - CS21 (green transition), CS22 (digital transition), and CS23 (healthier future) Essentially, these areas for improvement are also corroborated with the findings on the preceding evaluation questions.

Annexes

Annex 1: Methodology

Further to the brief description of the methodology (see section 1.4), we provide more details on the performed **data mining/analysis**, **desk research**, and **interviews**. The case studies are listed in Annex 3.

Data mining/analysis

To provide insights on potential synergies, as well as gaps, H2020 projects were linked with projects from other EU initiatives, including the following programmes: European Structural Investment Funds (ESIF), Health Programme, Connecting Europe Facility (CEF), Research Fund for Coal and Steel (RFCS), LIFE, Common Agricultural Policy (CAP), and Creative Europe (CE). **The linking was performed through a two-step process**. **Firstly, by linking projects from H2020 and projects from other programmes sharing at least one beneficiary**. This provides initial insights on possible links between H2020 and other programmes, but it does not necessarily indicate any synergies or overlaps. Hence, in a second step, to refine these links, **projects that did not share any keywords were decoupled**. Keyword linking was done, when possible, using EuroSciVoc keywords as the majority of H2020 projects have several of these keywords assigned to them. In cases when projects from a particular programme do not have any keywords assigned to them, linking is done using available free keywords assigned to the projects, or the title and description of the projects if such information is also not available. This allowed us to refine the linking and remove some, but not all, overlaps. Moreover, given that the linking is based on natural languages processing that can be inaccurate in some regards, the results of the analysis should be interpreted with caution. Another reason is that EuroSciVoc keywords maybe assigned arbitrary, which is often the case when coding research and projects. Besides, the programmes for which we have performed the linking are for the 2014-2020 period, which precludes the identification of links across different programming periods. Despite these limitations, some interesting insights may be derived based on this methodology (presented in Annex 2).

In addition to exploring links at the EU level, they were also explored at the national level by linking H2020 projects with projects financed through different national initiatives. The same methodology was used as outlined above, and projects from five different national and regional R&I initiatives across the EU were linked with H2020 projects. More specifically, projects funded through the following sources were analysed: (i) DFG (German Research Foundation), (ii) ANR (French National Research Agency) and similar institutions in France, (iii) Croatian Science Foundation (HRZZ), (iv) National Science Centre (NCN) of Poland and similar institutions, and (v) the Swedish Research Council, Swedish innovation agency Vinova, and similar. The initiatives were selected for the analysis to ensure a relatively diverse view of national funding in the EU.

Table 7 provides an overview of how many different R&I projects were funded in the select EU countries. Given the data limitations, the table does not provide insights on all research projects financed through regional/national initiatives. Nevertheless, some insights from the data could be derived.

There is quite a large variation between R&I projects regarding how much funding they received. On average, R&I projects in France receive the most funding, around 750 thousand EUR per project, while projects in Croatia and Poland receive the least, around 125 thousand

EUR and 170 thousand EUR respectively. Finally, as presented in Table 7, the average number of participants in research projects is relatively small, ranging from around one to three. However, compared to the variation in the number of participants in projects financed through different H2020 funding schemes, the variation between countries is minor.

Table 7. Descriptive statistics of R&I projects in selected EU countries

Country	Number of projects	Grants per project (thousand EUR)*	Average number of participants in projects
Germany	129,730	NA	1.29
France	51,450	752.46 €	3.01
Croatia	2,115	125.86 €	1.00
Poland	278,472	170.57 €	1.47
Sweden	52,346	305.65 €	1.96

* Grant per project was estimated rather than the total as in several of the datasets, a lot of grant information is missing

Source: Own estimates based on data from different national research organisations.

To identify possible synergies, the same methodology used for linking H2020 projects with projects financed through non-H2020 initiatives was used (see findings in Annex 2).

Desk research

Horizontal desk research covered an initial in-depth review of 35 sources, including EC staff working documents, evaluations, studies and non-papers (see Annex 4), including those listed in the technical specifications as key reference documents. These files were uploaded in the qualitative research software Atlas.ti and relevant contents were coded according to the evaluation questions. See Figure 5 for examples of the interface for the coding work.

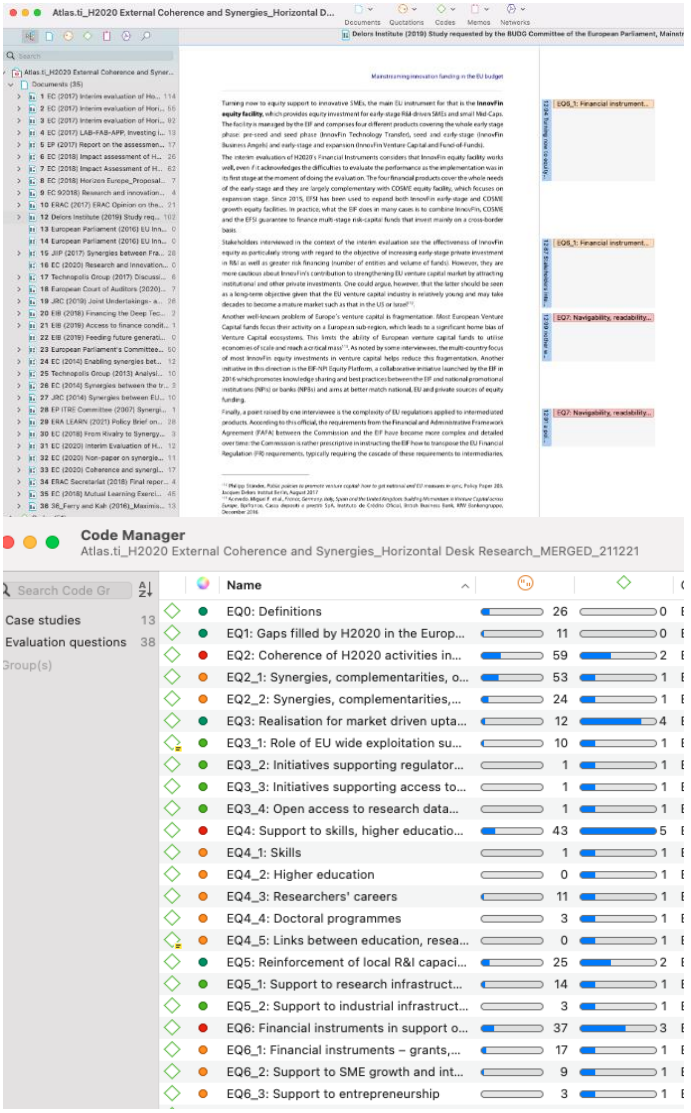


Figure 5.Examples of the coding interface in Atlas.ti software

In the drafting process additional documents and Internet resources were also consulted, see Annex 5.

Interviews

As a part of the study, the team performed **scoping interviews** (in the Inception stage) and **case study interviews** (as a part of the data gathering phase). Of the planned 10-12, **our team conducted 11 scoping interviews**. The table below provides the list of interviewed organisations.

Table 8. Conducted scoping interviews

Nr	Organisation
1.	DG RTD/external
2.	DG RTD
3	DG BUDG
4.	Bio-based industries joint undertaking
5.	Innovation Policy Matters
6.	EIT
7.	DG RTD
8.	EISMEA
9.	EIB
10.	DG REGIO
11.	DG CNECT

During the scoping interviews, interviewees provided their opinion on general topics such as their overall view on H2020, ideas on case studies/good practices, Public-public and public-private partnerships, mechanisms (and lack of them) for ensuring coherence and synergies. Furthermore, interviewees provided their views on specific H2020 elements (e.g. ERA-NET, MSCA, JU) and coherence with programmes such as CEF and Creative Europe. All these views were considered in the design of the case studies.

Further to the scoping interviews, **more than 120 interviews** (the planned minimum number of interviews for the study was 100) were conducted within the framework of the case studies. The input from the interviews was used in the drafting of the case studies, which is why in the table below we provide the interviews per case study. The list of interviewed organisations includes:

- A combination of **EU and national level actors**;
- A **large variety of stakeholders**: universities, research centres, associations, regional authorities, ministry representatives, programme managers, National Contact Points, different DGs of the EC, the EIB;
- Interviewees at **relevant positions** for the type of information inquired (heads of units, directors, coordinators, etc.).

Thus, the interviewees cover **all main stakeholder groups and provide sufficiently representative views for the purposes of the case studies and the study.**

Table 9. Case study interviews

Case study number	Organisation	Member state
CS1	Kalundborg Symbiosis	DK
	Paper Province	SE
	German Aerospace Center (DLR)	DE
	Plataforma Solar de Almería (PSA)	ES
	EC, DG Environment	EU
	FriedrichSchiller University Jena	DE
CS2	European Commission, European Semester & Country Intelligence (DG RTD.A.1)	EU
	European Commission, DG RTD Research and Innovation, IPA4SMEs	EU
	European Commission, EIC Governance & Coordination / RTD.A.EISMEA.D.1	EU
	Beneficiary of IPA4SMEs	ES
	European Commission, DG RTD-A-1	EU
CS3	Association Cluster Portugal Mineral Resources (ACPMR)	PT
	ICAMCyL Foundation (Fundacion ICAMCYL, International Center in Advanced Materials and raw materials of Castilla y Leon) Iberian Sustainable Mining Cluster (ISMC)	ES
	SmartNorth Regional Council of Lapland, Finland)	FI
	National Technical University of Athens (NTUA), Greece	GR
	DG-JRC, European Commission	EU
CS4	European Union Agency for Cybersecurity (ENISA)	EU
	Austrian Federal Ministry for Agriculture, Regions and Tourism	AT
	National Office for Cyber and Information Security of Czech Republic	CZ

Case study number	Organisation	Member state
	Tallinn University of Technology	EE
	European Commission, Directorate-General for Communications Networks, Content and Technology (DG CNECT)	EU
CS5	European Research Executive Agency, Unit REA.A2, Marie Skłodowska-Curie European Postdoctoral Fellowships	EU
	Oslo university	NO
	European Association of Institutions in Higher Education (EURASHE)	LT
CS6	ESFRI	IT
	CERIC-ERIC	IT
	Ministry of Education, Science and Sport, Slovenia	SI
	Federal Ministry of Education, Science and Research in Austria	AT
	Directorate-General V - Scientific Research; International Relations, Austrian Federal Ministry of Education, Science and Research	AT
	Research and Development, Ministry of Education, Youth and Sports, Czech Republic	CZ
	Directorate of Science and Innovation, The Ministry of Education and Science of Ukraine	UA
CS7	European Commission, DG JRC	EU
	European Investment Bank (EIB)	EU
	Austrian Federal Ministry of Education, Science and Research	AT
	European Research Executive Agency	EU
CS8	University of Foggia and Director of the Apulia Region Department of Agriculture, Rural and Environmental Development, Bari	IT
	Research Centre for Cereal and Industrial Crops - Council for Agricultural Research and Economics (CREA), Foggia	IT
	Institute for Sustainable Plant Protection – National Research Council (CNR), Bari	IT

Case study number	Organisation	Member state
	CAIONE - La Quercia Soc. Coop. Agricola and CON.CER. – Farmers Organization, Foggia	IT
	Hort@, spinoff company of Università Cattolica del Sacro Cuore, Piacenza	IT
CS9	CEF-Transport	EU
	Netherlands Aerospace Centre (NLR), discussing the perspective of Clean Aviation JU and the complementarity activities mechanism	NL
	Europe's Rail JU	EU
	Expertise- en InnovatieCentrum Binnenvaart (EICB), discussing R&I from the perspective of inland navigation	NL
	TNO	NL
CS10	European Factories of the Future Research Association – EFFRA	EU
	EIT Manufacturing	DE
	ICT Innovation for Manufacturing SMEs – I4MS	ES
	Finnish Ministry of Economic Affairs and Employment	FI
	Business Finland	FI
CS11	DG RTD, Cluster 2: Culture, Creativity and Inclusive society; Fair Societies and Cultural Heritage Unit (RTD.D.3)	EU
	DG RTD, Open and Inclusive Societies unit	EU
	DG CNECT, STARTS programme, Media Convergence and Social Media (CNECT.I.4)	EU
	DG EAC, Creative Europe programme (EAC.D.2)	EU
	European Innovation Fund, Cultural and Creative Sectors Guarantee Facility (CCS GF)	EU
CS12	Central Project Management Agency in Lithuania	LT
	European Institute of Innovation and Technology, Science Valley in Lithuania	LT

Case study number	Organisation	Member state
	Science Europe, Former Research Director, at present independent consultant.	IE
	Head of Spreading Excellence and Widening Participation South-East European Research Centre	EU
	Cormack Consultancy Group in UK, Lithuania, USA and Australia NB. The interview was postponed, finally, it was not fully finished due to the war in Ukraine.	UK
CS13	European Institute of Innovation and Technology	EU
	EIT Health	EU
	EIT Food	EU
	EIT RawMaterials	EU
	Riga Technical University	LV
	Cleantech Bulgaria	BG
CS14	EIT Food	ES
	CTA (Corporación Tecnológica de Andalucía)	ES
	ILVO	BE
CS15	European Council of Doctoral Candidates and Junior Researchers (Eurodoc)	EU
	European Executive research agency, MSC Actions & support to experts department	EU
	University of Zadar	HR
	University of Zagreb	HR
	PhD Assciation Network of Denamrk (PAND)	DK
	Aarhus University	DK
CS16	University of Foggia (Italy)	IT
	Apulia Regional Government	
	Department of Agriculture, Food, Natural resources and Engineering (DAFNE)	IT
	Agrifood Technological District (DARe)	

Case study number	Organisation	Member state
	Consorzio Gargano Pesca	IT
	Consorzio SEMI	IT
CS17	Museum für Naturkunde/ EU-Citizen.Science	DE
	Rescoop	EU
	Leibnitz Gemeinschaft	DE
	European Liaison Office of the German Research Organisations	DE
CS18	Tallinn University	EE
	TalTech – Tallinn University of Technology	EE
	Estonian Ministry of Environment	EE
	ETAG - Estonian Research Council	EE
CS19	European Commission, DG RTD-A-1	EU
	Helsinki-Uusimaa Regional Council	FI
	Projects and Platforms" at the Interreg Europe 2014-2020	EU
CS20	Municipal Public Health Service of Utrecht	NL
	H2020 NCP Health	LT
	Italian Ministry of Health	IT
CS21	Ministry of Economic Affairs and Climate Policy	NL
	Ministry of Agriculture, Nature and Food Quality	NL
	Latvian High Added Value and Healthy Food Cluster	LV
	DG ENER	EU
	Wageningen University & Research	EU
CS22	COSME	EU
	ECSEL	EU
	euRobotics	EU

Case study number	Organisation	Member state
	EFFRA	EU
	Ministry of Employment and Economy, Department for Innovation and Enterprise Financing	FI
	EPoSS	EU
	Austrian Research Promotion Agency	AT
CS23	ICPerMed	EU
	National Centre for Research and Development	PL
	European Project Office of the Health Institute 'Carlos III'	ES
	University of Pavia	IT
	EHEN	NL
	H2020 NCP Health	DE
	Swedish Research Council for Health	SE
	DG SANTE	EU

Annex 2: Data analysis

State of play

Horizon 2020 was the biggest EU Research and Innovation programme in the 2014-2020 period, with nearly €80 billion of funding available. In total, more than 35 thousand projects were financed through H2020 (see Table 10 below)269. The majority of the projects were financed through the Marie Skłodowska-Curie Action (11,662 projects; 9,825 MSCA-IF projects, 1,034 MSCA-ITN, 586 MSCA-RISE, and 217 MSCA-COFUND), European Research Council (ERC) Frontier Research (7,833 projects), Small and Medium-Sized Enterprises actions (5,733; 4,233 SME-1 projects and 1,500 SME-2 projects), Research and innovation actions (4,758), and Coordination and support actions (2,606 projects). It is important to note that funding schemes with the most projects are not necessarily the largest in terms of the volume of financing. For example, although Research and Innovation (RIA) actions and Innovation Actions (IA) have a much smaller number of projects than MSCA, these funding schemes were also the largest in terms of volume – €28.90 bn. and €21.33 bn., respectively. However, the largest and most expensive funding schemes were not necessarily the ones with the most participants. Funding schemes with the most participants, on average, include COFUND-EJP and ERA-NET-Cofund, which had, on average, 99.57 and 26.58 participants.

[269] Newest data (15/02/2022) on H2020 projects and beneficiaries available retrieved from data.europe.eu: https://data.europa.eu/data/datasets/cordish2020projects

Table 10. Descriptive statistics of H2020 funding schemes

Funding scheme	Short summary*	Number of projects	Total costs (bn. EUR)	EC contr. (bn. EUR)	MS or other contr. (bn. EUR)	Average number of participants in projects
Research and Innovation Actions (RIA)	Action primarily consisting of activities aiming to establish new knowledge and/or to explore the feasibility of a new or improved technology, product, process, service or solution. It may include basic and applied research, technology development and integration, testing and validation on a small-scale prototype in a laboratory or simulated environment	4,758	€28.90	€24.90	€3.99	13.81
Innovation Actions (IA)	Actions primarily consisting of activities directly aiming at producing plans and arrangements or designs for new, altered or improved products, processes or services. This includes also continuously open, innovator-driven calls will target innovation projects addressing any technology or societal challenge field projects.	2,293	€21.33	€14.73	€6.60	14.51
COFUND-EJP	Support to coordinated national research and innovation programmes in implementing a joint programme of activities (ranging from research and innovation activities to coordination activities, training activities, dissemination activities and financial support to third parties).	7	€1.77	€0.92	€0.85	99.57
ERA-NET-Cofund	Support public-public partnerships in their preparation, establishment of networking structures, design, implementation and coordination of joint activities as well as Union topping-up of a trans-national call for proposals.	78	€1.74	€0.55	€1.19	26.58
Pre-Commercial	PCP actions aim to encourage public procurement of research, development and validation of new solutions that can bring significant	34	€0.25	€0.21	€0.04	10.12

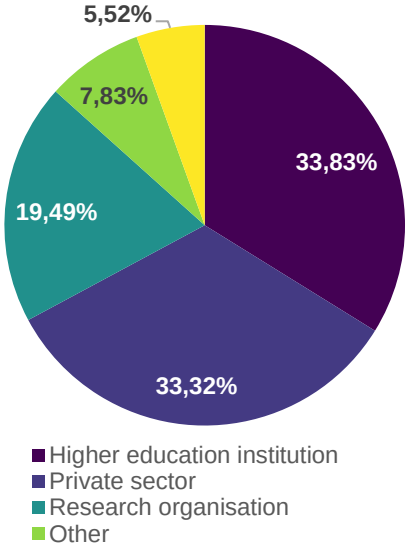
Procurements (PCP)	quality and efficiency improvements in areas of public interest, whilst opening market opportunities for industry and researchers active in Europe.					
Public Procurement of Innovative solutions (PPI)	PPI actions enable groups of procurers to share the risks of acting as early adopters of innovative solutions, whilst opening market opportunities for industry.	3	€0.09	€0.03	€0.06	7.33
Coordination and Support Actions (CSA)	Actions consisting primarily of accompanying measures such as standardisation, dissemination, awareness-raising and communication, networking, coordination or support services, policy dialogues and mutual learning exercises and studies, including design studies for new infrastructure and may also include complementary activities of networking and coordination between programmes in different countries.	2,606	€4.09	€3.92	€0.17	7.80
MSCA ITN	ITN supports competitively selected doctoral(-level) programmes, implemented by partnerships of universities, business and other RPOs across Europe and beyond. Partnerships take the form of collaborative European Training Networks (ETN), European Industrial Doctorates (EID) or European Joint Doctorates (EJD).	1,034	€3.46	€3.46	0	12.45
MSCA RISE	The Research and Innovation Staff Exchanges (RISE) support international and inter-sectoral collaboration through research and innovation staff exchanges, and sharing of knowledge an ideas from research to market (and vice-versa).	586	€0.59	€0.55	€0.04	10.81
Nonbeneficiary grants						
MSCA IF	IF (Individual Fellowships) Support experienced researchers undertaking mobility between countries, and where possible to the non-academic sector.	9,825	€1.88	€1.87	0	1.14
MSCA COFUND	Aims at stimulating regional, national or international programmes (fellowship or doctoral programmes) to foster excellence in researchers'	217	€1.20	€0.60	€0.60	4.41

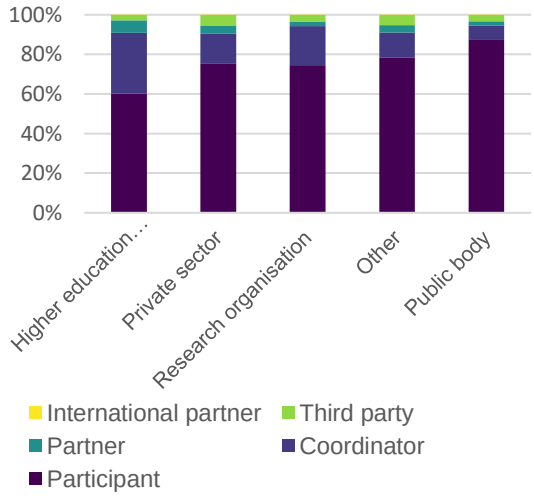
	training, mobility and career development, spreading the best practices of MSCA.					
ERC Frontier Research	Funding for projects evaluated on the sole criterion of scientific excellence in any field of research, carried out by a single national or multinational research team led by a 'principal investigator'.	7,833	€13.41	€13.41	0	1.25
SME Instrument Phase 1	Instrument is targeted at all types of innovative SMEs showing a strong ambition to develop, grow and internationalise. It provides staged support covering the whole innovation cycle in three phases complemented by a mentoring and coaching service. Phase 1 – feasibility study verifying the technological/practical as well as economic viability of an innovation idea/concept.	4,233	€0.30	€0.21	€0.09	1.04
SME Instrument Phase 2	Phase 2 – innovation projects that address a specific challenge and demonstrate high potential in terms of company competitiveness and growth underpinned by a strategic business plan.	1,500	€3.75	€2.63	€1.12	1.12
Specific Grant Agreement (SGA)	The Financial Regulation provides the possibility of Framework Partnership Agreements for long term partnerships and associated specific grant agreements. Framework Partnership Agreements and Specific Grant Agreements have been used in a limited way when in line with the objectives of the programme parts.	342	€0.07	€0.07	0	5.98
All projects		**35,349**	**€82.83**	**€68.05**	**€14.75**	**4.86**

* Based on the European Commission's In-depth Interim Evaluation of Horizon 2020
Based on 15/02/2022 H2020 project and beneficiary data retrieved from data.europe.eu.

Regarding the distribution, the **majority of H2020 projects were carried out by higher education institutions and organisations from the private sector** (see Figure 6 below). In total, there were around 170 thousand participations in H2020 projects from around 40 thousand organisations. On the one hand, based on Figure 6 around 33.83% of participations, which constitutes a bit above 58 thousand participations from around 2.7 thousand organisations, were by higher education institutions. On the other hand, around 33.32%, which constitutes a bit below 56 thousand participations from around 26 thousand organisations, were from privately-owned organisations. Although the number of participations of these two types of organisations is similar, there were almost ten times more privately-owned organisations participating in H2020 than higher education institutions. This implies that the same institutions often participate in H2020 projects, which might highlight that they have an easier time continuing building on their work and hence might foster synergies, while **privately-owned organisations more often have "one-off" participations**. This is supported by the finding that around **68% of privately owned organisations only participated in one H2020 project, while for higher education institutions this statistic is 34%**. Regarding other types of organisations, 19.49% participations were from research institutions, 7.83% were from other types of institutions, while 5.52% were from public bodies.

In addition, regarding the roles of said participants, in most cases, higher education institutions served as project coordinators, while other types of institutions predominantly are regular participants in H2020 projects (see Figure 7). This might be motivated by the fact that the majority of organisations from the private sector do not have as extensive experience with H2020 as higher education institutions, because a lot of them are participating for the first time in H2020 projects. In addition, compared to other types of organisations, public bodies rarely participate as coordinators as they most frequently take the role of participants.





Source: Own estimates based on information on projects funded through different EU initiatives. Based on 15/02/2022 H2020 project and beneficiary data retrieved from data.europe.eu.

Figure 6. Percentage of participations of organisations in H2020 projects by type of organisation

Figure 7. Distribution or participations by organisation type and role of organisation in H2020 projects

Keywords analysis

With the purpose of identifying **thematic areas** on which projects focus, we have used the European Science Vocabulary (EuroSciVoc) keywords, which are assigned to the majority of H2020 projects. These keywords are arranged in a hierarchical manner and range from very generic at the top level, such as agricultural science, humanities, natural science, to very concrete ones at the bottom level, such as plant protection, literary criticism, and enzymes. **The most frequently appearing keywords in H2020 projects were proteins (in 1,126 projects), renewable energy (in 944 projects), and business models (in 877 projects).** For a visualisation of how frequent different keywords appear, see Figure 8.

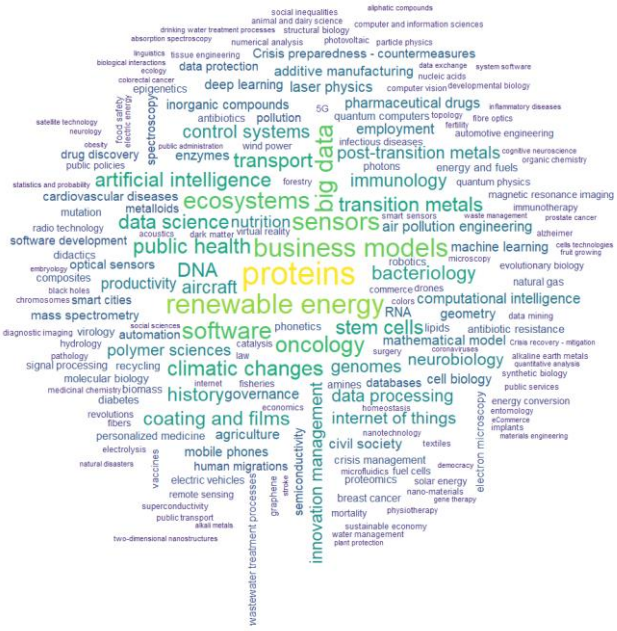


Figure 8. Word cloud of the EuroSciVoc keywords associated with the H2020 projects

Based on H2020 project and beneficiary data retrieved from data.europe.eu, as of 15/02/2022

Note 1: Size of the keyword indicates its frequency. Keywords that appeared in less than 10 projects were excluded from the visual
Note 2: Visual was created using information from 32018 H2020 projects.

More insights can also be derived by looking at the most popular keywords in different H2020 funding schemes, which are provided in Table 11. As can be seen, different funding schemes focus on quite different thematic areas. These include, but are not limited to aircraft, data sciences and related topics (incl. big data), renewable energy and topics related to it, and more.

Table 11. Top five EuroSciVoc keywords / phrases used in projects funded through different H2020 funding schemes

Funding scheme	Top five EuroScieVoc keywords / phrases
Research and Innovation Actions (RIA)	Aircraft, big data, sensors, artificial intelligence, ecosystems
Innovation Actions (IA)	Aircraft, business models, renewable energy, ecosystems, control systems
COFUND-EJP	Animal feed, antibiotic resistance, Crisis preparedness - countermeasures, edaphology, food safety
ERA-NET-Cofund	Educational sciences, nutrition, climatic changes, ecosystems, bioeconomy
Pre-Commercial Procurements (PCP)	Smart cities, big data, data science, physiotherapy, public service
Public Procurement of Innovative solutions (PPI)	Cardiac arrhythmia, Crisis recovery - mitigation, critical care medicine, public services, supercomputers
Coordination and Support Actions (CSA)	Renewable energy, innovation management, civil society, ecosystems, governance
MSCA ITN	Drug discovery, oncology, data science, big data, polymer sciences
MSCA RISE	Data science, coating and films, public health, big data, oncology
MSCA IF	Proteins, history, climatic changes, transition metals, bacteriology
MSCA COFUND	Employment, computer and information sciences, Crisis recovery - mitigation, mathematics, Crisis preparedness - countermeasures
ERC Frontier Research	Proteins, oncology, DNA, genomes, stem cells
SME Instrument Phase 1	Business models, software, sensors, renewable energy, internet of things
SME Instrument Phase 2	Software, sensors, control systems, renewable energy, internet of things
Specific Grant Agreement (SGA)	Innovation management, business models, ecosystems, post-transition metals, commerce
ALL	**Proteins, renewable energy, business models, sensors, big data**

Based on 15/02/2022 H2020 project and beneficiary data retrieved from data.europe.eu

To further expand on keywords, Table 12 was created where the rows represent projects that focus on one of the six broad thematic areas found in the EuroSciVoc while columns represent an average amount of keywords from these thematic areas assigned to H2020 projects. This means that, for example, the intersect between the row and column indicating Agricultural sciences, which shows 42.66%, indicates that from all H2020 projects that contained at least one keyword associated with Agricultural sciences (rows) around 43% of keywords in such projects were associated with Agricultural sciences. This means 57% of keywords in such projects were associated with other thematic areas.

As can be seen in Table 12, and as expected, projects assigned to a specific thematic area also contain quite a lot of keywords (around 50%), associated with these thematic areas. However, given that there are still 50% of keywords, on average, from other thematic areas, it can be stipulated that there are strong thematic links between projects. In other words, projects were rarely focusing on only one thematic area and they were frequently multidisciplinary in nature. It seems projects related to agricultural science are the most multidisciplinary as they also heavily cover engineering and technology, as well as natural sciences. However, at the same time, apart from projects explicitly covering agriculture, projects in other academic disciplines seldom cover keywords related to agriculture.

			Keywords from EuroSciVoc broad thematic areas					
		Number of projects	Agricultural sciences	Engineering and technology	Humanities	Medical and health sciences	Natural sciences	Social sciences
Projects	Agricultural sciences	1,996	**42.66%**	16.14%	1.58%	7.01%	24.76%	8.38%
	Engineering and technology	11,912	2.21%	**56.73%**	0.86%	5.40%	27.24%	8.86%
	Humanities	2,398	1.14%	4.50%	**57.10%**	3.16%	17.19%	17.16%
	Medical and health sciences	8,182	1.65%	6.81%	0.82%	**58.82%**	26.32%	5.09%
	Natural sciences	20,284	1.82%	14.67%	1.69%	10.23%	**64.72%**	7.46%
	Social sciences	9,138	1.85%	13.61%	4.22%	5.42%	19.53%	**55.86%**

Table 12. Average percentage of EuroSciVoc keywords/phrases associated with relevant topics in H2020 projects connected to the same keywords / phrases

Own calculations, based on 15/02/2022 H2020 project and beneficiary data retrieved from data.europe.eu.
Note: Columns do not add exactly to 100% due to rounding errors.

In addition, projects in the majority of thematic areas heavily cover topics related to natural sciences. For example, on average 23% of all keywords in projects from other disciplines come from natural sciences. These overlapping keywords include, but are not limited to: biodiversity, genetics, earth and related environmental sciences, and similar. These results are likely because of a strong focus of research on greening and climate change, which is a cross-cutting issue across many disciplines. Also, as natural sciences cover mathematics,

computer and information sciences, including machine learning, and similar, it is also likely that projects from other disciplines heavily utilise methods that come from this thematic area.

Further insights could be derived by evaluating the keywords that prevail in the R&I projects at the national level (from the five select countries presented in Annex 1). As shown in Figure 9, which visualises the frequency of EuroSciVoc keywords used in the projects from the five select countries, R&I projects funded through national and regional initiatives cover a vast array of different topics. Nationally funded projects most frequently cover topics related to proteins, which also frequently appears in the "top keywords" for H2020 projects. However, unlike in the H2020 projects, the discussion on proteins dominates the national R&I sphere more, given that it is by far the most popular topic, with the topic of transition metals, transport, history, and mathematical models trailing quite far behind.

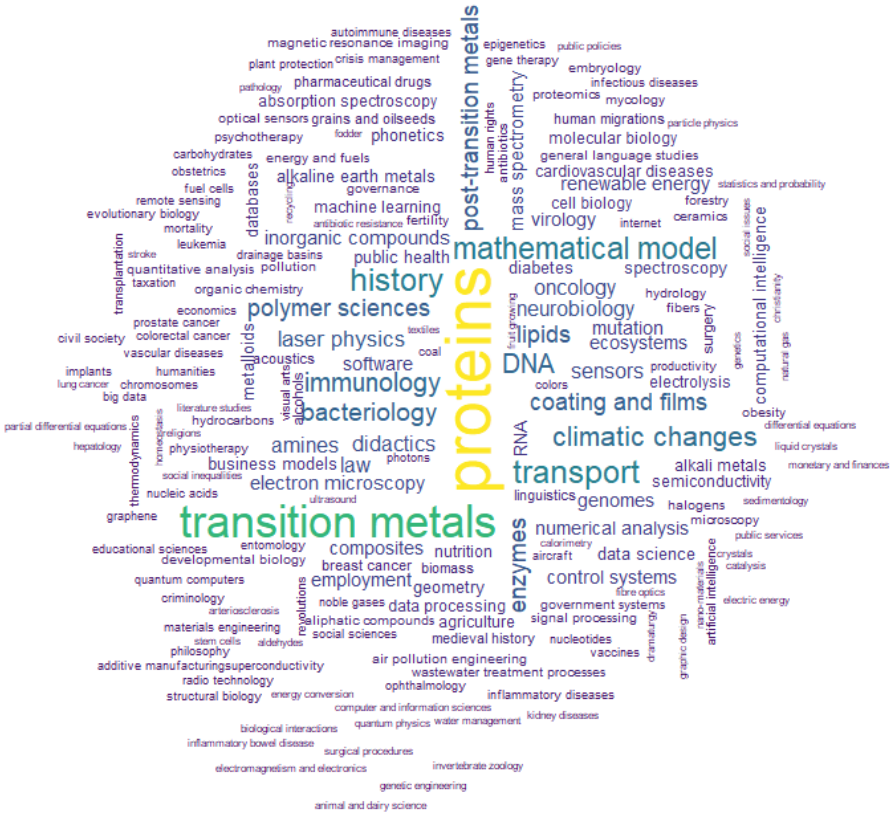


Figure 9. Word cloud of the EuroSciVoc keywords associated with national projects

Source: Own estimates based on data from different national research organisations.

Note 1: Size of the keyword indicates its frequency. Keywords that appeared in less than 10 projects were excluded from the visual

Note 2: Visual was created using information from 303,331 projects from the five select countries for which EorSciVoc keywords were available.

Expanding on this, according to Table 13, in Germany, France, and Croatia "proteins" is the top keyword used in the R&I projects, while in the case of Poland and Sweden, this keyword is in the top 5 keywords used. In addition, in the case of Poland, the most prevalent key phrase is "transition metals", which most likely shifted the importance of this key phrase in Figure 9 above. Regarding Sweden, the most frequently used key phrase is "climate

changes", which also is in the top 5 keywords for France and Croatia. Besides, the most frequently used keywords both in projects financed through national/regional funds and H2020 funds match quite heavily in all countries.

Table 13. Top five EuroSciVoc keywords / phrases used in R&I projects funded at the national / regional levels

Country	Top five EuroScieVoc keywords / phrases
Germany	Proteins, transport, history, immunology, transition metals
France	Proteins, climatic changes, transport, renewable energy, transition metals
Croatia	Proteins, climatic changes, DNA, mathematical model, machine learning
Poland	Transition metals, mathematical model, proteins, history, law
Sweden	Climatic changes, proteins, business models, employment, public health

Source: Own estimates based on data from different national research organisations.

Overlaps, possible external synergies, and gaps between H2020 and projects financed through other EU initiatives

As a part of the analysis, we explored the percentage of H2020 projects from different actions connected (following the methodology described in Annex 1) to projects not financed through H2020. Initiatives that were analysed, and for which received the relevant data include: European Structural Investment Funds (ESIF), LIFE, HEALTH, Common Agricultural Policy (CAP), Creative Europe (CE), Connecting Europe Facility (CEF), and Research Fund for Coal and Steel (RFCS). From a methodological perspective, two projects were considered to be connected if they shared a beneficiary and a relevant keyword. It is important to note that though a connection of two projects does not necessarily mean a synergy, it still implies a possible continuation of a project, exchange of ideas, and similar, which provides some evidence of possible synergies. Nevertheless, due to the limitations of data mining, these results need to be interpreted with a lot of reservations, especially given that connections do not cover all types of synergies, such as upstream and downstream ones. Figure 10 below provides the statistics of this linking. As can be seen, **a relatively large number of H2020 projects could be connected to projects outside the H2020 framework.**

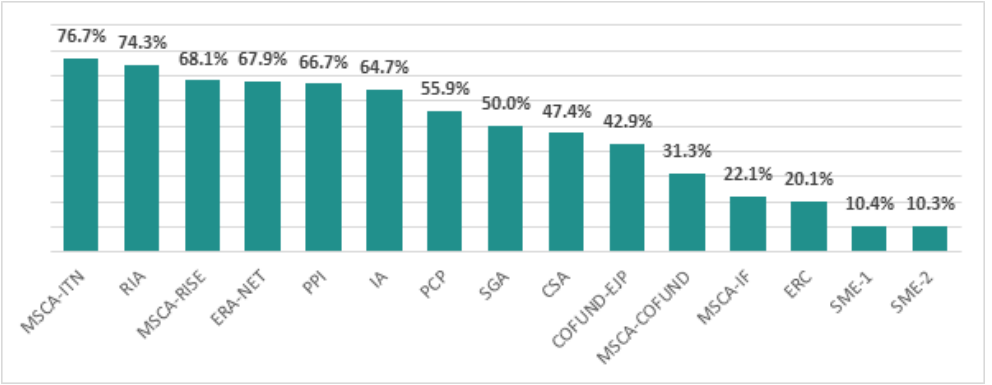


Figure 10. Percentage of H2020 projects from different actions connected to projects funded through other EU initiatives

Source: Own estimates based on information on projects funded through different EU initiatives

Projects from MSCA-ITN, RIA, and MSCA-RISE seem to be the most interlinked with projects not financed through H2020. At the same time, SME-2, SME-1, ERC, MSCA-IF, and MSCA-COFUND seem to be the least interlinked. However, to some extent the differences between these two groups of projects can be explained by a relatively different number of participants. For example, MSCA-ITN, RIA, and MSCA-RISE, on average, have 12.45, 10.81, and 13.81 participants respectively, while SME-2, SME-1, ERC, MSCA-IF, and MSCA-COFUND have 1.12, 1.04, 1.25, 1.14, and 4.41. This means that in the first group of projects there were more organisations that could have continued the work conducted in the H2020 project than in the second group. Nevertheless, a smaller amount of links here does not indicate that there are no synergies, as the linking process does not take into account upstream and downstream synergies. Expanding on these findings, Figure 11 provides more detailed insights on links between H2020 and non-H2020 initiatives by highlighting how many non-H2020 projects from different initiatives were linked to H2020 projects. More specifically, the visual indicates how many projects, in percentage terms, carried out through non-H2020 initiatives (e.g., ESIF, LIFE, HEALTH, etc.), were connected to H2020 project. The linking was carried out using the same approach outlined prior. The percentage values were estimated rather than providing raw data as there is quite a large variation between the numbers of projects in different non-H2020 initiatives. For example, based on our data, there were 176 RFCS funded projects, which is on the low end, and around 560,000 ESIF projects,

on the high end. There is also a large variation between budgets. Hence, the percentage allows normalising this data and fosters a more accurate comparison between initiatives.

The results, first of all, indicate that **projects financed through RFCS, HEALTH, and LIFE are the most connected (based on the same beneficiary and same topic) initiatives to H2020 projects**. One plausible reason why these projects are the most interconnected is that all of them focus on very similar topics as a large portion of H2020 projects, including improving the well-being of individuals and the climate. Namely, RFCS focuses on fostering sustainable production, LIFE heavily focuses on addressing climate change, while HEALTH focuses on helping to keep citizens of the EU, and beyond it, healthy. These topics also are cross-cutting, touching upon many fields, which further fosters possible synergies. In addition, such strong interlinking can also be due to such projects being relatively broadly defined, making them more conducive to possible synergies than more, specific, projects.

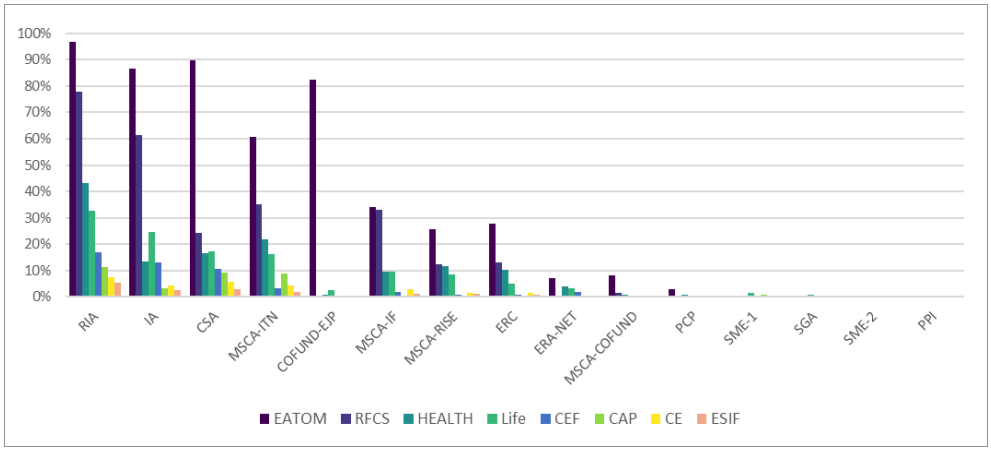


Figure 11. Percentage of non-H2020 projects connected to different H2020 funding schemes in percentage terms

Source: Own estimates based on information on projects funded through different EU initiatives.
Note: The visual presents how many projects financed through different non-H2020 initiatives were connected to H2020 projects. The results are presented in percentage terms, where the baseline is the total number of non-H2020 projects (I.e., both connected and not connected ones) in each non-H2020 initative.

In addition, H2020 financial schemes with more projects are connected to more non-H2020 projects. Relevant funding schemes include RIA (3,993 projects), MSCA (11,662), IAC (1,766), and similar. Also, it is interesting to highlight that the SME Instrument is a funding scheme with a large number of projects, but seems to be less connected to non-H2020 projects. In addition, there is also quite a lot of variation between different MSCA projects, where some are much more interconnected than others. This implies that even though a lot of projects come from the same action (MSCA) it is very multifaceted in terms of synergies. However, it is also important to highlight that lack of connections or abundance of them does not necessarily mean strong or weak synergies. This is because, for example, SME projects might have different kind of synergies, such as synergies through private investments. Similarly, interlinkage of MSCA with other projects might imply that this action shares a lot of values and goals as many non-H2020 projects. Hence, these results have to be interpreted with a lot of caution and reservation.

Figure 12 demonstrates how many projects, in percentage terms, from different non-H2020 financed initiatives were connected to projects from H2020 assigned to different scientific disciplines. As can be seen, RFCS, Health, and LIFE are the initiatives more frequently connected to H2020 projects. In addition, Figure 12 also indicates many expected results, such as projects focusing on medical and health science most frequently being connected to projects from HEALTH, and projects connected to agricultural sciences most frequently being

connected to CAP. **Though these results are expected, they also show that there are likely synergies between H2020 projects focusing on different disciplines and other EU initiatives focusing on similar disciplines**.

Although ESIF is connected relatively sparsely, which is due to many one-off ESIF projects, given the large number of such projects, there is still a large amount of connections. For example, H2020 projects related to national sciences were linked to 2.48% ESIF projects, which translated to around 14 thousand projects. Similarly, around 15 thousand ESIF projects were linked to H2020 projects focusing on engineering and technology, around six thousand that focus on medical and health science, and around a thousand focusing on social sciences. Also, important to note that connections here were estimated the same way as for other initiatives, where two projects were linked if they share a beneficiary and keywords. However, given that the focus of this analysis is on specific thematic fields, only keywords relevant to these thematic fields were used in the linking.

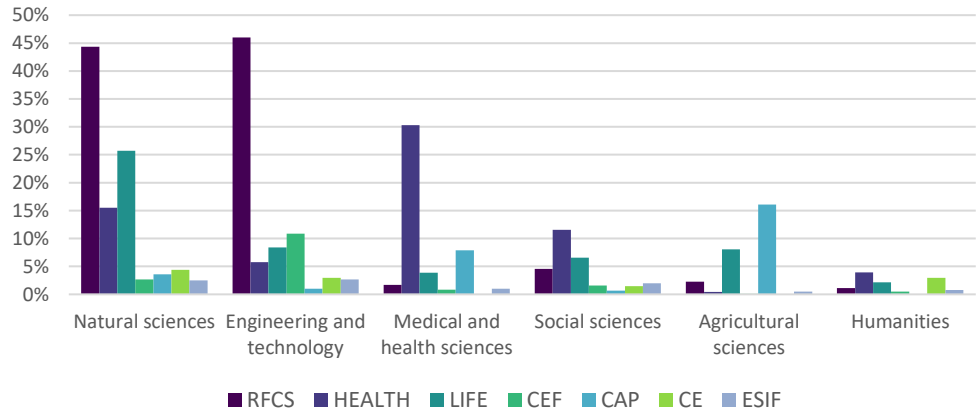


Figure 12. Percentage of projects funded through different non-H2020 initiatives, compared to the total number of such projected, connected to H2020 projects from different thematic fields

Source: Own estimates based on information on projects funded through different EU initiatives

Overlaps, possible external synergies, and gaps between H2020 and projects financed through national and regional initiatives

In addition to exploring links at the EU level, they were also explored at the regional and national level by linking H2020 projects with projects financed through different regional and national initiatives for which there was available data (for Germany[270], France[271], Croatia[272], Poland[273], and Sweden[274]).

Figure 13 indicates how many H2020 projects, in percentage terms, were linked with projects financed through national/regional initiatives. On the one hand, **H2020 projects financed through ERA-NET, MSCA-ITN, and RIA (Research and innovation actions) actions were the ones that were linked the most to nationally/regionally funded projects.** This is, to a large extent, consistent with the results at EU level presented above. Nevertheless, comparing these results with the EU-level results, it can be clearly seen that there are fewer linkages between H2020 and national/regional funded projects. Similarly, **H2020 projects**

[270] DE-GEPRIS
[271] FR-scanR
[272] HR-HRZZ
[273] PL-POLON; PL-BWNP; PL-INVENTORUM
[274] SE-SWECRIS

funded through SME-1 and 2 (Small and Medium-Sized Enterprises) instruments, as well as SGA (Specific Grant Agreement), actions are the ones that are connected the least to projects financed through national/regional funding schemes.

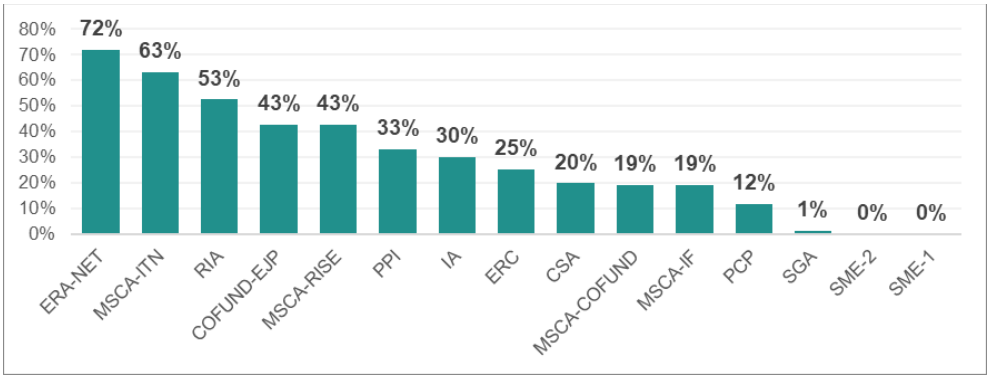


Figure 13. Percentage of H2020 projects from different funding schemes connected to projects funded through national/regional initiatives

Source: Own estimates based on data from different national research organisations.

Annex 3: Case studies

The Case study report is provided separately, while below we present the list of the case studies.

#	Case study topic
Synergy cases	
1	Deployment of green innovations
2	Horizon 2020 Seals of Excellence
3	Complementary financing with Cohesion policy at project level
4	Determinants of the use of relevant Horizon 2020 results to shape cybersecurity policies at the EU or national level
5	Skills and R&I: Coherence with (higher) education activities
6	Infrastructure and R&I: coherence between funding for research and technological infrastructures
7	Cooperation and coordination for R&I: coherence between EU and national level actions within ERA
8	Coherence in support to agri-food value chains
9	Coherence in support to the transport, infrastructure and mobility sector
10	External coherence of H2020 in supporting Industry 4.0
11	Coherence in the EU to support creativity
12	Synergies for strengthening R&I policy reforms in the EU Associated Countries
13	Coherence and synergies between the EIT Regional Innovation Scheme and smart specialisation strategies
Fictional cases	
14	An individual entrepreneur in the EU with an innovative idea with strong potential for a breakthrough in the agri-food sector
15	Support for young researchers in Europe

16	A fish farmer in need of existing research and innovative solutions to deploy in her fields for more sustainable farming
17	A group of citizens looking for answers and innovative solutions to burning climate, environmental and health research question
18	A city willing to make the transition to a smart and sustainable city, but lacking innovative solutions, experience, skills, infrastructures
19	A border regional government in the EU willing to join R&I forces with another border region to address their digital gap
20	Decentralized public health authorities across the EU in need of a breakthrough innovative solution to address common public health issues
System cases	
21	System case on the green transition
22	System case on the digital transition
23	System case on healthier future

Annex 4: Main sources reviewed under the horizonal desk research

No	Source title
1	EC (2017) Interim evaluation of Horizon 2020, Staff Working Document.pdf
2	EC (2017) Interim evaluation of Horizon 2020, Staff Working Document, Annex 1.pdf
3	EC (2017) Interim evaluation of Horizon 2020, Staff Working Document, Annex 2.pdf
4	EC (2017) LAB-FAB-APP, Investing in the European future we want, Report of the independet HLG.pdf
5	EP (2017) Report on the assessment of Horizon 2020 implementation in view of its interim evaluation and the FP9 proposal.pdf
6	EC (2018) Impact assessment of Horizon Europe, Staff Working Document_part 1.pdf
7	EC (2018) Impact Assessment of Horizon Europe, Staff Working Document_part 2.pdf
8	EC (2018) Horizon Europe_Proposal for a Regulation COM.pdf
9	EC 92018) Research and innovation valorisation channels and tools_Boosting the transformation of knowledge into new sustainable solutions.pdf
10	ERAC (2017) ERAC Opinion on the Interim Evalaution of Horizon 2020 and preparations for the next Framework Programme.pdf
11	Delors Institute (2019) Study requested by the BUDG Committee of the European Parliament, Mainstreaming Innovation Funding in the EU Budget .pdf
12	European Parliament (2016) EU Innovation Policy, Part I – Building the EU innovation policy mix.pdf
13	European Parliament (2016) EU Innovation Policy, Part 2 - EU policies and instruments supporting
14	JIIP (2017) Synergies between Framework Programmes for Research and Innovation and European Structural and Investment Funds, Contributing to the Interim Evaluation of Horizon 2020.pdf
15	EC (2020) Research and Innovation analysis in the European Semester 2020 Country Reports.pdf
16	Technopolis Group (2017) Discussion paper for the Informal meeting for Ministers responsible for Competitivenes, Increased coherence and openness of EU research and innovation partnerships.pdf
17	European Court of Auditors (2020) The SME Instrument in action- an effective and innovative programme facing challenges.pdf
18	JRC (2019) Joint Undertakings- analysis of collaboration mechanisms with ESI Funds in an S3 context.pdf
19	EIB (2018) Financing the Deep Tech Revolution_How investors assess risks in Key Enabling Technologies
20	EIB (2019) Access to finance conditions for financing the Circular Economy.pdf
21	EIB (2019) Feeding future generations_ How finance can boost innovation in agri-food.pdf
22	European Parliament's Committee on Regional Development (2016) Maximisation of synergies between European Structural and Investment Funds and other EU instruments to attain Europe 2020 goals.pdf
23	EC (2014) Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes Guidance for policy-makers and implementing bodies.pdf
24	Technopolis Group (2013) Analysis of synergies fostered by the EIT in the EU innovation landscape.pdf
25	EC (2014) Synergies between the transport component of Horizon 2020 and the Cohesion Policy 2014–2020, Expert Group Report 7th Research Framework Programme Transport Programme Committee.pdf
26	JRC (2014) Synergies between EU R&I Funding Programmes. Policy Suggestions from the Launching Event of the Stairway to Excellence Project.pdf
27	EP ITRE Committee (2007) Synergies between the EU 7th Research Framework Programme, the Competitiveness and Innovation Framework Programme and the Structural Funds.pdf
28	ERA LEARN (2021) Policy Brief on Synergies between R&I partnerships and ESIF.pdf
29	EC (2018) From Rivalry to Synergy - R&I Policy and Cohesion Policy.pdf
30	EC (2020) Interim Evaluation of Horizon 2020s Financial Instruments.pdf
31	EC (2020) Non-paper on synergies in Horizon Europe.pdf
32	EC (2020) Coherence and synergies of candidate European Partnerships under Horizon Europe.pdf
33	ERAC Secretariat (2018) Final report by the ERAC Ad-hoc Working Group on Partnerships.pdf
34	EC (2018) Mutual Learning Exercise_Widening Participation and Strengthening Synergies.pdf
35	Ferry and Kah (2016)_Maximisation of synergies between ESIF and other EU instruments.pdf

Annex 5: Additional sources reviewed under the horizontal desk research

1. EC (2018) Mid-Term Evaluation of the Connecting Europe Facility (CEF), Staff working document
2. EC (2017) Report on the Mid-term Evaluation of the Programme for Environment and Climate Action (LIFE), Staff working document
3. EC (2014) (Decision C (2014)4995 of 22 July 2014) HORIZON 2020 WORK PROGRAMME 2014 – 2015 3. Marie Skłodowska-Curie Actions.
4. EC (2017) FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions (MSCA): final report, Publications Officehttps://data.europa.eu/doi/10.2766/103174
5. EC (2018) Mid-term evaluation of the Erasmus+ programme (2014-2020), Staff working document
6. EC (2016) Analysis of ERA-NET Cofund actions under Horizon 2020. Final report of the expert group
7. Guide for OUTGOING [PEGASUS]² MARIE SKŁODOWSKA - CURIE fellow applicants, (2016) Available at: https://www.fwo.be/media/448403/-pegasus-%C2%B2_outgoing_guidelines.pdf
8. EC (2011) Communication Proposal for a Council decision establishing the Specific Programme Implementing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020),
9. EC (2017) Sustainable European Research Infrastructures - A call for action. Commission Staff Working Document - Long-term sustainability of Research Infrastructures.
10. H2020 project ACCELERATE (2017) Deliverable Report: D 1.1 Synergies in European RI Funding
11. EC (2010) 2020 final: Communication from the Commission. Europe 2020: A strategy for smart, sustainable and inclusive growth
12. COM (2011) 808 final: Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and The Committee of the Regions. Horizon 2020 - The Framework Programme for Research and Innovation.
13. EC (2017) Interim Evaluation of the COSME Programme
14. EY (2017) Ad-hoc audit of the application of the Regulation 2015/2017 (the EFSI Regulation): Final Report. Available at https://ec.europa.eu/info/sites/default/files/ey-report-on-efsi_en.pdf
15. EC (2017), Mid-term review of the Galileo and EGNOS programmes and the European GNSS Agency: final report, Publications Office, 2017, https://data.europa.eu/doi/10.2873/01585
16. EC (2017) Interim evaluation of Copernicus. July 2017. Available at: https://www.copernicus.eu/sites/default/files/2020-05/ET0417742ENN.en_.pdf
17. EC (2021) Updated Guidance on State Aid in European Structural and Investment (ESI) Funds. Financial instruments in the 2014-2020 programming period, Staff working document
18. EC (2017) Horizon 2020 Work Programme 2016-2017: 6. Access to Finance. Available at https://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-finance_en.pdf [13/04/2022]
19. ERAC (2017) ERAC Opinion on the Interim Evaluation of Horizon 2020 and preparations for the next Framework Programme
20. EIT (2017), EIT Regional Innovation Scheme: Implementation Guidance Note 2018-2020, https://eit.europa.eu/sites/default/files/eit_ris_guidance_note_2018-2020.pdf
21. JRC (2019) EIT KICs: Collaboration in RIS3 context

Annex 6: Graphical mapping of the European R&I support system

The graphical 'maps' presented below were used in the discussions for the validation workshop implemented under the study, and they aim to visualise the findings for some of the evaluation questions (where graphical presentation was considered possible).

A 'map' of the R&I support system for skills

The mindmap below was prepared for the validation workshop and was updated with the inclusion of the EIT.

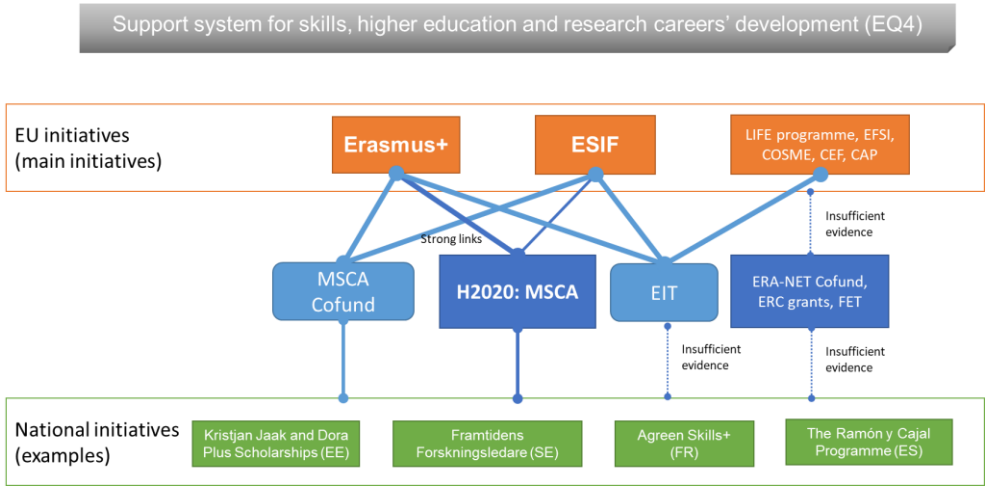


Figure 14. A 'map' of the R&I support system for skills

Source: Own elaboration

A 'map' of the R&I support system concerning financial instruments and SMEs

The mindmap below was prepared for the validation workshop and was updated with the inclusion of the INNOSUP instrument.

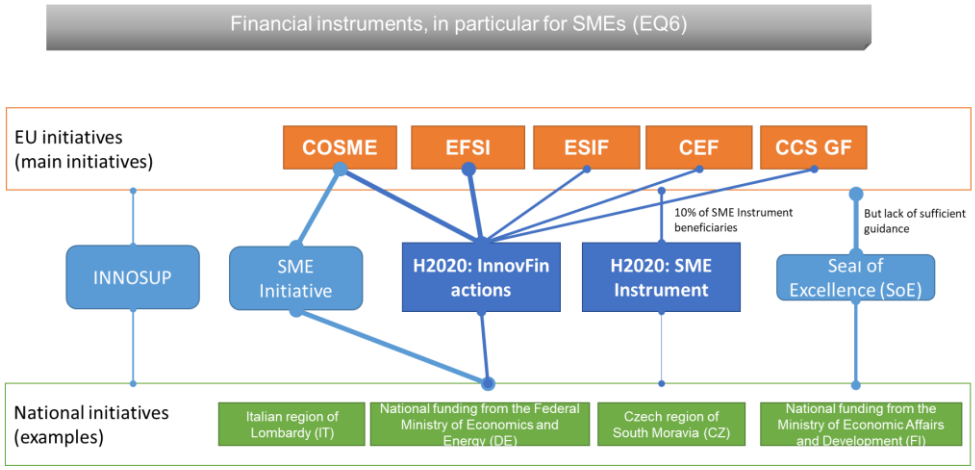


Figure 15. A 'map' of the R&I support system - financial instruments and SMEs

Source: Own elaboration

A 'mind-map' of the navigation and coordination challenges

The 'mind-map' below summarises the key findings on the challenges related to H2020 navigation and coordination for ensuring synergies.

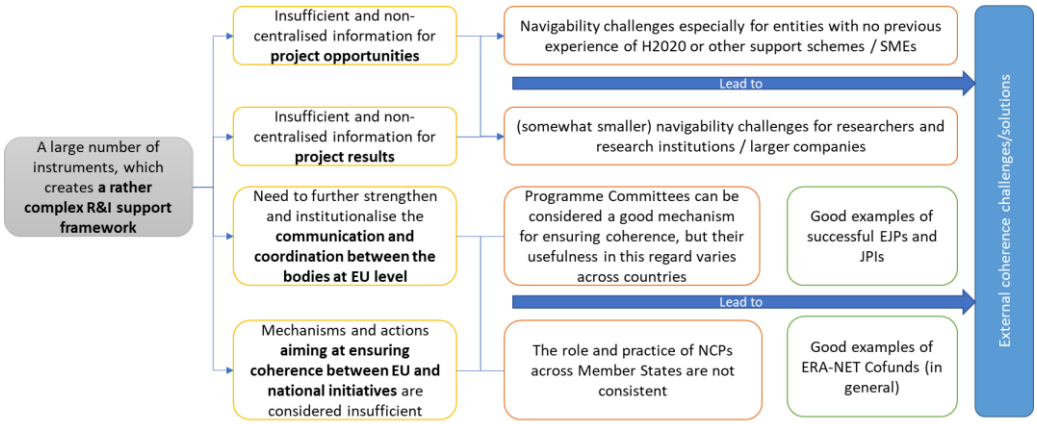


Figure 16. A 'mind-map' of the H2020 navigation and coordination challenges

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This final report provides the results of the ‘Evaluation study on the external coherence and synergies of Horizon 2020 within the European research and innovation support system’. The study was implemented in the period April 2021-October 2022 by a consortium consisting of Ecorys, EFIS, Visionary Analytics, and Carsa. Via case studies, interviews, desk research, and data mining, the study explores the links, overlaps, and synergies between H2020 and other R&D projects, programmes, and policies at the EU and national levels.

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