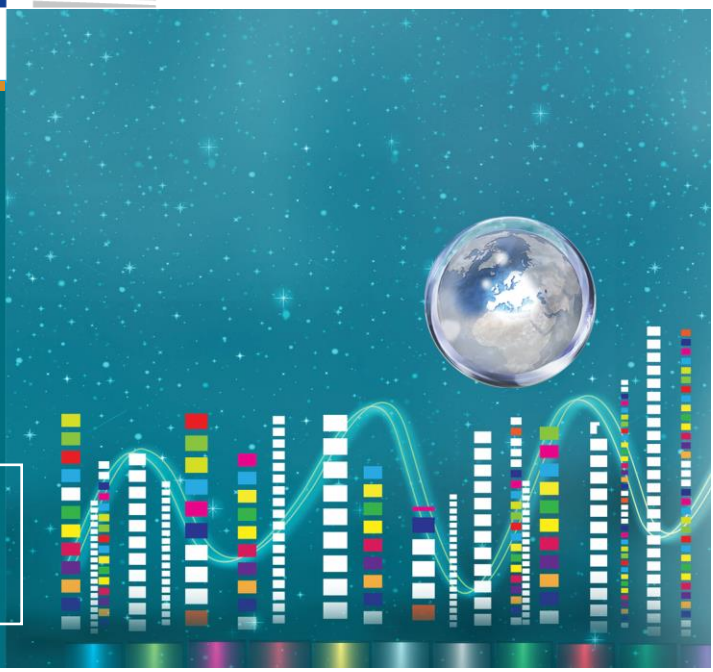
European Commission

Evaluation study on the European Framework Programmes for Research and Innovation for addressing Global Challenges and Industrial Competitiveness – Focus on activities related to the Green Transition – Final report Phase 1

Executive Summary

Independent Expert Report



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EXECUTIVE SUMMARY

Evaluation objective and methodology

This report is part of a study combining a back-to-back-approach for the ex-post evaluation of Horizon 2020 and the interim evaluation of Horizon Europe with a thematic focus on Green Transition aspects and the long-term impact of the Framework Programme(s). It constitutes the final report for phase 1 (Horizon 2020).

This evaluation study covers all activities of the European Framework Programmes in the impact area Green Transition, i.e., all related activities in Horizon 2020 (2014-2020) and the first phase of Horizon Europe. It notably covers four Societal Challenges under Horizon 2020: SC2, SC3, SC4, and SC5. This evaluation study also assesses European partnerships under the Framework Programme active in Green Transition-related fields with a legal obligation for evaluation (Joint Undertakings, Knowledge and Innovation Communities, Art. 185 or 187 TFEU), as well as the JRC. Other partnerships relevant for the Green Transition (Horizon 2020 contractual public-private partnerships, EJP Co Funds, Joint Programming Initiatives, ERA Nets) are taken into account as part of the evaluation of the thematic areas.

To conduct the evaluation, a specific methodological approach was designed during the inception phase, in agreement with the steering committee. The selected methodological approach mixed various data collection and data analysis tools (e.g. bibliometrics, case study, survey, benchmarking). The different tools mobilised throughout the evaluation enabled the collection of evidence to answer the various evaluative questions considered under this evaluation.

Overview of the Green Transition in Horizon 2020

Research and innovation can play a considerable role in providing the desired directionality for R&I efforts, the foundational technological requirements, technological and social innovations for shaping the transformation process to a green European society, paving the way for the required behavioural

change through integration of all stakeholders, including civil society. However, the Green Transition goes far beyond transitions pushed by new technologies. Nature-based, non-technological and socio-economic innovations are also hugely important to advance the transition.
The launch of the European Green Deal, in 2019, can be considered a (r)evolution given its comprehensiveness, consistency and the priority given to the Green Transition. The package sketched many elements for the conceptualisation of a Green Transition in Europe, even if, from an R&I perspective, a clear definition does not currently exist. Green Transition can be considered as the necessary shift for achieving the priority objective of a climate-neutral economy in Europe by 2050, to which R&I constitute one of the fundamental components. It should be noted that the diagnosis leading to the need for Green Transition and related objectives already existed prior to the Green Deal, and were included in many policy and programme developments (including Horizon 2020), albeit in a more siloed manner.
In the design and implementation of Horizon 2020, tackling Societal Challenges and addressing EU policy priorities and global challenges through R&I has already been given an equal footing with fostering scientific excellence and enabling industrial leadership. Thematic priorities in the multi-annual Work Programmes were increasingly geared towards sustainability objectives. An initial conceptualisation of a Green Transition was thus embedded in Horizon 2020, with the following principles:

- R&I should contribute to the development of technologies and innovation so that all technological solutions and the respective innovation systems become net zero.
- In the meantime, while this is a longer-term endeavour, more sustainable alternatives need to be made available now (i.e. more efficient use and effective uptake of existing technologies as well as innovative business models).
- Producers and consumers along the value chains must make more sustainable choices, for which there is a need to provide the networks and capacities for rethinking and redesigning the incentives to deliver the required behavioural change.
- Negative externalities to the environment and to society must be reduced in parallel in order to prevent, minimise, or repair damages and ensure higher levels of resource efficiency.

Based on this overarching definition, sectoral definitions, for each Societal Challenge, were developed in the frame of this study.

Main findings for the four Societal Challenges

For Societal Challenge 2 (Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy), Horizon 2020 was an enabler of the Green Transition within the R&I scope. It constituted a unique, instrumental and ambitious mechanism to bring forward an R&I agenda, and then support relevant topics. During its timeframe, the design of topics and the selection process shifted towards a more applied and integrated perspective, which can be considered a success in support of the Green Transition. Horizon 2020 appeared to be effective, as many projects are on track to make significant progress. There is however a lack of information on the impacts, which cannot be measured immediately and for which additional monitoring tools to 'traditional' R&I indicators will need to be implemented.
For Societal Challenge 3 (Secure, clean and efficient energy), the framework programme was positively assessed in terms of relevance, coherence and effectiveness. The level of ambition, topical choices and tools mobilised appeared to be highly satisfactory to address and adapt to the challenges and needs of relevant stakeholder groups for the Green Transition. Horizon 2020 was found to be effective in terms of addressing this Societal Challenge, as many projects are on track to make significant progress. The programme support helped developing practice-oriented and usable solutions, as well as flagship initiatives that demonstrate how policy objectives can be operationalised with a holistic perspective. As for SC2, the overall impacts cannot yet be measured and will require appropriate monitoring over time.
For Societal Challenge 4 (Smart, green and integrated transport), the evaluation found that the relevance, coherence and effectiveness were overall positive. The Work Programmes successfully transformed during the course of Horizon 2020 to match the evolving needs in this field, one of the largest in terms of GHG emissions. However, the programme put a strong emphasis on medium-to-long term technological development, at the expense of other types of innovation (e.g., social,

economic, organisational), which are immediately needed in order to support the Green Transition. However, and as is the case for other SCs, it is not possible to measure the impacts at this stage.
For Societal Challenge 5 (Climate action, environment, resource efficiency and raw materials), the evaluation found a significant degree of appropriate and timely progress in support of a Green Transition. The intervention area was found to be relevant, with a progressive focus on more systemic approaches and topical focal areas (e.g., adaptation rather than mitigation in WP 2018-2020). In terms of coherence, some room for improvement was identified, whether through an enhancement of inter-DG collaboration/coordination or through a better articulation with other national and EU-level policies. Most projects are on track to achieve their objectives, notably in the area of knowledge/capacity building and scientific and technological development, and are expected to generate significant effects in key areas (e.g., Circular Economy-based approaches, NBS). Nonetheless, it was noted that the level of collaboration across all the necessary stakeholder groups to support the Green Transition could have been enhanced.

Contribution of the Framework Programme to the Green Transition

In order to analyse the extent to which Horizon 2020 has induced the necessary processes for a Green Transition, the evaluation used the concept of the Multi-Level Perspective and the concept of transformative outcomes. Three analytical levels are distinguished: (i) niches, which are protected spaces and the locus for radical innovations; (ii) socio-technical regimes, which represent the institutional structuring of existing systems leading to path dependence and incremental change; and (iii) exogenous socio-technical landscape developments. To manage and steer transitions, stakeholders can have control over three, general, spatially-bounded macro-mechanisms: (1) building or nurturing niches; (2) expanding and mainstreaming niches, and (3) opening up and unlocking regimes.
Regarding the first macro-process, Horizon 2020 was successful in providing a visionary approach, and supporting the development of new relevant areas, knowledge and stakeholders for the Green Transition. It contributed to establishing and promoting new fields of innovation, whether through new areas of knowledge, ground-breaking solutions or support to pioneers. It successfully contributed to learning and exchanging in the field of Green Transition, as well as promoting awareness of problems related to the Green Transition and new ways of solving them. It fostered networking between young innovation fields, and it contributed to managing expectations and promoting shared visions among innovators. In many instances, the programme provided a common understanding of the future direction of innovation in the respective areas. Horizon 2020 was recognised as contributing to the expansion of new fields of innovation relevant to the Green Transition, including for non-technological innovations (notably for SC2, SC3, and, to a lesser extent, SC5).
For ‘Expanding and mainstreaming niches’, Horizon 2020 seemed to play a key role in supporting the implementation of innovative solutions in field of Green Transition, although it could have been stronger in terms of radical innovations. Horizon 2020 was found to support the expansion of new fields of innovation, but also the replication of innovative solutions relevant to the Green Transition in new contexts. It successfully contributed to the dissemination and diffusion of innovative solutions and concepts. However, it was found to have had a lesser impact in terms of the institutionalisation of new strategies and norms relevant to the Green Transition, calling into question the links between R&I and policy making.
Finally, for the last macro-regime, responses have been more mitigated regarding the role of Horizon 2020. The programmes contributed partially to all related items, from breaking up outdated structures and strategies relevant to the Green Transition to abandoning outdated habits and rules to enable the Green Transition, and from exchanging between "old" and "new" areas of knowledge relevant to the Green Transition to flexible response to changing framework conditions to enable the Green Transition.

The role of the partnerships

The analysis performed in relation to the partnerships contributing to the Green Transition showed that these have been of high relevance in relation to the Work Programmes of the Societal Challenges and the Green Transition. Throughout all SC areas, the different types of partnerships managed to gather innovation actors and stakeholder communities around topics of strategic mutual interest, with the industrial development-oriented partnerships in particular contributing to increasing coherence. Indeed, relevant regulatory bodies have been effectively involved in the partnership activities that allowed for a better co-development of new technologies, standards and norms, whereas the public-private partnerships managed to activate EU Member State actors around topics of their specific

interests and contributed to the alignment of national research programmes. The partnerships proved to be an important tool for close cooperation and exchange with different actors on behalf of the European Commission, other union bodies, and the EU Member States. However, some challenges in aligning activities of the partnerships with national governments and their activities persist, as do challenges in relation the coordination of strategic activities of the partnerships and the work programmes.

Key findings per evaluation criteria

Relevance – Horizon 2020 already partially the Green Transition, even though its conceptualisation was initiated only during its implementation with the emergence of the European Green Deal. An orientation towards facilitating the Green Transition had already been incorporated in the programming of Horizon 2020 with clear references to (and the incorporation of) the strategic policy priorities in the Europe 2020 strategy. However, no specific, measurable and time-bound R&I targets related to the Green Transition in Horizon 2020 had been set up. There is a need to better define and conceptualise the requirements for the Green Transition at the R&I policy level. Specific definitions of the Green Transition, R&I targets and indicators for contributing to the Green Transition should be developed at the thematic level in Horizon Europe.
Horizon 2020 was found to be relevant to tackle the challenges and key EU priorities associated to the Green Transition in each societal domain, and adapted to their evolution over time. Horizon 2020 exhibited a strong capacity to react, and gradually adapt to emerging challenges and new policy developments. However, it has to be noted that Horizon 2020 did not take a proactive approach towards shaping the Green Transition. In some areas, the evaluation identified emerging needs that were not fully captured by the programme, or to the extent the urgency of action is needed. It was also found that, although a gradual shift was operated over time towards more systemic approaches, the programme could have put further emphasis to address the wider set of challenges related to the Green Transition, including socio-economic issues, and less on supporting 'simple' technological changes.
Overall, Horizon 2020 was effective in reaching out to relevant stakeholders and addressing the needs of the target groups. Across all SC areas, project participants showed high motivation to contribute to relevant aspects related to the Green Transition. Tackling Societal Challenges effectively requires addressing all relevant stakeholders associated with the intervention. The project portfolio analysis showed that, compared to FP7 projects, Horizon 2020 was associated with higher shares of projects involving multiple sectors, indicating a higher degree of trans-disciplinarity. A minority of beneficiaries still considered that Horizon 2020 was only partially successful in addressing all relevant stakeholder groups. In order to ensure the mobilisation of relevant stakeholders, the planning and incorporation of a coherent and continuously updated stakeholder engagement strategy at the project level is a key pre-requisite for reaching out to the required stakeholders. At the programme level, strong emphasis should be put on the elaboration of specific instruments that allow to engage all required stakeholders for enabling the Green Transition. The provision of Coordination and Support Actions and making use of the competences of partnerships to reach out to regional/local stakeholders can further enhance knowledge diffusion and scaling-up of solutions.

Coherence – Horizon 2020 funding related to the Green Transition is in a unique position, with a strong positioning within the European research and innovation landscape. However, Horizon 2020 has lacked some coherence on the issue of mobilisation and coordination of multiple actors across different sectors and at different levels (i.e. EU, national, regional, local), which is increasingly seen to be a requirement for effectively managing the Green Transition. At the R&I programming level, evidence on the coordination between the Framework Programme and the European Partnerships has been mixed and no common approach existed, leading to fragmented results. To further enhance coherence and synergies among the Framework Programme, the European Partnerships and the EU Member States, specific governance mechanisms for the coordination of the strategic planning of activities need to be set up.

Efficiency – Overall, Horizon 2020 was found to be cost-effective. Horizon 2020 allocated more EC funds across all Societal Challenges than the previous framework programme, while the average cost per project remained rather similar. The programme was assessed to be very efficient in terms of administration and management. Perceptions are positive regarding administrative and financial requirements, as well as for contractual conditions. The project application and selection processes

were efficient to a large extent. Continued improvements are underlined by beneficiaries in terms of EU requirements, both from FP7 to Horizon 2020, but also from Horizon 2020 to HE. Efforts for the preparation and submission of proposals were deemed appropriate, and projects were carried out in a timely manner or required limited changes. When necessary, the degree of flexibility of Horizon 2020 was mostly appropriate. Nevertheless, the coordination of the Green Transition requires management and governance capacities going beyond the R&I policy level. Significant capacities for steering and managing the coordination between different policy areas, across organisational boundaries are needed both at the programme level and at the project level.

Effectiveness – The main outputs related to the Green Transition in all SC areas comprise: 1) technological outputs; 2) scientific outputs; 3) networks; 4) close-to-market outputs and 5) policy outputs. It appears however that the current monitoring system does not allow to fully capture the extent of the effects in the field of Green Transition, and that additional monitoring tools to 'traditional' R&I indicators will need to be implemented. Horizon 2020 funding in the Green Transition Area enabled researchers to reach top tier status within the subset of their Horizon 2020-funded publications but did not lead to significant results on other dimensions (e.g., cross-disciplinarity, international co-publications, science-industry collaborations). The influence of these dimensions, and notably the R&I quality, on the Green Transition processes should be further investigated.
Horizon 2020 funding in the Green Transition Area did not result in high levels of demonstrators, utility models or trademarks. Comparators for measuring the impact or quality of these outputs are missing. Furthermore, it is too early to assess the effects of Horizon 2020 funding in the Green Transition area related to patenting activities. Beyond publications, patents and demonstrators, there are no project-level output metrics available that provide information on the success of Horizon 2020 research and innovation projects. With a view on the Interim Evaluation of Horizon Europe, it should be assessed to which extent the introduction of project specific Impact Pathways and related documentation of projects results provide better information on the effectiveness of the intervention.
The overall results of the study indicate that the FPs in the Green Transition area have been effective in reaching the desired objectives of the projects. Horizon 2020 contributed to reaching the desired outcomes in terms of knowledge creation and capacity building and scientific and technological development. The contribution to better policy planning, new technical standards and standard setting measures gained in importance. The effects in terms of market and business are less tangible, but are frequently not a core ambition of funded R&I projects in any case. The results, however, do not allow for the establishment of reliable claims regarding longer-term outcomes and impacts. While there is strong evidence for achieving the desired project goals and the contribution to the generation of new knowledge, networks and the development of new technologies is high, there is less evidence to which extent projects provide concrete solutions to deliver on the Societal Challenges. If the intention is to further increase deployment of new technologies and the introduction of marketable results, measures for increasing this type of activities need to be strengthened. However, the study findings also indicate that the Green Transition does not only require new technologies but solutions that go beyond the provision of new technologies. There is an evident need for stronger coordination between R&I policy, sectoral policies, and fiscal policies.
Horizon 2020 contributed to support the EU policy priorities and EU action in relation with achieving the Sustainable Development Goals, although no dedicated monitoring system was set up to measure the real achievements.

EU added-value – Across all Societal Challenges, there is widespread acknowledgement that Horizon 2020 has a significant EU added value in terms of funding geared towards the Green Transition. For the vast majority of R&I projects funded across all Societal Challenges, it became evident that without EU funding the projects would not have been implemented or their scope would have been significantly reduced. In addition, Horizon 2020 projects enabled cooperative partnerships of a pan-European nature that would not have existed otherwise. Furthermore, there are strong indications that in some SCs Horizon 2020 provided funding for various topics, where no or little (or only in very few MS) national funding R&I funding possibilities exist and where European coordination in the provision of R&I support is strongly needed. The European Partnerships played an important role in this regard. Horizon 2020 and its partnerships for R&I contributed to better coordination and alignment of R&I activities at the level of policy makers and at the level of R&I communities.

European Commission
Directorate-General for Research and Innovation
Contacts Thomas Schubert (DG RTD), Angelica Marino (DG RTD)
Email Thomas.SCHUBERT@ec.europa.eu
RTD-G2-SUPPORT@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

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