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COVER NOTE

From:	Secretary-General of the European Commission, signed by Ms Martine DEPREZ, Director
date of receipt:	23 February 2021
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2021) 37 final - Part 15/19
Subject:	COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the document Proposal for a COUNCIL REGULATION establishing the Joint Undertakings under Horizon Europe European Partnership for Clean Aviation

Delegations will find attached document SWD(2021) 37 final - Part 15/19.

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EUROPEAN
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Brussels, 23.2.2021
SWD(2021) 37 final

PART 15/19

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

Accompanying the document

Proposal for a COUNCIL REGULATION establishing the Joint Undertakings under Horizon Europe

European Partnership for Clean Aviation

{COM(2021) 87 final} - {SEC(2021) 100 final} - {SWD(2021) 38 final}

ANNEXES

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Annex 1 Procedural information

1. LEAD DG, DECIDE PLANNING REFERENCES

Lead DG: Directorate-General Research and Innovation (RTD)

Decide number: PLAN/2019/5304

2. ORGANISATION AND TIMING

Institutionalised partnerships are foreseen in Articles 185 and 187 of the Treaty on the Functioning of the European Union (TFEU). The preliminary agreement on Horizon Europe contained a list of possible areas for institutionalised partnerships based on Articles 185 and 187. For these areas, the Commission considered 12 potential institutionalised partnerships. Their set up involves new EU legislation and the establishment of dedicated implementing structures and therefore an impact assessment for each of these initiatives.

Following political validation in June 2019, the impact assessment process started with the publication of inception impact assessments for each initiative in August 2019.

An inter-service steering group (ISSG) on research and innovation partnerships under Horizon Europe was set up in May 2019 and held four meetings before submission of the Staff Working Document to the Regulatory Scrutiny Board (7 May 2019, 19 June 2019, 5 December 2019, and 20 January 2020). The ISSG consisted of representatives of: the Secretariat-General; Directorate-General for Budget; Directorate-General for Research and Innovation; Directorate-General for Communications Networks, Content and Technology; Directorate-General for Mobility and Transport, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Directorate-General for Energy; Directorate-General for Environment; Directorate-General for Climate Action; and the Legal Service.

An online public stakeholder consultation was launched between September and November 2019, receiving 1635 replies for all 12 initiatives.

3. CONSULTATION OF THE RSB

Two upstream meetings with the Regulatory Scrutiny Board were held on 10 July 2019 and 30 September 2019.

In accordance with the feedback received from the Regulatory Scrutiny Board on 12 June 2020 the Staff Working Document has been revised as presented in Figure 1. The impact assessment was endorsed by the Inter Service Steering Group on 20 January 2020.

4. EVIDENCE, SOURCES AND QUALITY

To ensure a high level of coherence and comparability of analysis for all candidate initiatives, an external study was procured to feed into the impact assessments of the 12 candidate institutionalised partnerships[1]. It consisted of a horizontal analysis and individual thematic analyses for each of the initiatives under review.

For all initiatives, the evidence used includes desk research partly covering the main impacts and lessons learned from previous partnerships. A range of quantitative and qualitative data

[1] Technopolis Group, 2020, forthcoming.

sources complement the evidence base, including evaluations; foresight studies; statistical analyses of framework programmes application and participation data and Community Innovation Survey data; analyses of science, technology and innovation indicators; reviews of academic literature; sectoral competitiveness studies and expert hearings. The analyses included a portfolio analysis, a stakeholder and social network analysis in order to profile the actors involved as well as their co-operation patterns, and an assessment of the partnerships' outputs (bibliometrics and patent analysis). A cost modelling exercise was performed in order to feed into the efficiency assessments of the partnership options. Public consultations (open and targeted) supported the comparative assessment of the policy options. For each initiative up to 50 relevant stakeholders were interviewed by the external contractor (policymakers, business including SMEs and business associations, research institutes and universities, and civil organisations, among others). In addition the analysis was informed by the results of the Public Consultation (Sept. – Nov. 2019), the consultation of the Member States through the Strategic Programme Committee and the online feedback received on the Inception Impact Assessments of the set of candidate Institutionalised European Partnerships.

A more detailed description of the methodology and evidence base used, completed by thematic specific methodologies, is provided in Annexes 4 and 6.

Figure 1 Modifications to the draft Staff Working Document based on comments received from the Regulatory Scrutiny Board

Comments from the Regulatory Scrutiny Board	**Actions taken for the Staff Working Document**
The report should be clearer about the differences between the new partnership and the current one and the underlying drivers (e.g. evaluation results, policy or market developments).	The report, mainly chapter 1, has been updated to better reflect the underlying drivers of the proposed initiative. A summary table, on page 67, compares the preferred option to the current partnership. In addition, an annex 6.11 has been added including a table indicating the changes to the Clean Aviation initiative to address the perceived shortcomings of Clean Sky 2 (source Clean Sky 2 mid-term evaluation and impact assessment study)
The report should clarify how the proposed two-pronged approach would work in practice. It should explain the links between the foreseen actions under the traditional calls for collaborative research and the institutionalised partnership. It should explain to what extent these approaches address different problems and have distinct objectives.	The problems addressed by the Clean Aviation initiative have been better explained in chapter 2 of the report. Point 4.4.3 on priority setting and the level of directionality, has been revised to clarify the distinction between the activities of the Clean Aviation initiative and collaborative research, and how these relate to each other.
The report could explain better the links with other EU policies and instruments in place to support aviation and to tackle its climate and environmental impacts	The revised report explains how activities are linked. Specifically, the revised report, mainly Chapters 1.3 and 4.4.4, address synergies

	while Annex 6.10 contains an initial list of potential synergies. Chapter 3.2 emphases the role of the Commission to ensure co-operation between various policy areas, and national programmes. Note also that one of the specific objectives of the initiative is to expand and foster the integration of the aviation R&I value chains, including SMEs, also by exploiting synergies with other initiatives national and European related programmes.
The report should specify more precisely the environmental and climate impacts the initiative will address. It should discuss the extent to which the partnership would be able to deliver these ambitious objectives. In this regard, the report should better explain the foreseen sequencing and expected timing of the forthcoming disruptive technologies.	The environmental impact of aviation is better explained in Annex 6.3. A paragraph has been added to Point 4.1, explaining why the focus on climate neutrality by this initiative is justified. The Clean Aviation initiative will primarily focus on the Green Deal's ambition to reduce net greenhouse gas emissions. This has been made clearer in the description of the objectives and specific objectives.
The report should explain how the new partnership would be better able to attract relevant stakeholders and Member States. It should discuss whether smaller companies with potential to provide disruptive solutions are likely to be interested in traditional calls, instead of applying for the partnership.	The two-pronged approach (a focussed Clean Aviation, and a complementary collaborative research programme) is explained on page 32 of the main report. This is further detailed in Chapter 4.4.3. An Annex 6.9 has been added confirming the commitment and involvement of the private sector and stakeholders to the Clean Aviation initiative. In addition, the private sector has finalised a Strategic Research and Innovation Agenda (SRIA). The most recent public consultation (statistics also included in Annex 6.9), which was part of the SRIA's preparation process, received a remarkable high number of positive reactions from SMEs (16%) and private citizens (36%). Overall, the feedback was very positive on the ambition and focus of the presented SRIA, and the stakeholders' interest in participating.

The report should clarify the logic behind the intervention. It could better explain the links between problems and objectives, and between objectives, targeted impacts and functionalities. The intervention logic should focus on the part of the "two-pronged" approach that the Clean Aviation partnership would address.	The report has undergone various changes to improve the logic from problems to targeted impacts and functionalities; this effort was based on the replies given to the questions asked by the Regulatory Scrutiny Board before and during the hearing with the RSB. The revised intervention logic is focussing on the Clean Aviation partnership activities. The collaborative research is not addressed as this is outside the scope of the partnership.
The report should integrate the latest realistic expectations on the effects of the Covid-19 crisis on the aviation sector. It should consider these in the analysis of the problems, baseline and impacts.	The COVID-19 crisis is still on-going and insights in the potential impact still evolving. The text related to COVID-19 under Chapter 1 has been changed, adding the position of stakeholders that are involved in the preparations for the proposed initiative to protect the focus of the Clean Aviation initiative on its Green Deal-oriented objectives. An Annex 6.2 has been added with a summary of the known information at the moment of writing.

Annex 2 Stakeholder Consultation

1. OVERVIEW FOR ALL CANDIDATE INSTITUTIONALISED EUROPEAN PARTNERSHIPS

1.1. Introduction

In line with the Better Regulation Guidelines,[2] stakeholders were widely consulted as part of the impact assessment process of the 12 candidates for institutionalised partnerships, including national authorities, the EU research community, industry, EU institutions and bodies, and others. These inputs were collected through different channels:

- A feedback phase on the inception impact assessments of the candidate initiatives in August 2019, gathering 350 replies for all 12 initiatives on the "Have your Say" web portal during a three-week period;
- A structured consultation of Member States performed by the EC services 2019 through the Shadow Strategic Configuration of the Programme Committee of Horizon Europe (in line with the Article 4a of the Specific Programme of Horizon Europe). This resulted in 44 possible candidates for European Partnerships identified as part of the first draft Orientations Document towards the Strategic Plan for Horizon Europe (2021-2024), taking into account the areas for possible institutionalised partnerships defined in the Regulation.
- An online public stakeholder consultation administered by the EC, based on a structured questionnaire, open between September and November 2019, gathering 1635 replies for all 12 initiatives;
- A targeted consultation run by the external study contractors with a total of 608 interviews performed as part of the thematic studies by the different study teams between August 2019 and January 2020.

1.2. Horizontal results of the Open Public Consultation

The consultation was open to everyone via the EU Survey online system.[3] The survey contained two main parts to collect views on general issues related to European partnerships (in Part 1) and specific responses related to one or more of the 12 candidate initiatives (as selected by a participant). The survey was open from 11 September until 12 November 2019. The consultation was available in English, German and French, and was advertised widely through the European Commission's online channels as well as via various stakeholder organisations.

1.2.1. Profile of respondents

In total, 1635 respondents filled in the questionnaire of the open public consultation. Among them, 272 respondents (16.64%) were identified to have responded to the consultation as part of a campaign (coordinated responses). Based on the Better Regulation Guidelines, the groups of respondents where at least 10 respondents provided coordinated answers were labelled as *'campaigns',* segregated and analysed separately and from other responses. In total 11 campaigns were identified, the largest of them included 57 respondents[4]. In addition, 162

[2] https://ec.europa.eu/info/files/better-regulation-guidelines-stakeholder-consultation_en
[3] https://ec.europa.eu/eusurvey/runner/ConsultationPartnershipsHorizonEurope
[44] The candidate Institutionalised Partnership Clean Hydrogen has the highest number of campaigns, namely 5. A few initiatives, such as Innovative SMEs, Smart Networks and Systems, were not targeted by campaigns. Some campaign respondents decided to provide opinions about several partnerships.

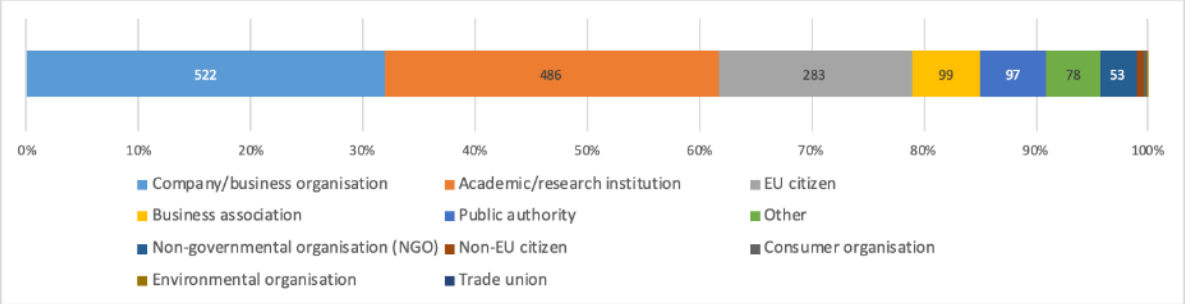
respondents in the consultation also display similarities in responses but in groups smaller than 10 respondents. Hence, these respondents were not labelled as campaigns and therefore were not excluded from the general analysis.

Table 1: Country of origin of respondents (N=1635)

Country	Number of respondents	Percentage of respondents
Germany	254	15.54%
Italy	221	13.52%
France	175	10.70%
Spain	173	10.58%
Belgium	140	8.56%
The Netherlands	86	5.26%
Austria; United Kingdom	61	3.73%
Finland	49	3.00%
Sweden	48	2.94%
Poland	45	2.75%
Portugal	32	1.96%
Switzerland	28	1.71%
Czechia	24	1.47%
Greece	23	1.41%
Norway; Romania	22	1.35%
Denmark	20	1.22%
Turkey	19	1.16%
Hungary	14	0.86%
Ireland	12	0.73%
United States	11	0.67%
Estonia; Slovakia; Slovenia	10	0.61%
Bulgaria; Latvia	9	0.55%
Bosnia and Herzegovina	7	0.43%
Lithuania	4	0.24%
Canada; Croatia; Israel	3	0.18%
China; Ghana; Iceland; Japan; Luxembourg; Morocco	2	0.12%
Bhutan; Botswana; Cyprus; Iran; Malta; Mexico; Moldova; Mongolia; Palestine; Russia; Serbia; South Africa; Tunisia; Ukraine; Uruguay	1	0.06%

As shown in Figure 2, the three biggest **categories of respondents** are representatives of companies and business organisations (522 respondents or 31.9%), academic and research institutions (486 respondents or 29.7%) and EU citizens (283 respondents or 17.3%). Among the group of respondents that are part of campaigns, most respondents are provided by the same groups of stakeholders, namely company and business organisations (121 respondents or 44.5%), academic and research institutions (54 respondents or 19.8%) and EU citizens (42 respondents or 15.4%).

Figure 2 Type of respondents (N=1635) - For all candidate initiatives



Among all consultation respondents, 1,303 (79.69%) have been **involved in the on-going research and innovation framework programme** Horizon 2020 or the preceding Seventh Framework Programme, while 332 respondents (20.31%) were not. In the group of campaign respondents, the share of those who were involved in these programmes is higher (245 respondents out of 272 or 90.07%) than in the group of non-campaign respondents (1058 out of 1,363 or 77.62%). When respondents that participated in the Horizon 2020 or in the preceding Seventh Framework Programme were asked to indicate in which capacity they were involved in these programmes, the majority stated they were a beneficiary (1,033 respondents) or applicant (852 respondents). The main stakeholder categories, e.g. companies/business organisation, academic/research institutions, etc., show a similar distribution across the capacities in which they 'have been involved in Horizon 2020 or in the Seventh Framework Programme' as the overall population of consultation respondents.

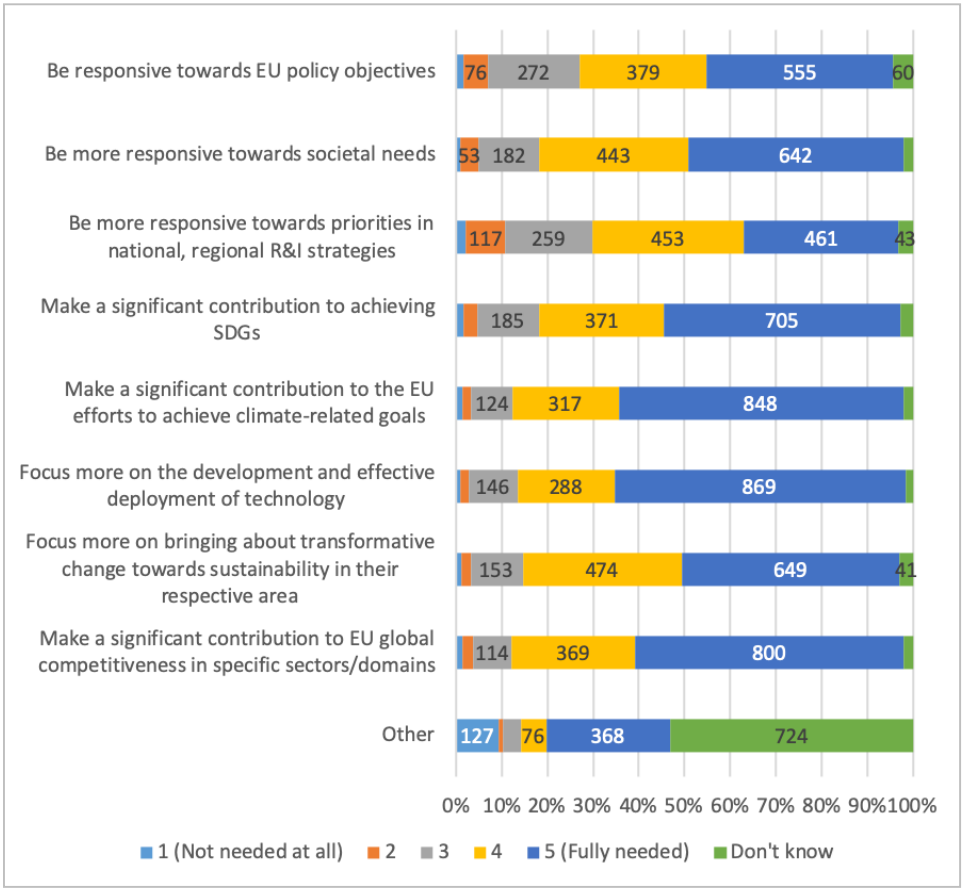
Among those who have been involved in Horizon 2020 or the preceding Seventh Framework Programme, 1,035 respondents (79.43%) are/were **involved in a partnership**. The share of respondents from campaigns that are/were involved in a partnership is higher than for non-campaign respondents, 89.80% versus 77.03% respectively.

1.2.2. Characteristics of future candidate European Partnerships

Respondents were asked to assess what areas, objectives, aspects need to be in the **focus of the future European Partnerships** under Horizon Europe and to what extent. According to Figure 6, a great number of respondents consider that a significant contribution by the future European Partnerships is 'fully needed' to achieve climate-related goals, to the development and effective deployment of technology and to EU global competitiveness in specific sectors/domains. Overall, respondents' views reflect that many aspects require attention of the Partnerships.

Overall, only minor differences can be found between the main stakeholder categories. Academic/research institutions value the responsiveness towards EU policy objectives and focus on development and effective deployment of technology a little less than other respondents. Business associations, however, found that the future European Partnerships under Horizon Europe should focus a little bit more on the development and effective deployment of technology than other respondents.

Figure 6: To what extent do you think that the future European Partnerships under Horizon Europe need to (N=1363) (non-campaign replies) For all candidate initiatives



1.2.3. Main advantages and disadvantages of Institutionalised European Partnerships

An open question asked respondents to outline the main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe (1,551 respondents). The advantages mentioned focus on the development of technology, overall collaboration between industry and research institutions, and the long-term commitment. Disadvantages mentioned are mainly administrative burdens. An overview is provided below.

Advantages mentioned: Long term commitment, stability, and visibility in financial, legal, and strategic terms; Participation of wide range of relevant stakeholders in an ecosystem (large/small business, academics, researchers, experts, etc.); Complementarity with other (policy) initiatives at all levels EU, national, regional; Efficient and effective coordination and management; High leverage of (public) funds; Some innovative field require high levels of international coordination/standardisation (at EU/global level); Ability to scale up technology (in terms of TRL) through collaboration; Networking between members; Direct communication with EU and national authorities

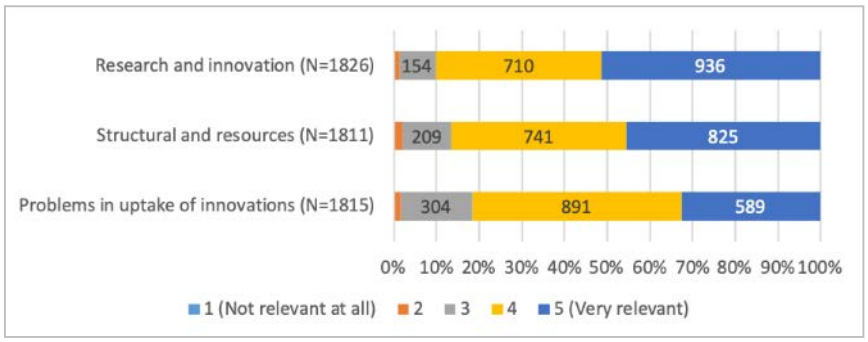
Disadvantages mentioned: Slow processes; System complexity; Continuous openness to new players should be better supported as new participants often bring in new ideas/technologies that are important for innovation; Lower funding percentage compared to regular Horizon Europe projects; Cash contributions; Administrative burdens; Potential for IPR constraints.

1.2.4. Relevance of EU level to address problems in Partnerships' areas

Respondents were asked to rate the **relevance of research and innovation efforts at EU level efforts to address specific problems in the area of partnerships**. Research and innovation related problems were rated as most relevant across all candidate initiatives, followed by structural and resources problems and problems in the uptake of innovations.

Overall, all three areas were deemed (very) relevant across the partnerships, as more than 80% of respondents found these challenges (very) relevant across the partnerships. Only minor differences were found between stakeholder categories. Research and innovation problems were found slightly more relevant by academic/research institutions, yet slight less relevant by large companies and SMEs. Structural and resource problems were indicated as slightly more relevant by NGOs, but slightly less by academic/research institutions. While both NGOs and public authorities found it slightly more relevant to address problems in uptake of innovation than other respondents. The views of citizens are not significantly different. Respondents that are/were directly involved in a current/preceding partnership find, however, the need to address problems related to the uptake of innovations was slightly more relevant than other respondents.

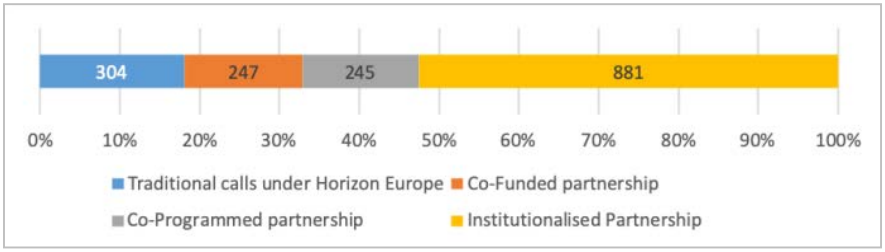
Figure 9: To what extent do you think this is relevant for research and innovation efforts at EU level to address the following problems in relation to the candidate partnership in question? (non-campaign replies) Aggregation of responses of all candidate initiatives



1.2.5. Horizon Europe mode of intervention to address problems

Respondents were asked to indicate how these challenges could be addressed through **Horizon Europe intervention**. Just over 50% of all respondents indicated that institutionalised partnerships were the best fitting intervention, with relatively strong differences between stakeholder categories. The use of Institutionalised Partnership was favoured more by business associations and large companies, but less by academic/research institutions and SMEs. While academic/research institutions valued traditional calls more often, this was not the case for business associations, large companies and public authorities. Public authorities indicated a co-programmed intervention more often than other respondents. Citizens indicated slightly less often that institutionalised partnerships were the best fitting intervention. Respondents that are/were directly involved in a current/preceding partnership, selected the institutionalised partnership intervention in far higher numbers (nearly 70%).

Figure 10: In your view, how should the specific challenges described above be addressed through Horizon Europe intervention? (non-campaign replies) For all candidate initiatives



When asked to reflect on their answers, respondents that pointed to the need for using institutionalised partnerships mentioned the long-term commitment of collaboration, a common and ambitious R&I strategy as well as the overall collaboration between industry and research institutions. Others shared positive experiences with other modes of interventions:

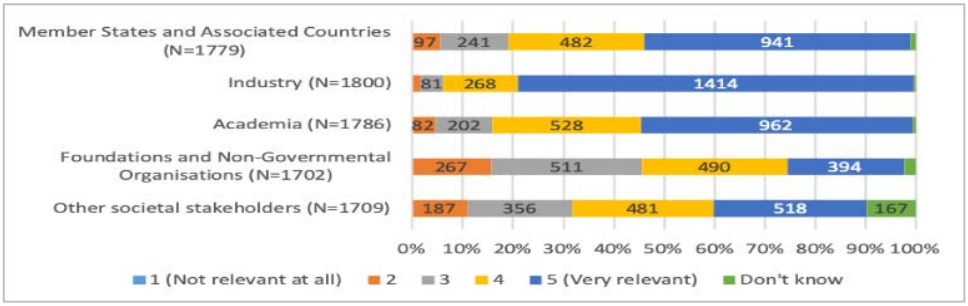
- Traditional calls, because of their flexibility and integration of a wide range of actors, as long as the evaluation panels do not deviate from the policy focus. This was mentioned by 94 participants, including companies (25), academics (26) and EU citizens (25).
- Co-funded partnership, as a mechanism to ensure that all participants take the effort seriously, while allowing business partnerships to develop. This approach was deemed suitable based on previous experiences with ERANETs. This was raised by 84 participants, 36 of them academic respondents, 18 companies and 16 EU citizens.
- Co-programmed partnerships, to tackle the need to promote and engage more intensively with the private sector. This was mentioned by 97 participants, most of them companies (34), followed by academics (22), business associations (15) and EU citizens (11).

1.2.6. Relevance of a set of elements and activities to ensure that the proposed European Partnership would meet its objectives

Setting joint long-term agendas

Respondents were asked how relevant it is for the proposed European Partnerships to meet their objectives to have a strong involvement of specific stakeholder groups in setting joint long-term agenda. All respondents see stakeholders from industry as the most relevant, followed by academia and governments. The involvement of foundations and NGOs as well as other societal stakeholders were, however, still found to be (very) relevant by more than 50% of the respondents. Most respondents indicated the stakeholder group they belong to themselves or that represent them as relevant to involve.

Figure 11: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives - Setting joint long-term agenda with strong involvement of: (non-campaign replies) For all candidate initiatives

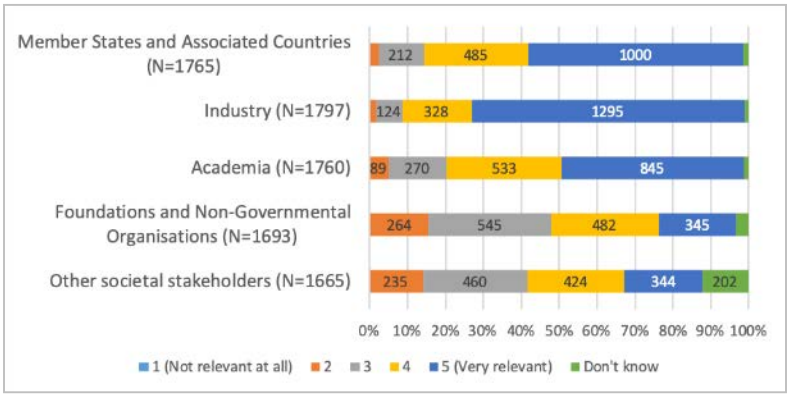


Pooling and leveraging resources through coordination, alignment and integration with stakeholders

Respondents were asked how relevant it is for the proposed European Partnership to meet its objectives to pool and leverage resources (financial, infrastructure, in-kind expertise, etc.) through coordination, alignment and integration with specific groups of stakeholders. Respondents see stakeholders from industry as the most relevant, followed by academia and governments (Member States and Associated Countries). The involvement of foundations and NGOs as well as other societal stakeholders are also still found to be (very) relevant for more

than 50% of the respondents. Similarly as described for the question on setting joint long-term agendas, most stakeholder categories valued their own involvement higher than other respondents – although also here differences between stakeholder categories were minor.

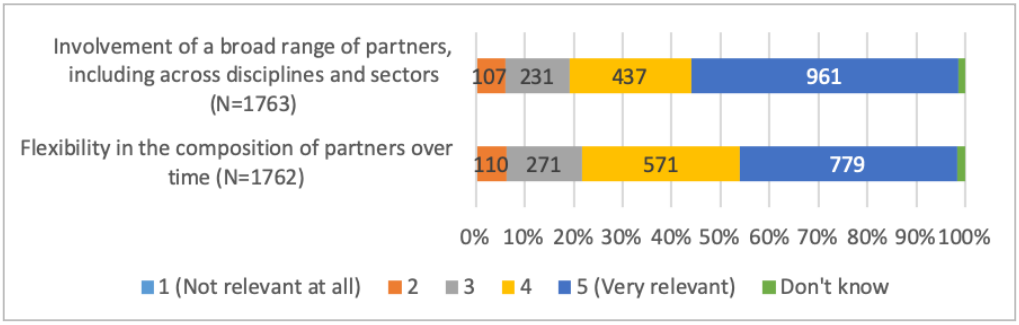
Figure 12: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Pooling and leveraging resources (financial, infrastructure, in-kind expertise, etc.) through coordination, alignment and integration with: (non-campaign replies) For all candidate initiatives



Composition of the partnerships

Regarding the composition of the partnership most respondents indicated that for the proposed European Partnership to meet its objectives the composition of partners needs to be flexible over time and that a broad range of partners, including across disciplines and sectors, should be involved (see Figure 13). When comparing stakeholder groups only minor differences were found. Academic/research institutions and public authorities found the involvement of a broad range of partners and flexibility in the composition of partners over time slightly more relevant than other respondents, while large companies found both less relevant. SMEs mainly found the flexibility in the composition of partners over time less relevant than other respondents, while no significant differences were found regarding the involvement of a broad range of partners. Citizens provided a similar response to non-citizens. Respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, indicated a slightly lower relevance of involving a broad range of partners and flexibility in the composition of partners over time.

Figure 13: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Partnership composition (non-campaign replies) Aggregation of responses of all candidate initiatives

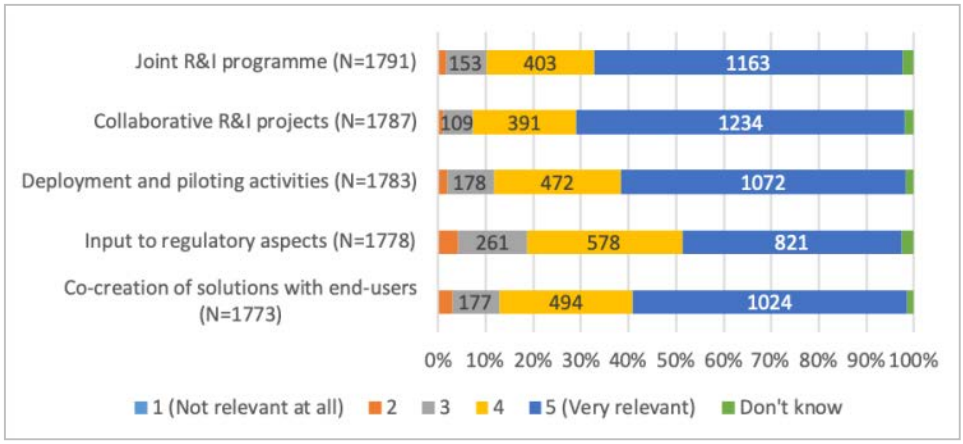


Implementation of activities

Most respondents indicated that implementing activities like a joint R&I programme, collaborative R&I projects, deployment and piloting activities, providing input to regulatory aspects and the co-creation of solutions with end-users are all (very) relevant for the partnerships to be able to meet its objectives. Minor differences were found between the main stakeholder categories, the differences found were in line with their profile. As such, academic/research institutions found joint R&I programme & collaborative R&I projects slightly more relevant and deployment and piloting activities, input to regulatory aspects and co-creation with end-users slightly less relevant than other respondents.

For SMEs an opposite pattern is shown. Large companies, however, also found collaborative R&I projects slightly more relevant than other respondents, as well as input to regulatory aspects. The views of citizens are similar to non-citizens. Respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, show a slightly higher relevance across all activities.

Figure 14: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Implementing the following activities (non-campaign replies) For all candidate initiatives

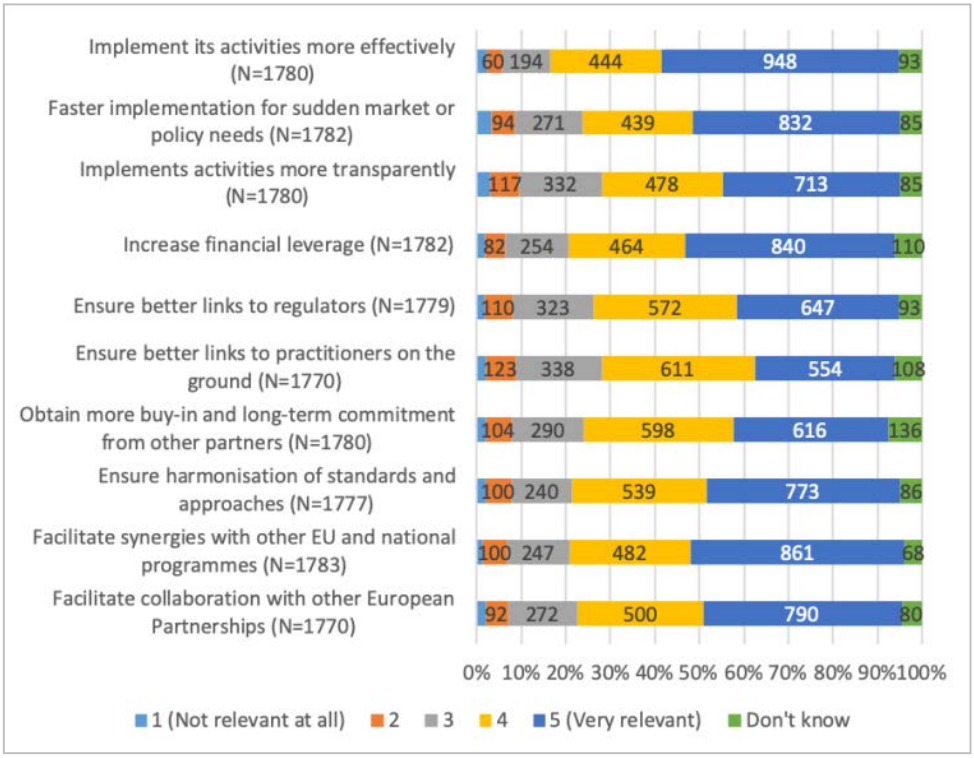


1.2.7. Relevance of setting up a legal structure (funding body) for the candidate European Partnerships to achieve improvements

Respondents were asked to reflect on the relevance of setting up a legal structure (funding body) for achieving a set of improvements, as shown in the below Figure. In general, 70%-80% of respondents found a legal structure (very) relevant for these activities. It was found

most relevant for implementing activities in a more effective way and least relevant for ensuring a better link to practitioners on the ground, however differences are small.

Figure 15: In your view, how relevant is to set up a specific legal structure (funding body) for the candidate European Partnership to achieve the following? (non-campaign replies) Aggregation of responses of all candidate initiatives



When comparing stakeholder categories there are only minor differences. Academic/research institutions indicated a slightly lower relevance for transparency, better links to regulators as well as obtaining the buy-in and long-term commitment of other partners. SMEs also indicated a lower relevance regarding obtaining the buy-in and long-term commitment of other partners. Large companies showed a slightly higher relevance for implementing activities effectively, ensure better links to regulators, obtaining the buy-in and long-term commitment of other partners, synergies with other EU/MS programmes and collaboration with other EU partnerships.

NGOs found it slightly more relevant to implement activities faster for sudden market or policy needs. Public authorities, however, find it slightly less relevant to facilitate collaboration with other European Partnerships than other respondents. The views of citizens show a slightly lower relevance for a legal structure in relation to implementing activities in an effective way. Respondents that are/were directly involved in a current/preceding partnership indicated a higher relevance across all elements presented.

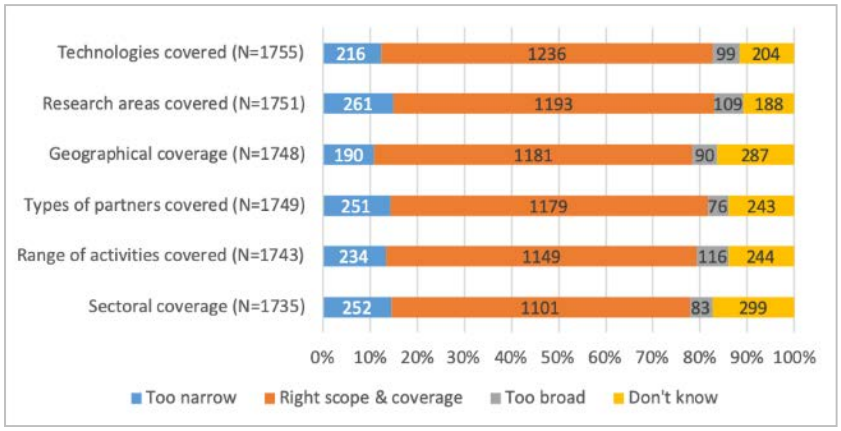
1.2.8. Scope and coverage of the candidate European Partnerships based on their inception impact assessments

Consulted on the scope and coverage for the partnerships, based on their inception impact assessments, the large majority considered that the scope and coverage initially proposed in the inception impact assessments is appropriate. However, about 11-15% of the respondents indicated the scope and coverage to be too narrow. About 11-17% of respondents answered "Don't know". Overall, differences between the main stakeholder categories were found to be

minor. Academic/research institutions indicated slightly more often that the research area was "too narrow" then other respondents. SMEs on the other hand indicated slightly more often that the research area and the geographical coverage were "too broad". NGOs and public authorities, however, found the geographical coverage slightly more often "too narrow".

Large companies found the range of activities slightly more often "too broad" and the sectoral focus slightly more often "too narrow" when compared to other respondents. The views of citizens are the same as for other respondents. Respondents that are/were directly involved in a current/preceding partnership more often indicated that the candidate institutionalised European Partnership have the "right scope & coverage".

Figure 16: What is your view on the scope and coverage proposed for this candidate institutionalised European Partnership, based on its inception impact assessment? (non-campaign replies) Aggregation of responses of all candidate initiatives



1.2.9. Scope for rationalisation and alignment of candidate European Partnerships with other initiatives

When asked whether it would be possible to rationalise a specific candidate European Institutionalised Partnership and its activities, and/or to better link with other comparable initiatives, nearly two thirds of respondents answered "Yes" (1,000, or 62%), while over one third answered "No" (609, or 39%). Nearly no differences were found between stakeholder categories, only large companies and SMEs indicated slightly more often "Yes" in comparison to other respondents. The views of citizens are the same as for other respondents. Respondents that are/were directly involved in a current/preceding partnership, indicated "No" more often, the balance is about 50/50 between "Yes" and "No" for this group.

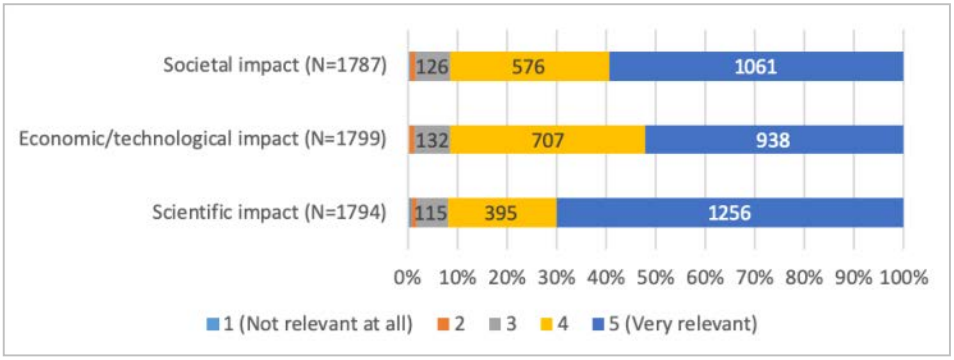
Relevance of European Partnerships to deliver targeted scientific, economic/technological and societal impacts

Finally, respondents were asked to rate the relevance of partnership specific impacts in three main areas: Societal; Economic/technological; and Scientific impacts. All three areas were deemed (very) relevant across the candidate partnerships. Scientific impact was indicated as the most relevant impact, more than 90% of respondents indicated that this as (very) relevant. Only minor difference between stakeholder groups were found.

Academic/research institutions found scientific impacts slightly more relevant, while large companies found economic and technological impacts slightly more relevant than other respondents. NGOs found societal impact slightly more relevant, while SMEs found this

slightly less important. Citizens did not a significantly different view when compared to other respondents. Respondents that are/were directly involved in a current/preceding partnership find all impacts slightly more relevant than other respondents.

Figure 17: In your view, how relevant is it for the candidate European Institutionalised Partnership to deliver on the following impacts? (non-campaign replies) Aggregation of responses of all candidate initiatives



Stakeholder consultation results for this specific initiative

1.2.10. Feedback to the inception impact assessment on candidate initiatives for Institutionalised Partnerships

Following the publication of the inception impact assessment, a feedback phase of three weeks allowed any citizen to provide feedback on the proposed initiatives on the "Have your say" web portal. In total, 350 feedback responses were collected for all initiatives.

For the initiative "Clean Aviation", 34 individual feedback responses were collected, mainly from businesses and business associations, academic/research institutions, non-governmental organisations and public authorities.[5] These responses included the following topics:

- Overall support in achieving climate neutrality in aviation;
- Requirement for further collaboration between stakeholders to accomplish the innovation and impact required for achieving the objectives;
- Persistence of problems in absence of policy intervention;
- Support of EU action to address different aspects of the problem;
- The need to explore, mature and demonstrate new technologies, whilst maintaining competition;
- The potential of Horizon Europe to have significant scientific impacts, delivering economic, technological and societal benefits, while ensuring competitiveness in Europe;
- Support of the implementation of an institutionalised partnership to successfully deliver economic and technological impacts; and
- The need to cooperate with other initiatives to enable cutting-edge technologies to be incorporated into the aviation sector.

1.2.11. Structured consultation of the Member States on European partnerships

The structured consultation of Member States resulted in 44 possible candidates for European Partnerships identified as part of the first draft Orientations Document towards the Strategic Plan for Horizon Europe (2021-2024), taking into account the areas for possible institutionalised partnerships defined in the Regulation.

The thematic coverage for the Cluster Climate, Energy and Mobility is perceived as rather satisfying, with 62% being somewhat satisfied and 10% very satisfied, while 7% each are not very satisfied or not satisfied at all.

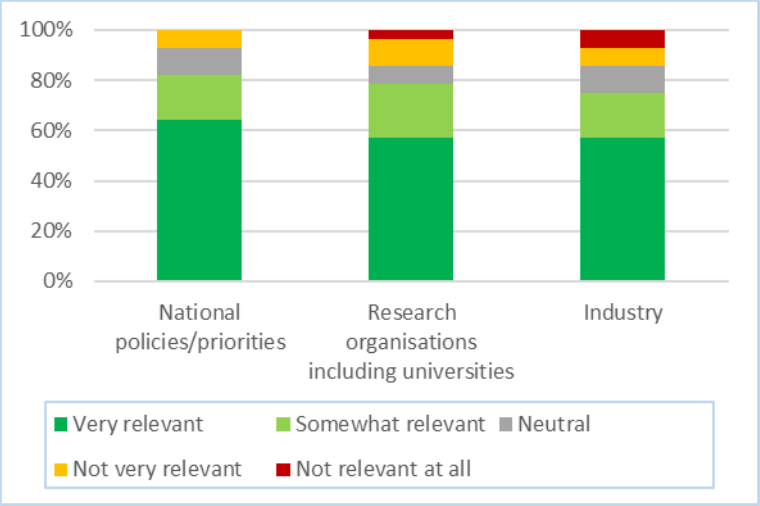
Many delegations comment on the **balance of topics and suggest a stronger focus on the environment and climate**, as well as energy topics. Mobility is considered too prominent and should be rationalised further. The area of transport in particular appears to have a disproportionate number of partnerships, which may result in an under-investment for open calls in this area.

For the initiative "Clean Aviation", the following overall feedback was received from Member States.

Relevance and positioning in a national context

[5] Feedback on inception impact assessment to be found on https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2019-4972457/feedback_en?p_id=5722372

Overall, the results of the consultation confirm the relevance of the proposed European Partnership on Clean Aviation, with 78% considering it 'very relevant' or 'somewhat relevant' for their national policies and priorities.



Relevance of the European Partnership on Clean Aviation in the national context

On the question of existing national/regional R&I strategies, plans and programmes in support of the proposed partnership on Clean Aviation, 68% (19 out of 28) countries report that they relevant elements in place.

Feedback on aspects that could be reinforced in the proposal for this partnership in order to increase its relevance for national priorities[6] underline support for the ambition of reducing the environmental footprint of aviation and achieving a carbon neutral aviation. But, there seems to be a divergence of views on the scope of the partnership and the pathway to achieve this goal. For instance, some delegations underline that **the focus should be on real world introduction of new technologies** (i.e. the next generation of commercial aircraft).

Other comments suggest broadening the scope to focus on short-range transport solutions within urban and developing small/ urban aircraft solutions, and thereby ensure bigger involvement of smaller suppliers for the air industry, and to strengthen the impact narrative beyond environmental (e.g. by including safety needs, international competitiveness goals, quicker in-service introduction).

The majority of countries (57%) are undecided regarding their interest in participating.

Feedback on objectives and impacts

Overall, there was a strong agreement (82%) on the use of a partnership approach in addressing challenges related to EU aviation and the development and demonstration of aircraft technologies. There was broad agreement (71%) that a partnership is more effective in achieving the objectives and delivering clear impacts for the EU and its citizens, and to lesser degree that (56%) it would contribute to improving coherence and synergies within the EU R&I landscape.

[6] Comments on scope and content have to be assessed in the context of the overall priority setting to ensure coherence.

Member States indicated strong agreement with the proposed objectives for the short, medium and long term (75%) and the expected scientific, economic and societal impacts at European level (75%), with the remaining ones remaining neutral. 71% of countries consider the impacts very or somewhat relevant in the national context. There was overall agreement with the envisaged duration of the proposed partnership with 82% of countries finding it adequate.

In addition, individual comments suggested considering the full life-cycle of the aircraft by including the means of production and disposal, as well as to include under objectives innovative flight design, and redesign of the entire aviation system. In terms of technologies, individual respondents highlighted the importance to cover also aeronautics advance manufacturing technologies and materials, and novel battery technologies.

Views on partners, contributions and implementation

The responses suggested that there is good agreement between countries (57%) on the type and composition of partners. In additional comments, several countries called for opening the proposed partnership to more industries involved in aeronautics, and ensuring broad participation of new and small players. There are some countries expressing support for a model with a core group of partners steering the European Partnership, whilst ensuring appropriate involvement of participants from other sectors.

The majority of countries (71%) found that there was insufficient information to assess the nature of contributions and level of commitment from the partners, notably on the introduction of financial contributions from industry.

The proposed mode of implementation in the form of Article 187 TFEU is supported by 46% of countries, whilst three countries Additional comments suggest considering a co-programmed model for implementing the priority, to merge the proposed European Partnership on Integrated Air Traffic Management, and to move away from mode-specific implementation in mobility. Moreover, several delegations (notably from smaller countries) highlighted the need to ensure transparency and openness of the partnership, including the use of open competitive calls.

1.2.12. Targeted consultation of stakeholders

Approach to the targeted consultation

The stakeholder interviews underpin:

- The selection and description of the policy options for the intervention;
- The comparative assessment of options: and
- The assessment of the preferred option in terms of its effectiveness and coherence as well as in relation to the key criteria for European Partnerships (openness and transparency, additionality and directionality, Member States' involvement, and systemic approach and flexibility).

Accordingly, the consultation exercise covered a wide range of organisations in identifying stakeholders, the following criteria were applied:

- The need to discuss the role of a future partnership with key European bodies with a central role in the delivery of EU policy objectives, in particular the European Commission and the CS2 JU itself;
- The need to engage with stakeholders located in all Member States with an interest in the future direction of aviation-related R&I;

- The need to obtain views from both founding and associate members of the CS2 JU, including manufacturers and industry who can provide insights into the costs and benefits of a partnership approach to sponsorship and coordination of R&I;
- The importance of understanding key developments in research through dialogue with universities and other research institutions engaged in pre-competitive R&I in the aviation sector;
- The need to engage with organisations who have had little or no involvement in the existing JU but whose role in the delivery of clean aviation and in ensuring that the sector meets European economic, social and environmental targets is important;
- The importance of engaging with pan-European representative organisations who can provide an overview of the perspectives of specific stakeholder groups, including environmental representatives who can bring diverging views from the aeronautics industry;
- The need to obtain data to support an analysis of the costs and benefits of different policy options.

Overview of respondents to the targeted consultation

The table below describes the number of interviews undertaken by stakeholder category, as well as its proportion of the total.

Stakeholder category	Number	Share (%)
Key European bodies	7	14%
Member State transport authorities	3	6%
Industry and representatives	19	38%
Research organisations and universities	14	28%
Airlines and airports representatives	3	6%
Non-aviation technology organisations	2	4%
European environmental organisations	2	4%
TOTAL	**50**	**100%**

Representatives from all stakeholder groups were interviewed to ensure that all groups were represented in the impact assessment.

1.2.13. Key results/messages from the targeted consultation

Political and legal context: Emerging challenges in the field

All stakeholders interviewed were supportive of the proposed objective of achieving climate neutrality by 2050. It was felt that that objective, whilst extremely ambitious, was more encompassing of the effects of aviation and also allowed a more long-term solution to be realised in comparison with those presented under CS2. As well as mitigating the impacts of climate change there was also a consensus that striving towards climate neutrality would

support the longevity of the aviation industry in Europe. Many stakeholders noted that the European aviation industry was facing increased competition from Russia and China, and thus investing in new technologies could also reinforce Europe's position in the global market place.

Problem definition: What are the problems?

Many interviewed stakeholders highlighted the effect of long development and innovation cycles and high associated costs as a contributing factor to the growing ecological footprint, and that a transformative change was required to achieve sustainability in the industry, despite the actuals of this being unclear at this stage. There was recognition amongst stakeholders that investments would have to be made in both airframe and propulsion technologies as well as in alternative fuels to achieve the objective at hand. Most stakeholders noted the importance of EU industrial leadership in the field, especially in the face of increasing competition from China and Russia.

What are the problem drivers?

The development of the problem drivers also took the views of stakeholders into account and were fixed as follows:

- Demand for mobility increases faster than the deployment of technological improvements;
- Improving the environmental performance of the aviation industry is complex, lengthy, costly and risky;
- Economic incentives for greener aviation are not strong enough; and
- Ensuring strong competitiveness of the EU aeronautics industry is complex.

There was widespread recognition amongst stakeholders that current levels of traffic growth were not sustainable in the longer term, especially given this growth currently causes a net increase in emissions.

Stakeholders agreed in part that this was due to long and costly development cycles in the industry, especially when compared with non-aviation industries. At the same time there was also recognition that shifting the aviation industry to cleaner fuels is a more complicated and involved process than implementing changes to land-based transport modes. Some parties mentioned the effective duopoly in the commercial aircraft market as a reason for stifled development.

European environmental organisations and some other stakeholder also highlighted that the current state of the market permits this rapid growth and that this could be reduced through the implementation of taxes on fossil fuels. The implementation of taxes and/or market-based measures could have the effect of both reducing air transport demand and increasing the attractiveness of greener technologies as they become more cost effective.

Stakeholders also noted that presence of regulatory barriers in the context of standard and disruptive technology development, although these considerations were felt less strongly than those. It was noted by some stakeholders that the lack of global integrated standards undermines the benefits of R&I activities developed at an EU level, thus affecting European competitiveness.

How will the problem(s) evolve?

There was a strong consensus, in the absence of policy intervention, that it would not be possible to achieve the long-term strategy and level of stakeholder participation required to achieve the goal of climate neutrality by 2050. The vast majority of stakeholders recognised that the aviation industry has to be more environmentally friendly, if it wants to continue growing in Europe.

At the same time many stakeholders noted that the current regulation in place for CS2 was not always as efficient as required with the majority of stakeholder citing that it was too inflexible and should be reviewed for Horizon Europe. This would enable resources to be allocated more effectively throughout the programme dependent on levels of achievement rather than through pre-determined allocations.

Why should the EU act?

There was widespread recognition of the problem of fragmentation and lack of effective coordination of R&I activity underpinning the case for intervention at the European level. Many stakeholders described a lack of coordination in R&I activities at Member State level and national interests considerations rather than a united European approach. Stakeholders participating in the interview programme and providing feedback on the inception impact assessment were also generally fully supportive of EU action to address these and other aspects of the problem.

Objectives: What is to be achieved?

The vast majority agreed that more focus should be placed on bringing about a transformative change towards sustainability through the development and effective deployment of technology, whilst also making significant contributions towards EU global competitiveness.

There was general support to focus higher proportions of the budget on larger commercial aircraft as resulting developments would have larger impacts compared other airborne modes. The overwhelming majority of stakeholders interviewed supported inclusion of EASA in Clean Aviation, albeit in different roles, to assist in addressing product certification at an earlier stage. Ultimately this should assist in allowing new products to enter the market more quickly.

Likely scientific impacts

Virtually all stakeholders agreed that the objectives would be achieved through the development of airframe, propulsion and fuel technology, all of which would further the advancement of science in materials, aerodynamics, combustion and fuels. During the interview process many research organisations and universities mentioned however that more research results from the partnership should be published.

Likely economic/technological impacts

Most stakeholders regarded the resulting economic and technological impacts from the partnership as being very relevant and were supportive of ensuring increased European industrial leadership as well as the creation of more high-skilled jobs in a low-carbon economy.

Several stakeholders highlighted the importance of encouraging participation from a wide group of stakeholders, including those outside the traditional aviation-market, to assist with the development of innovative technologies. There was a general consensus that EASA

should also have oversight of all developments to ensure that the regulation process does not delay the introduction of new technologies.

Likely societal impacts

The vast majority of interviewees maintained the view that safety in the European aviation was of paramount importance, but also explained that developments from new technologies would ensure the longevity and relevance of the European aviation industry, whilst also resulting in reductions of gas and noise emissions, which in turn contribute to improved societal impact.

Comparative assessment of the policy options

Assessment of effectiveness

Scientific impacts

Most of stakeholders interviewed for this study supported the view that the scientific impact under Horizon Europe would be best achieved through and institutionalised partnership. Most stakeholders emphasised the importance of a long-term strategy and greater participation of a wider selection of stakeholders. At the same time some stakeholders were of the opinion that the budget should be focussed on higher TRL projects, i.e. levels 3-6, which would ultimately reduce the scientific impact realised from more innovative technologies. Stakeholders interviews also noted that the ability to have more flexibility with regards to programme composition and funding allocation during the partnership would enable resources to be better focussed on more promising technologies, ultimately improving scientific impact.

Economic/technological impacts

Virtually all interviewees considered that an institutionalised partnership was essential if EU sponsorship of aviation related R&I was to have a transformative economic and technological impact on the sector. In the absence of such a framework it transpired, particularly among many of the larger corporations, that their support for the partnership would be substantially reduced. The reason that was most often quoted by stakeholders for supporting a partnership was financial commitment of the industry in this option.

Societal impacts

The vast majority of stakeholders participating in the interview programme considered an institutionalised partnership to be offer the best range of societal benefits, whilst striving for climate neutrality.

Assessment of Coherence

Internal coherence

Stakeholders participating in the interview programme indicated that a future partnership would be able to cooperate more with other initiatives under Horizon Europe to leverage the benefits of technology that is not specific to the aviation sector.

External coherence

A significant proportion of stakeholders mentioned that links with external organisations, such as regulators or the bodies which define the standards, and the synergies drawn from these relationships, are considered as relevant or very relevant topics which need to be addressed by the type of partnerships which is put forwards and reflected in their legal

structure. The ability of each of the options, as described above, to deliver these impacts will be essential to achieve the expected outcomes.

1.3. Open Public Consultation

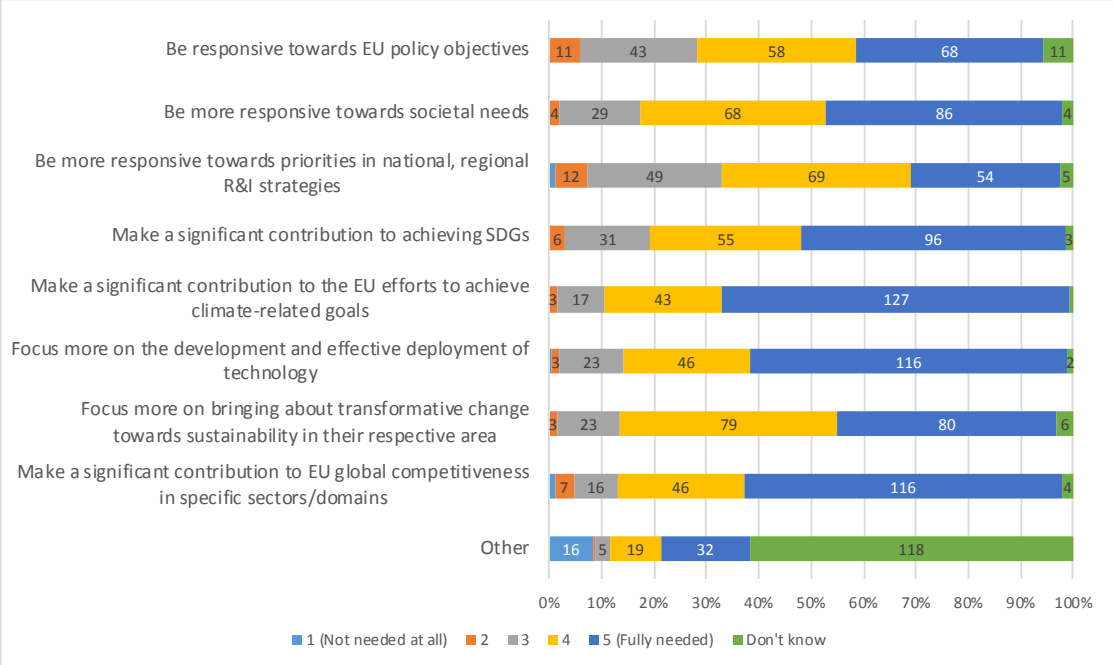
1.3.1. Characteristics of respondents

There are 191 respondents who have answered (part of) the consultation for the Clean Aviation Partnership. Of these respondents, 55 (29%) were citizens. The largest group of respondents were academic and research institutions (57, 30%) closely followed by businesses 55 respondents (28.80). There were five respondents from business associations (3%). The other respondents were eight representatives of public authorities (4%), three non-governmental organisations (1.57%), or seven others (4%). The overwhelming majority, namely 167 (87%) respondents, have been involved in the on-going research and innovation framework programme, of which 140 respondents (73%) were directly involved in a partnership under Horizon 2020 or its predecessor Seventh Framework Programme.

1.3.2. Characteristics of future candidate European Partnerships – as viewed by respondents to the Clean Aviation initiative

The respondents of this partnership were asked to indicate their views of the needs of the future European Partnerships under Horizon Europe. All 191 respondents answered and mainly indicated that many of these needs were required. The most valued option was making a significant contribution to the EU efforts to achieve climate-related goals (127, 66%).

Views of the respondents in regard to the needs of future European Partnerships under Horizon Europe (N=191)



Stakeholders also noted the presence of regulatory barriers in the context of standards and disruptive technology development and that the lack of global integrated standards

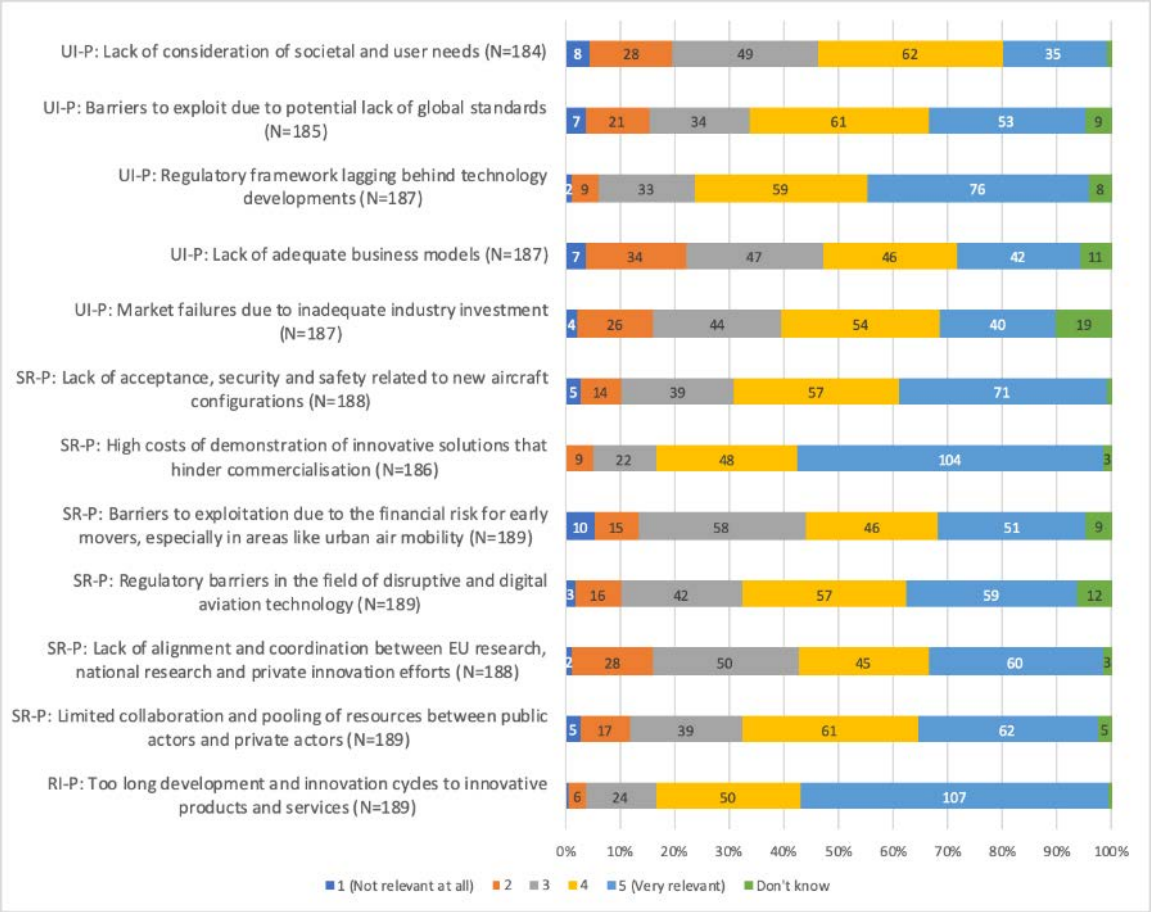
undermines the benefits of R&I activities developed at an EU level, thus affecting European competitiveness.

The Open Public Consultation responses pointed towards several factors that would contribute to a more effective delivery of scientific impacts under an institutionalised partnership.

1.3.3. Relevance of EU level efforts to address problems in relation to Clean Aviation

Respondents were asked to provide their view on the relevancy of research and innovation efforts at EU level to address three types of problems: problems in uptake of Clean Aviation innovations (UI-P), structural and resource problems (SR-P) and research and innovations problems (RI-P).

Views of respondents on relevance of research and innovation efforts at the EU level to address problems in relation to clean aviation



A substantial majority of business organisations, business associations, academic and research institutions, public authorities and EU citizens strongly recognise the impact that long development and innovation cycles and high associated costs of demonstration are having on the growing ecological footprint, whilst all parties also recognise that a future partnership must also make significant contributions to EU global competitiveness.

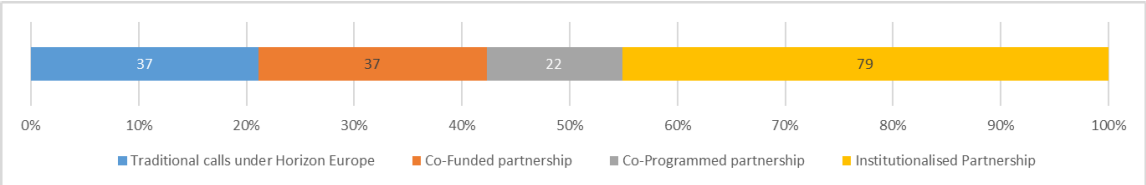
With regard to the uptake in innovation problems, 76 respondents have indicated that the regulatory framework lagging behind technology developments is very relevant (41%). The lack of consideration of societal and users' needs was considered as less relevant for research

and innovation efforts at EU level to address, with only 35 respondents indicating this was very relevant (19%)

1.3.4. Horizon Europe mode of intervention to address problems

Respondents were asked to indicate how these challenges could be addressed through Horizon Europe intervention. As shown in Figure 23, just over 45% of respondents indicated that institutionalised partnerships were the best fitting intervention.

Figure 23: Assessment of Horizon Europe intervention

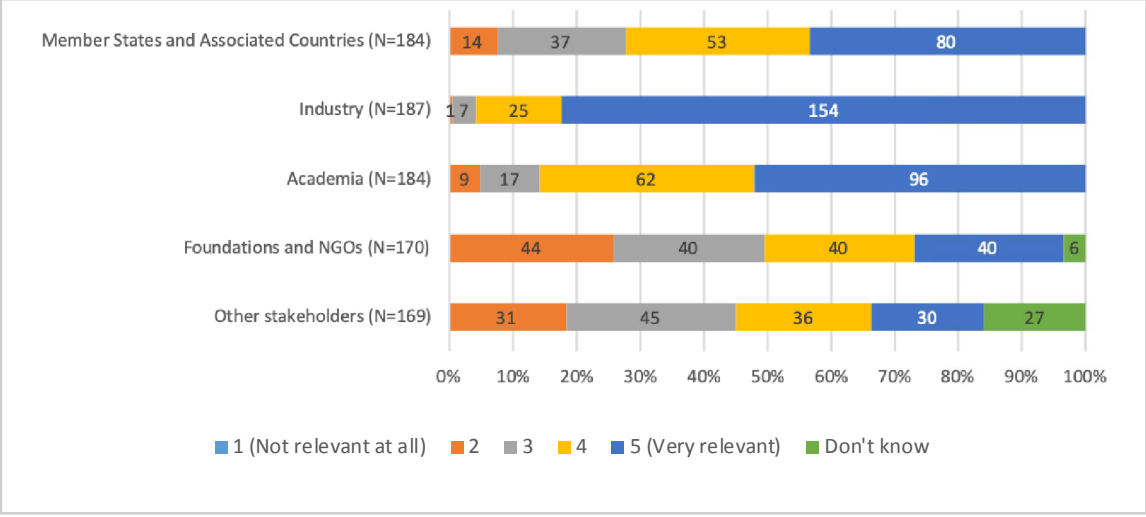


Long-term commitment, demonstration and development of new technology, relevant stakeholders and a common research roadmap were mentioned in support of an institutionalised partnerships

1.3.5. Relevance of a set of elements and activities to ensure that the proposed European Partnership would meet its objectives

Respondents were asked how relevant the involvement of actors is in setting a joint long-term agenda to ensure that the proposed European Partnership would meet its objectives. Most respondents indicated that the involvement of industry, (154 respondents; or 82.%) academia (96; 52.%) and Member States and Associated Countries (80; 43.%) is very relevant.

Views of respondents on relevance of actors in setting joint long-term agenda



The responses supported the view that the initiatives should enable the development of a long-term strategy, underpinned by a roadmap, that mainly draws on inputs from industry and academia, with additional inputs from Member States.

1.3.6. Relevance of elements and activities in pooling and leveraging resources

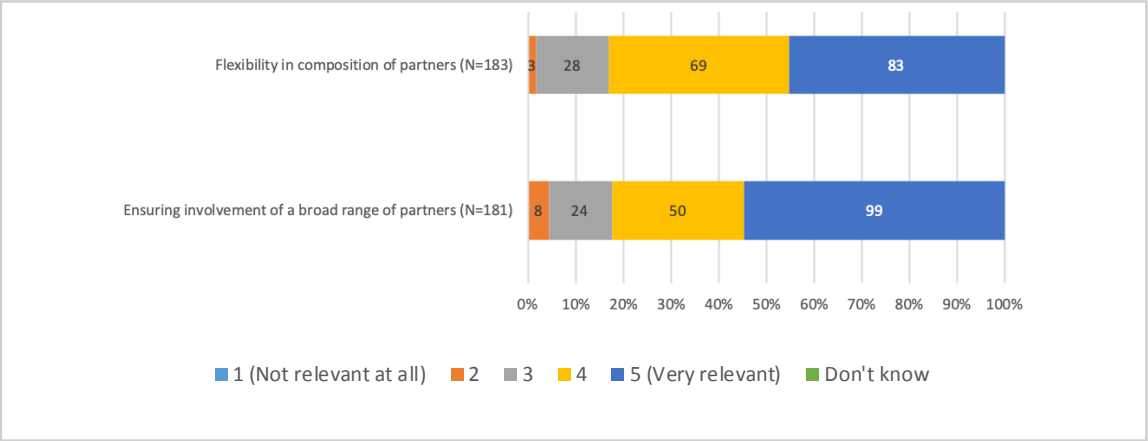
With respect to the relevance of actors in pooling and leveraging resources, such as financial, infrastructure, in-kind expertise etc.), to meet the partnership's objectives, the patterns are very similar. Most of the respondents (13.9; 75%) indicated that industry was very relevant. A large part of respondents also indicated that the involvement of Member States and Associated Countries (96; 52%) and academia (80; 43%) is very relevant.

Among stakeholders responding to the Open Public Consultation there was widespread recognition of the problem of fragmentation and lack of effective coordination of R&I activity, underpinning the case for intervention at the European level.

1.3.7. Relevance of elements and activities for the partnership composition

Respondents were asked about the relevance of Partnership composition, such as flexibility in the composition of partners over time, and involvement of a broad range of partners (including across disciplines and sectors), to reach the partnership's objectives. Ensuring involvement of a broad range of partners has more 'very relevant' answers (99; 55%) than the flexibility in the composition of partners (83; 45%). Overall, 83% of respondents have given flexibility either a score of 4 or 5 (very relevant) which is higher than the 82% who have given the broad range of partners a score of 4 or 5 (very relevant).

Views of respondents on relevance of partnership composition elements

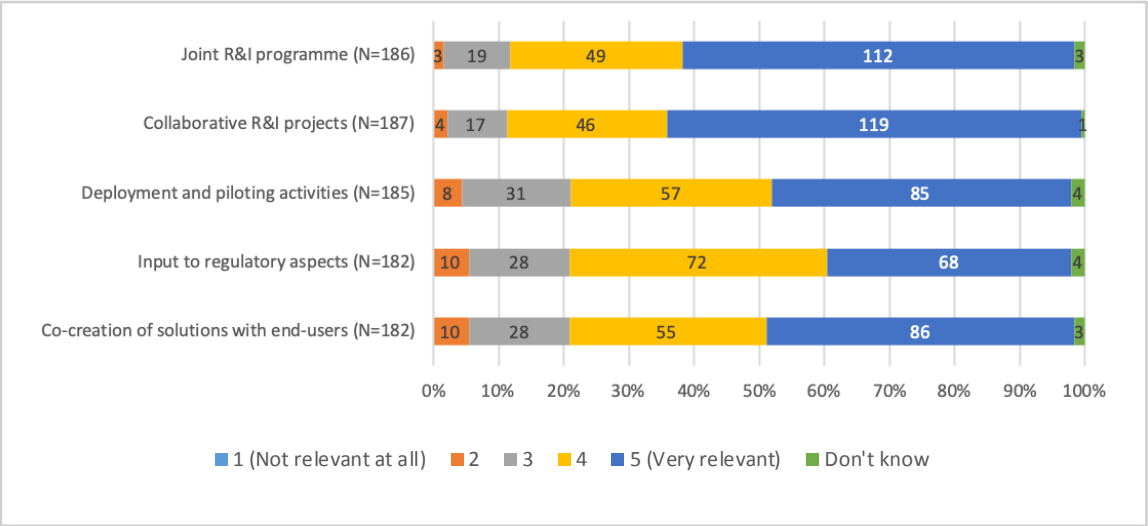


1.3.8. Relevance of implementation of activities

Respondents were asked to provide opinions on relevance of implementation of several activities for meeting objectives of the Clean Aviation. Among activities were listed – joint R&D programme, collaborative R&D projects, deployment and piloting activities, input to regulatory aspects and co-creation of solutions with end-users. Out of 187 respondents, 119 (64%) indicated that collaborative R&I projects are very relevant to ensure that the Partnership would meet its objectives. A Joint R&I programme has also been considered as very relevant by a large number of respondents (112 respondents or 60%). Input to regulatory aspects is seen by the least respondents as very relevant, with 37% (68) of the responses falling in this category, however 72 respondents (40%) have given it a score of 4 on the relevance scale, which indicates that it is still considered as relevant.

No statistical differences were found between the views of citizens and other respondents.

Views of respondents on relevance of implementation of the following activities

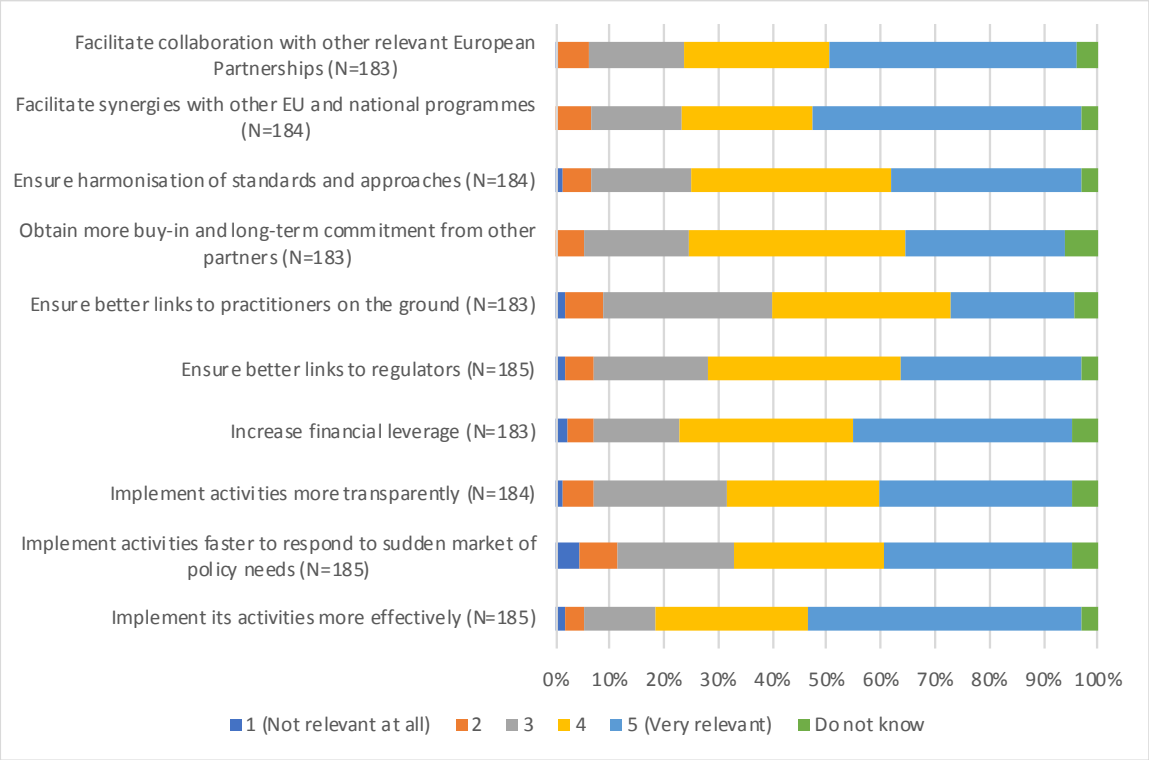


In addition, virtually all stakeholders consulted as part of the Open Public Consultation scored the following impacts with high relevance scores: increased industrial leadership and uptake of new technologies; the acceleration of key technologies through selected demonstrators; as well as the creation of high-skilled jobs in the low-carbon economy.

1.3.9. Relevance of setting up a legal structure (funding body) for the candidate European Partnerships to achieve improvements

Respondents were also asked to assess the relevance of a specific legal structure (funding body) for the candidate European Partnership to achieve several activities. According to Figure 29, the differences across the different categories are not incredibly large. For all but one measure (Implement activities more transparently), over 55% of respondents have selected either 4 or 5 (very relevant) for all the categories. The most respondents indicated that a specific legal structure was 'very relevant' to implement its activities more effectively (93 respondents; 50%).

Views of respondents on relevance of a specific legal structure



The Open Public Consultation responses provided further support for the view that a well-defined legal structure of the kind underpinning an institutional partnership could be expected to increase the economic and technological impacts of the initiative.

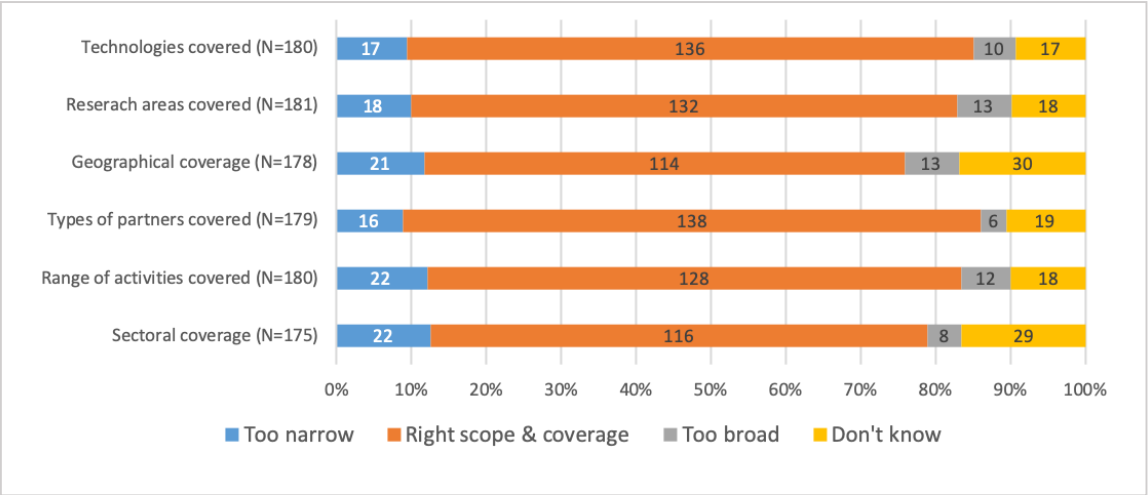
A substantial majority of business organisations of different sizes, business associations, academic institutions, public authorities and EU citizens considered that such a structure was either relevant or very relevant for achieving more effective and faster implementation of the initiative, increased financial leverage, better links to both regulators and practitioners on the ground, harmonised standards, facilitated synergies with EU/national programmes and facilitated collaboration with other partnerships.

1.3.10. Scope and coverage of the candidate European Partnerships based on their inception impact assessments

Respondents were asked to assess the scope and coverage of the Clean Aviation Partnership, based on its inception impact assessment. The clear majority of the respondents indicated that the partnership has the right scope and coverage across all areas, with over 60% of respondents choosing this option. Respondents were the most positive with regard to the type of partners covered (138; 77%), technologies covered (136; 76%) and research areas covered (132; 73%). Across all areas an average of 10% of the respondents indicated that the scope is too narrow.

No statistical differences were found between the views of citizens and other respondents.

Views of respondents on the scope and coverage proposed for the Clean Aviation Partnership



Aside from this multiple choice question, the respondents were also asked to provide any comment that they may have on the proposed scope and coverage for this candidate Institutionalised Partnership. This analysis showed the respondents used this question to talk about low carbon fuel, hybrid electric batteries, impact assessment and the geographical coverage of new technology.

1.3.11. Scope for rationalisation and alignment of candidate European Partnerships with other initiatives

The respondents were also asked if it they thought it would be possible to rationalise the candidate European Institutionalised Partnership and its activities, and/or to better link it with other comparable initiatives. 111 respondents (67%) have indicated that they think this is the case.

No statistical differences were found between the views of citizens and other respondents.

The respondents who answered affirmative, where asked which other comparable initiatives it could be linked with. The results show that respondents think the initiative could be linked with comparable initiatives at national level, other European partnerships, including clean hydrogen and traffic management.

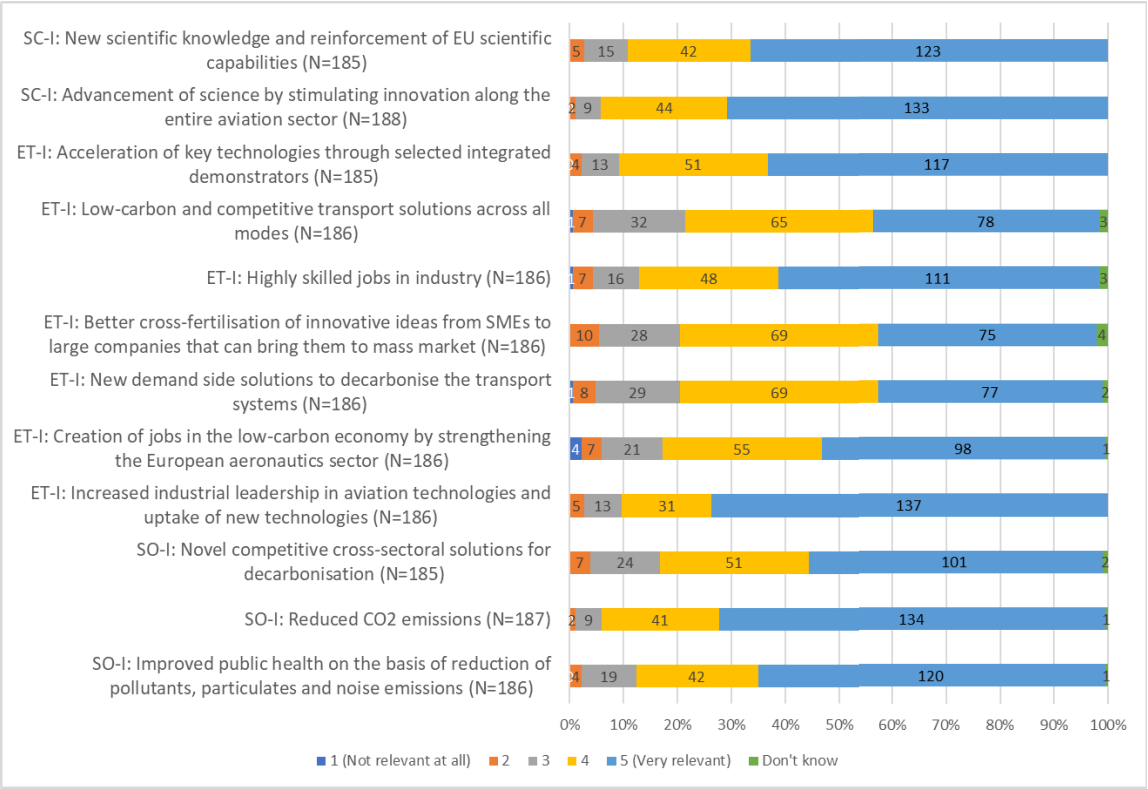
In responding to the Open Public Consultation, a majority of stakeholders stated that the legal structure underpinning an institutionalised partnership was either relevant or very relevant to the facilitation of collaboration with other partnerships under Horizon Europe. Support for this view was particularly strong among business organisations with fewer than 250 people, but it was also held by most SMEs, academic and research institutions, public authorities and EU citizens.

A substantial majority in each of the same stakeholder groups confirmed that there would be scope for rationalising the activities of the candidate partnership for Clean Aviation and to link it with other initiatives under Horizon Europe.

1.3.12. Relevance of European Partnerships to deliver targeted scientific, economic/technological and societal impacts

Respondents were asked to assess the relevance of the candidate European Institutionalised Partnership to deliver on listed impacts. Among societal impacts, a higher number of respondents, namely 134 out of 187 (72%), indicated that the partnership would be 'very relevant' for reducing CO_2 emissions. Figure 34 shows that among presented economic/technological impact categories, over 60% of respondents suggest that the partnership would be 'very relevant' for increasing industrial leadership in aviation technologies and in uptake of new technologies, for providing highly skilled jobs in industry, and for acceleration of key technologies through selected integrated demonstrators.

Views of respondents on the relevance of the candidate European Institutionalised Partnership to various impacts



Respondents were highly in favour of the potential partnership being used for the advancement of science, to develop new scientific knowledge and capabilities. Impacts that received high relevance scores include increased industrial leadership and uptake of new technologies, the acceleration of key technologies through selected demonstrators and the creation of high-skilled jobs in the low-carbon economy. The reduction in CO_2 emissions and the improvement in public health were also considered as relevant impacts.

1.3.13. Summary of campaigns results for this specific initiative

Three campaigns were identified among respondents that provided answers for the current candidate Partnership. The first campaign includes 17 respondents (campaign #2), the second campaign consists of 19 respondents (campaign #6) and the third campaign consists of 13 respondents (campaign #8).

Overview of responses of the first campaign (campaign #2) (N=17)

Question category	Summary of responses
Research and innovation problems	With exception of one respondent, all respondents from that campaign indicated that the research and innovation efforts at the EU level are 'very relevant' to address a listed problem.
Structural and resource problems	With exception of one respondent, all respondents gave a high score (5 'very relevant') for the following categories: "limited collaboration and pooling of resources between public actors and private actors" and "high costs of demonstration of innovative solutions that hinder commercialisation". Other answer categories received lower and more mixed scores.
Problems in uptake of digital innovations	Respondents views are very mixed across all answer categories. On average, each category received a score of 3.
Preferred Horizon Europe intervention	Institutionalised Partnership was selected by all respondents. When respondents were asked to explain their choice, all of them used the following quote: *"Regular calls under Horizon Europe would not deliver the coordinated approach needed for aviation decarbonisation goals. A co-programmed partnership would not have the legal status of an EU body to confer stability, legal certainty and clarity to the partnership. An Institutionalised Partnership has proven effective in ensuring broad participation & financial and legal commitment of all stakeholders, while delivering on ambitious technology Demonstration targets".*
Relevance of actors for setting join long-term agenda	All respondents consider the involvement of industry and academia 'very relevant'. The involvement of Member States and Associated Countries, on average, scored four. Other answer categories have a lower score, on average.
Relevance of actors for pooling and leveraging resources	All respondents consider the involvement of industry and academia 'very relevant'. The involvement of Member States and Associated countries, on average, scored four. Other answer categories have a lower score, on average.
Partnership composition	Both categories are considered 'relevant' (score 4), on average. However, respondents gave a higher rating to the category "involvement of a broad range of partners, including across disciplines and sectors".
Implementation of activities	Most respondents gave the highest score to the following activities: "joint R&I programme" and "collaborative R&I projects". Other categories have more mixed views and a lower score, on average.
Relevance of the legal structure	On average, across all categories, respondents indicated that the legal structure would be 'relevant' (score 4). The lowest score (namely, 2.8) was given to the category "ensure better links to practitioners on the ground".
Scope and coverage of the candidate Partnership	Most respondents consider that listed components of the candidate Partnership have right scope and coverage. The greatest number of respondents that indicated that the scope and coverage are too narrow was for the category "technologies covered". Respondents were offered an opportunity to provide comments on the proposed scope and coverage of the Institutionalised Partnership. Several of them included the following quote: *"Complexity of aviation products and the global-based market and regulations do require any EU effort in improving environmental impact is pursued in parallel and coherently with many other technologies allowing faster in-service introduction, affordability, modularity and simple upgrade of aeronautical products to answer to huge investments EU competitors are doing in those areas to challenge the EU leadership in the Sector".*

Question category	Summary of responses
Rationalisation of the candidate Partnership and linking to other initiatives	Out of 17 respondents, 11 (64.71%) consider that it would be possible to rationalise the candidate Partnership and its activities, and/or to better link it with other comparable initiatives. Respondents were asked to explain their answer. Several of respondents that stated that the Partnership and its activities could be rationalised inserted a following quote: *"Distinct partnerships needed as stakeholders and processes are different. Lowering emissions need links and synergies with other partnerships. Despite the aeronautical requirements, several building blocks technologies must be developed in common with other sectors and customized to aviation as of basic performances and potential assessed. Among them battery, materials, digitalization, software, big data, industry 4.0, automation, ATM. PPP-I has the strength and role to set-up such strong links".* Almost all respondents that states that it is not possible to rationalise the candidate Partnership and its activities, and/or to better link it with other comparable initiatives inserted the following quote: *"The initiatives have distinctly different technology challenges & objectives; while transport partnerships certainly are aligned with one another, the challenges that would be addressed within rail are distinctly."*
Societal impact	All respondents consider that the candidate Partnership would be 'very relevant' to "reduce CO_2 emissions". Other categories received a slightly lower score, but are considered 'relevant' by most respondents.
Economic/technological impact	Most respondents consider that the candidate Partnership would be 'very relevant' or 'relevant' for all suggested impacts.
Scientific impact	Both answer categories are considered 'very relevant' by all respondents.

Table 10: Overview of responses of the first campaign (campaign #6) (N=19)

Question category	Summary of responses
Research and innovation problems	All respondents indicated that the research and innovation efforts at the EU level are 'very relevant' to address a listed problem.
Structural and resource problems	Most respondents gave a high score (5 'very relevant') for the following categories: "limited collaboration and pooling of resources between public actors and private actors" and "high costs of demonstration of innovative solutions that hinder commercialisation". Other answer categories received lower and more mixed scores. The lowest score received the category "regulatory barriers in the field of disruptive and digital aviation technology".
Problems in uptake of digital innovations	The majority of respondents gave a low score (between 2 and 3) across all answer categories.
Preferred Horizon Europe intervention	Institutionalised Partnership was selected by all respondents. When respondents were asked to explain their choice, most of them used the following quote: *"Timescales, risks, interdependencies between technologies, integration challenge at aircraft design level require strong coordination. JU = critical mass & strengthens EU aero-industry ecosystem, global leadership & competitiveness. Stable, long-term commitment & collaboration from the innovation chain gives visibility, overcomes inhibitors to increased investment in disruptive R&I & market failure risks. Roadmap aligned with public policy & synergies with national programs".*
Relevance of actors for setting join long-term agenda	All respondents consider the involvement of industry is 'very relevant'. The involvement of Member States and Associated Countries, as well as, of academia, on average, received a score of 4. Other answer categories have a lower score, on average.

Question category	Summary of responses
Relevance of actors for pooling and leveraging resources	Most respondents consider the involvement of industry and academia is 'very relevant'. Other answer categories have a lower score, on average.
Partnership composition	Both categories are considered 'relevant' (score 4), on average.
Implementation of activities	All respondents gave a high score (either 4 or 5) for all activities, with exception of "co-creation of solutions with end users". This category received a lower score (3.16), on average.
Relevance of the legal structure	Almost all respondents considered that the legal structure would be 'very relevant' for implementation of Partnership activities more effectively, for ensuring better links to regulators, for obtaining more buy-in and long-term commitment from other partners, for facilitating synergies with other EU and national programmes and for facilitating collaboration with other relevant European Partnerships. Other answer categories received a lower score, but all of them are considered 'relevant', on average.
Scope and coverage of the candidate Partnership	With exception of one respondent, all listed components of the candidate Partnership are considered to be of right scope and coverage by all respondents. Respondents were offered an opportunity to provide comments on the proposed scope and coverage of the Institutionalised Partnership. Almost all respondents included the following quote: *"The Clean Aviation shall serve the green deal policy objectives and contribute to carbon neutrality. Research areas: the Partnership in itself covers the right research areas, but other issues must be tackled in other partnerships: e.g. batteries for aviation in the Battery partnership. Geographical coverage: excellence shall remain the only criterion for the selection of partners".*
Rationalisation of the candidate Partnership and linking to other initiatives	Most respondents (17, 89.47%) consider that it would be possible to rationalise the candidate Partnership and its activities, and/or to better link it with other comparable initiatives. Respondents were asked to explain their answer. Those who stated that it would be possible to rationalise the candidate Partnership included the following quote: *"No rationalisation but build bridges with other initiatives. Air transport decarbonisation is too complex for solutions to be developed in CA alone. Upstream cooperation is needed for solutions developed in different sectors to be integrated into aircraft/to ensure new fleets & transport modes can be integrated into ATM. EC should coordinate & support implementation of synergies with ATM, Key Digital Technologies, Batteries, Clean Hydrogen, cybersecurity, AI, 5G, Made in Europe".* Those respondents that considered that it would not be possible to rationalise the candidate Partnership and its activities inserted the following statement: *"A dedicated, strong and stable partnership embracing all relevant research and innovation actors not only from within the aeronautics sector, but where appropriate newcomers with key technologies from other sectors joining in the effort is a condition precedent for success. This partnership must maximize synergies with other partnerships such as ECSEL, SESAR and FOF to ensure coordination and increase impact".*
Societal impact	All respondents consider that all listed categories are 'very relevant'.
Economic/technological impact	With exception of one answer in one category, all respondents consider that the candidate Partnership would be 'very relevant' for all suggested impacts.
Scientific impact	All respondents consider that all listed categories are 'very relevant'.

Annex 3 Who Is Affected And How?

1. PRACTICAL IMPLICATIONS OF THE INITIATIVE

The proposed European Partnership on Clean Aviation focuses on areas where there is a demonstrable advantage in acting at the EU-level due to complexity and size of the industry, the significant societal impact, and scope of the efforts needed for the EU as a whole to achieve the intended objectives.

The partnership will aim at contributing significantly to meeting the intermediate Green Deal targets for 2030 and achieving climate neutrality for aviation by 2050. It will bring together the public, academic and private sectors around this common goal.

The coordinated involvement of the private sector in this context is crucial in designing a strategic research and innovation agenda with concrete targets, milestones and deliverables in line with Green Deal requirements. The private sector, by having a central role in the proposed Clean Aviation Partnership, will benefit from the long-term vision and financial certainty required for its businesses and industries to grow and to strengthen the competitiveness of the EU Clean Aviation value chain (notably SMEs);

The public sector involvement in the partnership needs to ensure adequate policy support to facilitate the market uptake of the partnership's technical achievements.

Academia and the scientific community play a pivotal role in strengthening and integrating scientific capacity to accelerate the development and improvement of advanced clean aviation technologies and create a pipeline of innovative solutions to be picked up by the partnership.

Civil society as a whole is mainly affected by the climate change issue. The proposed Clean Aviation Partnership provides the right framework to accelerate the greening of aviation.

Finally, in an increasingly globalized and interlinked world, governments are required to enhance their role in the fight against climate change. New evidence on this issue should be incorporated in every level of policy-making and in every sector. Governments are responsible for the development, implementation and enforcement of environmental clean energy and climate change regulation.

2. SUMMARY OF COSTS AND BENEFITS

For the preferred option

I. Overview of Benefits (total for all provisions) – Preferred Option		
Description	***Estimation (quantitative or qualitative)***	***Comments***
Direct benefits		
Impliment Green Deal for aviation	Major contribution to climate neutrality of aviation by 2050, as key policy of the European Union. Significant improvements in pollution related health issues.	Considering the world-wide impact of the European aeronautics industry, the benefits would have world-wide effects

	Reduction of noise around airports	
Increased competitiveness of the European aeronautics industry	Maintain employment. In total, aviation currently supports 12.2 million European jobs.	The technological advancements would significantly increase the quality of the European aircraft helping to maintain the European leadership position in this sector.
The alignment of European, national and company research efforts on basis of a single Strategic Research and Innovation Agenda would significantly increase the impact of aviation research	Increased effectiveness and efficiency of the European research in aviation.	
Better integrated research and innovation landscape	Early involvement of EASA reducing the long research and innovation life cycle in the sector Establish structural links with other sectors (such as batteries and hydrogen) leading to cross sectoral benefits Increased cooperation between European companies across the whole value chain in aviation.	
Indirect benefits		

II. Overview of direct and indirect costs – Preferred option

		Citizens/Consumers		Businesses		Administrations	
		One-off	Recurrent	One-off	Recurrent	One-off	Recurrent
Management/ Administrative costs	Direct costs				170		170
	Indirect costs			4	790	4	790
Personnel costs	Direct costs			0	2200	0	2200
	Indirect costs			4	105	4	105
Coordination costs (or transaction costs)					110		110

Budget expenditure/ investment costs				45		45	

TOTAL (kEUR) *6,854.96*

The table assumes a similar Office size for the Horizon Europe Clean Aviation partnership as the current Horizon 2020 Clean Sky 2 Joint Undertaking. The table is filled on basis of the actual 2019 administrative budgetary payments of the Clean Sky 2 Joint Undertaking. Since according to the Clean Sky 2 basic act 50% of the admin cost are covered by the private members, the figures were equally split between the "Businesses" and "Administrations" columns.

Thus the "business" part represents what's paid by industry and the "administration" part what's paid by EC funds.

In particular please find here after examples of categories of costs included:

Under the personnel category:

- Direct: salaries (interim and SNEs included)
- Indirect (recruitment, training fees, health insurance, transport)

coordination:

- Direct (meetings organisation; SCICOM experts)
- Indirect: N/A

Investment:

- Indirect: audio-visual equipment for meeting rooms, photocopier, laptop

Management:

- Direct: missions, experts reviewers
- Indirect: building, external consultants, communication (publications, events), telecommunications, IT operational expenses (external IT support, connections, systems etc)

REFIT Cost savings table

Not applicable for the proposed Clean Aviation Partnership. The initiative will benefit from the existing organisation/structure (e.g. the Programme Office) already in place for the CS2 JU. There are no additional regulatory costs associated, and no specific simplification measures apply in this case.

Annex 4 Analytical Methods

The methodology for each impact assessment is based on the Commission Better Regulation Guidelines[7] to evaluate and compare options with regards to their **efficiency, effectiveness and coherence**. This is complemented by integrating the **conditions and selection criteria for European Partnerships**, as well as requirements for setting up Institutionalised Partnerships.[8]

1. OVERVIEW OF THE METHODOLOGIES EMPLOYED

In terms of **methods and evidence used**, the set of impact assessments for all candidate Institutionalised European Partnerships draw on an external study covering all initiatives in parallel to ensure a high level of coherence and comparability of analysis.[9]

All impact assessment mobilised a mix of qualitative and quantitative data collection and analysis methods. These methods range from desk research and interviews to the analysis of the responses to the Open Consultation, stakeholder analysis and composition/portfolio analysis, bibliometric/patent analysis and social network analysis, and a cost-effectiveness analysis.

The first step in the impact assessment studies consisted in the definition of the context and the problems that the candidate partnerships are expected to solve in the medium term or long run. The main data source in this respect was desk research. This includes grey and academic literature to identify the main challenges in the scientific and technologic fields and in the economic sectors relevant for the candidate partnerships, as well as the review of official documentations on the policy context for each initiative.

In the assessment of the problems to address, the lessons to be learned from past and ongoing partnerships were taken into account, especially from relevant midterm or ex-post evaluations.

The description of the context of the candidate institutionalised European Partnerships required a good understanding of the corresponding research and innovation systems and their outputs already measured. Data on past and ongoing Horizon 2020 projects, including the ones implemented through Partnerships, served as basis for descriptive statistic of the numbers of projects and their respective levels of funding, the type of organisations participating (e.g. universities, RTOs, large companies, SMEs, public administrations, NGOs, etc.) and how the funding was distributed across them. Special attention was given to analysing the participating countries (and groups of countries, such as EU, Associated Countries, EU13 or EU15) and industrial sectors, where relevant. The sectoral analysis required enriching the eCORDA data received from the European Commission services with sector information extracted from ORBIS, using the NACE codification up to level 2. These data enabled the identification of the main and, where possible, emerging actors in the

[7] European Commission (2017), Better Regulation Guidelines (SWD (2017) 350)

[8] A pivotal element of the present analysis is the so-called two-step 'necessity test' for European Partnerships, used to establish: step 1) the need for a partnership approach in the first place, followed by step 2) a justification for the form of Institutionalised Partnership. The necessity test is described in Annex 6. This impact assessment focuses on the second step of the test.

[9] Technopolis Group (2020), Impact Assessment Study for Institutionalised European Partnerships under Horizon Europe

relevant systems, i.e. the organisations, countries and sectors that would need to be involved (further) in a new initiative.

A Social Network Analysis was performed by the contractors using the same data. It consisted in mapping the collaboration between the participants in the projects funded under the ongoing R&I partnerships. This analysis revealed which actors – broken down per type of stakeholders or per industrial sector – collaborate the most often together, and those that are therefore the most central to the relevant research and innovation systems.

The data provided finally served a bibliometric analysis run by the contractor aimed at measuring the outputs (patents and scientific publications) of the currently EU-funded research and innovation projects. A complementary analysis of the Scopus data enabled to determine the position and excellence of the European Union on the international scene, and identify who its main competitors are, and whether the European research and innovation is leading, following or lagging behind.

A cost modelling exercise was performed in order to feed into the efficiency assessments of the partnership options.

The conclusions drawn from the data analysis were confronted to the views of experts and stakeholders collected via three means:

- The comments to the inception impact assessments of the individual candidate institutionalised European Partnerships;
- The open public consultation organised by the European Commission from September to November 2019;
- The interviews (up to 50) conducted by each impact assessment study team conducted between August 2019 and January 2020 (policymakers, business including SMEs and business associations, research institutes and universities, and civil organisations, among others).

The views of stakeholders (and experts) were particularly important for determining the basic functionalities (see further below) that the future partnerships need to demonstrate to achieve their objectives as well as their most anticipated scientific, economic and technological, and societal impacts. The interviews allowed more flexibility to ask the respondents to reflect about the different types of European Partnerships. Furthermore, as a method for targeted consultation, it was used to get insights from the actors that both the study teams and the European Commission deemed the most relevant. For the comparative assessment of impacts, the external contractors confronted the outcomes of the different stakeholder consultation exercises to each other with a view of increasing the validity of their conclusions, in line with the principles of triangulation.

Annex 2 includes also the main outcomes of the stakeholder consultation exercises.

2. METHOD FOR ASSESSING THE EFFECTIVENESS, EFFICIENCY AND COHERENCE OF EACH OPTION - THE USE OF FUNCTIONALITIES

Given the focus of the impact assessment on comparing different forms of implementation, the Better Regulation framework has been adapted to introduce "**key functionalities needed**"

– so as to link the intended objectives of the candidate European Partnerships and what would be crucial to achieve them *in terms of implementation*. The identification of "key functionalities needed" for each initiative as an additional step in the impact assessment is based on the distinguishing factors between the different options (see Section 2.2.1 in the main body of the impact assessment). In practical terms, each option is assessed on the basis of the degree to which it would allow for the key needed functionalities to be covered, as regards e.g. the type and composition of actors that can be involved ('openness'), the range of activities that can be performed (including additionality and level of integration), the level of directionality and integration of R&I strategies; the possibilities offered for coherence and synergies with other components of Horizon Europe, including other Partnerships (internal coherence), and the coherence with the wider policy environments, including with the relevant regulatory and standardisation framework (external coherence). This approach guides the identification of discarded options. It also allows for a structured comparison of the options as regards their effectiveness, efficiency and coherence, and also against a set of other key selection criteria for European Partnerships (openness, transparency, directionality)[10].

Figure 3 Overview of key functionalities of each form of implementation of European Partnerships

Baseline: Horizon Europe calls	**Option 1: Co-programmed**	**Option 2: Co-funded**	**Option 3.1: Institutionalised Article 185**	**Option 3.2: Institutionalised Article 187**
Type and composition of actors (including openness and roles)				
Partners: N.A., no common set of actors that engage in planning and implementation Priority setting: open to all, part of Horizon Europe strategic planning Participation in R&I activities: fully open in line with standard Horizon Europe rules	Partners: Suitable for all types: private and/or public partners, foundations Priority setting: Driven by partners, open stakeholder consultation, MS in comitology Participation in R&I activities: fully open in line with standard Horizon Europe rules	Partners: core of national funding bodies or govern-mental research organisations Priority setting: Driven by partners, open stakeholder consultation Participation in R&I activities: limited, according to national rules of partner countries	Partners: National funding bodies or governmental research organisation Priority setting: Driven by partners, open stakeholder consultation Participation in R&I activities: fully open in line with standard Horizon Europe rules, but possible derogations	Partners: Suitable for all types: private and/or public partners, foundations Priority setting: Driven by partners, open stakeholder consultation Participation in R&I activities: fully open in line with standard Horizon Europe rules, but possible derogations
Type and range of activities (including additionality and level of integration)				
Activities: Horizon Europe standards that allow broad range of individual actions Additionality: no additional activities and investments outside the funded projects Limitations: No systemic approach beyond individual actions	Activities: Horizon Europe standard actions that allow broad range of individual actions, support to market, regulatory or policy/ societal uptake Additionality: Activities/investments of partners, national funding Limitations: Limited systemic approach beyond individual	Activities: Broad, according to rules/programmes of participating States, State-aid rules, support to regulatory or policy/ societal uptake Additionality: National funding Limitations: Scale and scope depend on the participating programmes, often	Activities: Horizon Europe standards that allow broad range of individual actions, support to regulatory or policy/societal uptake, possibility to systemic approach Additionality: National funding	Activities: Horizon Europe standards that allow broad range of individual actions, support to regulatory or policy/societal uptake, possibility to systemic approach (portfolios of projects, scaling up of results, synergies with other funds. Additionality: Activities/investments of partners/ national

[10] The criterion on the ex-ante demonstration of partners' long term commitment depends on a series of factors that are unknown at this stage, and thus fall outside the scope of the analysis.

Baseline: Horizon Europe calls	Option 1: Co-programmed	Option 2: Co-funded	Option 3.1: Institutionalised Article 185	Option 3.2: Institutionalised Article 187
	actions.	smaller in scale		funding
Directionality				
Priority setting: Strategic Plan and annual work programmes, covering max. 4 years. Limitations: Fully taking into account existing or to be developed SRIA/ roadmap	Priority setting: Strategic R&I agenda/ roadmap agreed between partners and COM, covering usually 7 years, including allocation of Union contribution Input to FP annual work programme drafted by partners, finalised by COM (comitology) Objectives and commitments are set in the contractual arrangement.	Priority setting: Strategic R&I agenda/ roadmap agreed between partners and COM, covering usually 7 years, including allocation of Union contribution Annual work programme drafted by partners, approved by COM Objectives and commitments are set in the Grant Agreement.	Priority setting: Strategic R&I agenda/ roadmap agreed between partners and COM, covering usually 7 years, including allocation of Union contribution Annual work programme drafted by partners, approved by COM Objectives and commitments are set in the legal base.	Priority setting: Strategic R&I agenda/ roadmap agreed between partners and COM, covering usually 7 years, including allocation of Union contribution Annual work programme drafted by partners, approved by COM (veto-right in governance) Objectives and commitments are set in the legal base.
Coherence: internal (Horizon Europe) and external (other Union programmes, national programmes, industrial strategies)				
Internal: Between different parts of the Annual Work programme can be ensured by COM External: Limited for other Union programmes, no synergies with national/regional programmes and activities	Internal: Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and COM External: Limited synergies with other Union programmes and industrial strategies If MS participate, with national/ regional programmes and activities	Internal: Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and COM External: Synergies with national/ regional programmes and activities	Internal: Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and COM External: Synergies with national/ regional programmes and activities	Internal: Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and COM External: Synergies with other Union programmes and industrial strategies If MS participate, with national/ regional programmes and activities

In line with the Better Regulation Framework, the assessment of the effectiveness, efficiency and coherence of each option is made in comparison to the baseline. Therefore, for each of the above criteria, the performance of using traditional calls under Horizon Europe is first estimated and scored 0 to serve as a reference point. When relevant, this estimation also includes the costs/benefits of discontinuing existing implementation structures. The policy options are then scored compared to the baseline with a + and – system along a two-point scale, to indicate limited (+ or -) or high (++ or --) additional/lower performance compared to the baseline. When a policy option is scored 0, this means that its impact is expected to be roughly equal to the baseline option.

On the basis of the evidence collected, the intervention logic of each initiative and the key functionalities needed, the impact assessments first evaluate the **effectiveness** of the various policy options to deliver on their objectives. To be in line with the Horizon Europe impact framework, the fulfilment of the specific objectives of the initiative is translated into 'expected impacts' - how success would look like -, differentiating between scientific,

economic/ technological, and societal (including environmental) impacts. Each impact assessment considers to which extent the different policy options provides the 'key functionalities needed' to achieve the intended objectives. The effectiveness assessment does not use a compound score but shows how the options would deliver on the different types of expected impacts. This is done to increase transparency and accuracy in the assessment of options[11].

A similar approach is followed to evaluate the coherence of options with the overarching objectives of the EU's R&I policy, and distinguishes between **internal** and **external coherence**. Specifically, internal coherence covers the consistency of the activities that could be implemented with the rest of Horizon Europe, including European Partnerships (any type). External coherence refers to the potential for synergies and/or complementarities (including risks of overlaps/gaps) of the initiative with its external environment, including with other programmes under the MFF 2021-27, but also the framework conditions at European, national or regional level (incl. regulatory aspects, standardisation).

To compare the expected costs and benefits of each option (**efficiency**), the thematic impact assessments broadly follow a cost-effectiveness approach[12] to establish to which extent the intended objectives can be achieved for a given cost. A preliminary step in this process is to obtain a measure of the expected costs of the policy options, to be used in the thematic assessments. As the options correspond to different implementation modes, relevant cost categories generally include the costs of setting-up and running an initiative. For instance, set-up costs includes items such as the preparation of a European Partnership proposal and the preparation of an implementation structure. The running costs include the annual work programme preparation costs. Where a Partnership already exists, discontinuation costs and cost-savings are also taken into account[13]. The table below provides an overview of the cost categories used in the impact assessment and a qualitative scoring of their intensity when compared to the baseline option (traditional calls). Providing a monetised value for these average static costs would have been misleading, because of the different features and needs of each candidate initiative.[14] The table shows the overall administrative, operational and coordination costs of the various options. These costs are then put into context in the impact assessments to reflect the expected co-financing rates and the total budget available for each of the policy options, assuming a common Union contribution (cost-efficiency):

- The costs related to the baseline scenario (traditional calls under Horizon Europe) are pre-dominantly the costs of implementing the respective Union contribution via calls and project, managed by the executive agencies (around 4%, efficiency of 96% for the overall investment).
- For a Co-Programmed partnership the costs of preparation and implementation

[11] In the thematic impact assessments, scores are justified in a detailed manner to avoid arbitrariness and spurious accuracy. A qualitative or even quantitative explanation is provided of why certain scores were given to specific impacts, and why one option scores better or worse than others.

[12] For further details, see Better Regulation Toolbox # 57.

[13] Discontinuation costs will bear winding down and social discontinuation costs and vary depending on e.g. the number of full-time-equivalent (FTEs) staff concerned, the type of contract (staff category and duration) and applicable rules on termination (e.g. contracts under Belgian law or other). If buildings are being rented, the cost of rental termination also apply. As rental contracts are normally tied to the expected duration of the current initiatives, these termination costs are likely to be very limited. In parallel, there would also be financial cost-savings related to the closing of the structure, related to operations, staff and coordination costs in particular. This is developed further in the individual efficiency assessments.

[14] A complete presentation of the methodology developed to assess costs as well as the sources used is described in the external study supporting this impact assessment (Technopolis Group, 2020).

increase only marginally compared to the baseline (<1%),[15] but lead to an additional R&I investment of at least the same amount than the Union contribution[16] (efficiency of 98% for the overall investment).

- For a Co-Funded partnership the additional R&I investment by Member States accounts for 2-3 times the Union contribution[17]. The additional costs compared to the baseline of preparing and implementing the partnership, including the management of the Union contribution implemented by the national programmes, can be estimated at 6% of the Union contribution (efficiency of 98% related to the overall investment).[18]
- For an Article 185 initiative the additional R&I investment by Member States is equal to the Union contribution[19]. The additional costs compared to the baseline of preparing and implementing the partnership, including the management of the Union contribution implemented by the dedicated implementation structure, can be estimated at 7% of the Union contribution (efficiency of 96% related to the overall investment).
- For an Article 187 initiative the additional R&I investment by partners is equal to the Union contribution[20]. The additional costs compared to the baseline of preparing and implementing the partnership, including the management of the Union contribution implemented by the dedicated implementation structure, can be estimated at 9% of the Union contribution (efficiency of 94% related to the overall investment).

Figure 4 - Intensity of additional costs compared with Horizon Europe Calls (for Partners, stakeholders, public and EU)

Cost items	Baseline: traditional calls	Option 1: Co-programmed	Option 2 Co-funded	Option 3a - Art. 185	Option 3b -Art. 187
Preparation and set-up costs					
Preparation of a partnership proposal (partners and EC)	0	↑↑			
Set-up of a dedicated implementation structure	0			Existing: ↑ New: ↑↑	Existing: ↑↑ New: ↑↑↑
Preparation of the SRIA/ roadmap	0	↑↑			
Ex-ante Impact Assessment for partnership	0			↑↑↑	
Preparation of EC proposal and negotiation	0			↑↑↑	
Running costs (annual cycle of implementation)					
Annual Work Programme preparation	0	↑			
Call and project implementation	0	0 In case of MS contributions: ↑	↑	↑	↑
Cost to applicants	Comparable, unless there are strong arguments of major differences in oversubscription				
Partners costs not covered by the above	0	↑	0	↑	↑

[15] Specifically, some additional set-up costs linked for example to the creation of a strategic research and innovation agenda (SRIA) and additional running costs linked with the partners role in the creation of the annual work programmes and the Commission's additional supervisory responsibilities. A CPP will have lower overall costs than each of the other types of European Partnership, as it will function with a smaller governance and implementation structure than will be required for a Co-Funded Partnership or an Institutionalised Partnership and – related to this – its calls will be operated through the existing Horizon Europe agencies and RDI infrastructure and systems.

[16] Minimum contributions from partners equal to the Union contribution.

[17] Based on the default funding rate for programme co-fund actions of 30%, partners contribute with 70% of the total investment.

[18] These costs reflect set-up costs and additional running costs for partners, and the Commission, of the distributed, multi-agency implementation model.

[19] Based on the minimum requirement in the legal basis that partners contribute at least 50% of the budget.

[20] Based on the minimum requirement in the legal basis that partners contribute at least 50% of the budget.

Cost items	Baseline: traditional calls	Option 1: Co-programmed	Option 2 Co-funded	Option 3a - Art. 185	Option 3b -Art. 187
Additional EC costs (e.g. supervision)	0	↑	↑	↑	↑↑
Winding down costs					
EC	0				↑↑↑
Partners	0	↑	0	↑	↑

Notes: 0: no additional costs, as compared with the baseline; ↑: minor additional costs, as compared with the baseline; ↑↑: medium additional costs, as compared with the baseline; ↑↑↑: higher costs, as compared with the baseline.

The cost categories estimated for the common model are then used to develop a scorecard analysis and further refine the assessment of options for each of the 12 candidate Institutionalised Partnerships. Specifically, the scores related to the set-up and implementation costs are used in the thematic impact assessments to consider the scale of the expected benefits and thereby allow a simple "value for money" analysis (**cost-effectiveness**). In carrying out the scoring of options, the results of fieldwork, desk research and stakeholder consultation undertaken and taken into account.

3. METHOD FOR IDENTIFYING THE PREFERRED OPTION – THE SCORECARD ANALYSIS

For the **identification of the preferred option,** a scorecard analysis is used to build a hierarchy of the options by individual criterion and overall in order to identify a single preferred policy option or in case of an inconclusive comparison of options, a number of 'retained' options or hybrid. This exercise supports the systematic appraisal of alternative options across multiple types of monetary, non-monetary and qualitative dimensions. It also allows for easy visualisation of the pros and cons of each option. Each option is attributed a score of the adjudged performance against each criterion with the three broad appraisal dimensions of effectiveness, efficiency and coherence.

This scorecard approach also relies on a standard cost model developed for the external study supporting the impact assessment, as illustrated in **Error! Reference source not found.**. Specifically, the scores related to the set-up and implementation costs are used in the thematic impact assessments to consider the scale of the expected benefits and thereby allow a simple "value for money" analysis (**cost-effectiveness**). In carrying out the scoring of options, the results of fieldwork, desk research and stakeholder consultation undertaken and taken into account.

These costs essentially refer to the administrative, operational and coordination costs of the various options. The figure shows how the scoring of costs range from a value of 0, in case an option does not entail any additional costs compared to the baseline (traditional calls), to a score of (-) for options introducing limited additional costs relative to the baseline and a score of (- -) when substantial additional costs are expected in comparison with the baseline. Should the costs of a policy option be lower than those of the baseline, (+) and (+ +) are used.

It is considered that while there is a clear gradation in the overall costs of the policy options, the cost differentials are less marked when one takes into account the expected co-financing rates and the total budget available for each of the policy options, assuming a common Union contribution. From this perspective, there are only one or two percentage points that split the most cost-efficient policy options – the baseline (traditional calls) and the Co-Programmed policy options – and the least cost-efficient – the Institutionalised Partnership option. A score of + is therefore assigned for **cost-efficiency** to the Co-Programmed and Co-Funded options,

a score of zero to the Article 185 option and a score of (-) for the Article 187 Institutionalised Partnership policy option[21].

Figure 5: Matrix on 'overall costs' and 'adjusted cost scoring'

	Baseline: Horizon Europe calls	Option 1: Co-programmed	Option 2: Co-funded	Option 3a: Institutionalised 185	Option 3b: Institutionalised 187
Administrative, operational and coordination costs	0	(0)	(-)	(- -)	(- -)
Administrative, operational and coordination costs adjusted per expected co-funding (i.e. *cost-efficiency*)	0	(+)	(+)	(0)	(-)

Notes: Score 0 = same costs as for the baseline; score (-) = limited additional costs compared to baseline; score (- -) = substantial additional costs compared to baseline. ; score (+) = lower costs compared to baseline

[21] The baseline (traditional calls) is scored 0, as explained above.

Annex 5 Subsidiarity Grid

1. Can the Union act? What is the legal basis and competence of the Unions' intended action?
1.1 Which article(s) of the Treaty are used to support the legislative proposal or policy initiative?
This proposal is based on (1) Article 185 TFEU which stipulates that in implementing the multiannual framework programme, the EU may make provision, in agreement with the Member States concerned, for participation in research and development programmes undertaken by several Member States, including participation in the structures created for the execution of those programmes; and (2) Article 187 TFEU according to which the EU may set up joint undertakings or any other structure necessary for the efficient execution of Union research, technological development and demonstration programmes (both articles are under Title XIX of the TFEU - Research and Technological Development and Space). The proposal aims to implement Article 8 of the Commission proposal for Horizon Europe - the future EU research and innovation (R&I) programme for 2021-2027, according to which, "*European Partnerships shall be established for addressing European or global challenges only in cases where they will more effectively achieve objectives of Horizon Europe than the Union alone and when compared to other forms of support of the Framework programme*". The Horizon Europe proposal has received the political agreement of the Council and the European Parliament.
1.2 Is the Union competence represented by this Treaty article exclusive, shared or supporting in nature?
Research is a shared competence between the EU and its Member States according to the TFEU. Article 4 (3) specifies that in the areas of research, technological development and space, the European Union can carry out specific activities, including defining and implementing programmes, without prejudice to the Member States' freedom to act in the same areas.
Subsidiarity does not apply for policy areas where the EU has ***exclusive*** *competence as defined in Article 3 TFEU*[22]*. It is the specific legal basis which determines whether the proposal falls under the subsidiarity control mechanism. Article 4 TFEU*[23] *sets out the areas where competence is shared between the Union and the Member States. Article 6 TFEU*[24] *sets out the areas for which the EU has competence only to support the actions of the Member States.*

[22] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12008E003&from=EN
[23] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12008E004&from=EN
[24] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:12008E006:EN:HTML

2. Subsidiarity Principle: Why should the EU act?

2.1 Does the proposal fulfil the procedural requirements of Protocol No 2[25]:

- Has there been a wide consultation before proposing the act?
- Is there a detailed statement with qualitative and, where possible, quantitative indicators allowing an appraisal of whether the action can best be achieved at Union level?

This proposal and the accompanying impact assessment were supported by a wide consultation of stakeholders, both during the preparation of the Horizon Europe proposal and - later on, all the candidates for European Partnerships. Member States were consulted via the Shadow Strategic configuration of the Horizon Europe Programme Committee. On candidates for institutionalised Partnerships based on Article 185/187 of the TFEU, an Open Public Consultation (OPC) was held between 11 September and 6 November 2019. Over 1 600 replies were received. In addition, targeted consultation activities were undertaken to prepare the present impact assessment. In particular, for each of the candidate partnerships, an external consultant interviewed a representative sample of stakeholders. The need for EU action as well as its added value were covered in those interviews.

The explanatory memorandum and the impact assessment (horizontal part, Section 3) contain a dedicated section on the principle of subsidiarity, as explained in question 2.2 below.

2.2 Does the explanatory memorandum (and any impact assessment) accompanying the Commission's proposal contain an adequate justification regarding the conformity with the principle of subsidiarity?

The impact assessment accompanying the proposal features a horizontal part on relevant common elements to all the candidate partnerships, including the conformity of the proposed initiative with the principle of subsidiarity (Section 3). Moreover, the individual assessments of each candidate partnership include additional details on subsidiarity, touching in particular on the specificities of a candidate partnership that could not be adequately reflected in the horizontal part of the impact assessment. This will also be reflected in the explanatory memorandum.

2.3 Based on the answers to the questions below, can the objectives of the proposed action be achieved sufficiently by the Member States acting alone (necessity for EU action)?

National action alone cannot achieve the scale, speed and scope of support to R&I needed for the EU to meet its long-term treaty objectives, to deliver on the EU's strategic policy priorities (including the climate and energy goals set out in the Paris Agreement, and the European Green Deal), and to contribute to tackling global challenges and meeting the Sustainable Development Goals (SDGs).

[25] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12016E/PRO/02&from=EN

(a) Are there significant/appreciable transnational/cross-border aspects to the problems being tackled? Have these been quantified?
The thematic areas covered by the candidate partnerships feature a series of challenges in terms of cross-border/transnational aspects, need to pool resources, need for a critical mass to meet intended policy objectives, need to coordinate different types of actors (e.g. academia, industry, national and regional authorities) across different sectors of the economy and society, which cannot be tackled to the same degree by Member States alone. This is particularly true for the research and innovation (R&I) dimension of the proposed initiative: the importance of a multi-centre and interdisciplinary approach, cross-country data collection and research, and the need to develop and share new knowledge in a timely and coordinated manner to avoid duplication of efforts are key to achieve high quality results and impact. The Interim Evaluation of Horizon 2020 and the impact assessment of Horizon Europe provide extensive qualitative and quantitative evidence on the above points. In addition, Sections 1 and 2 of the individual impact assessments on the candidate partnerships include more detail on the necessity to act at EU-level in specific thematic areas. Finally, it is worth noting that not all Member States have the same capacity or R&I intensity to act on these challenges. As the desired policy objectives can be fully achieved only if the intended benefits are widespread across the Member States, this requires action at the EU-level.
(b) Would national action or the absence of the EU level action conflict with core objectives of the Treaty[26] or significantly damage the interests of other Member States?
As per Article 4(3) TFEU, national action does not conflict with core objectives of the Treaty in the area of R&I. The absence of EU level action in this area would however prevent the achievement of core objectives of the Treaty. Indeed, national action alone cannot achieve the scale, speed and scope of support to R&I needed for the EU to meet its long-term Treaty objectives on e.g. competitiveness, to deliver on the EU's strategic policy priorities, and to contribute to tackling global challenges and meet the Sustainable Development Goals (SDGs).
(c) To what extent do Member States have the ability or possibility to enact appropriate measures?
As foreseen by Article 4(3) TFEU, this proposal does not hamper Member States' ability to enact appropriate measures in the field of R&I. However, the scale and complexity of the policy objectives pursued by the present initiative cannot be fully addressed by acting at national level alone.
(d) How does the problem and its causes (e.g. negative externalities, spill-over effects) vary across the national, regional and local levels of the EU?
As described in the horizontal part of the impact assessment accompanying the present proposal, several problems (e.g. on competitiveness, global challenges, demographic change) and their underlying causes affect the EU as a whole rather than individual Member States.

[26] https://europa.eu/european-union/about-eu/eu-in-brief_en

Where important differences between Member States are present, these are described in Sections 1 and 2 of the individual impact assessments.
(e) Is the problem widespread across the EU or limited to a few Member States?
The problem of coordinating R&I efforts in the thematic areas covered by the candidate partnerships affects all Member States, albeit to different degrees. However, from a general EU perspective, available evidence shows that the EU as a whole needs to step up efforts and investments in thematic areas that are crucial to tackle present and future policy challenges on several fronts, e.g. ageing population, global technological trends, and climate change to name a few. The way these problems affect the EU and its Member States is described in the horizontal part of the impact assessment and in Sections 1 and 2 of the individual impact assessments.
(f) Are Member States overstretched in achieving the objectives of the planned measure?
As indicated in the horizontal part of the impact assessment and in Sections 1 and 2 of the individual assessments, the sheer scale, speed and scope of the needed support to R&I would overstretch national resources, without guaranteeing the achievement of the intended objectives. Acting at EU-level would achieve greater impact in a more effective and efficient manner.
(g) How do the views/preferred courses of action of national, regional and local authorities differ across the EU?
No specific differences between the views of national, regional and local authorities emerged from the stakeholder consultation.
2.4 Based on the answer to the questions below, can the objectives of the proposed action be better achieved at Union level by reason of scale or effects of that action (EU added value)?
EU funded R&I activities, including those covered by the present proposal, produce demonstrable benefits compared to the corresponding national and regional initiatives, due to the scale, speed and scope achievable by acting at the EU level. In addition, the proposed initiatives should be seen as complementary and reinforcing national and sub-national initiatives in the same area.
(a) Are there clear benefits from EU level action?
Quantitative and qualitative evidence of the benefits of EU level action are available in the interim evaluation of Horizon 2020 and in the impact assessment of Horizon Europe, among others. An analysis of the emerging challenges in each thematic areas, of the EU's competitive positioning, as well as feedback gathered from different types of stakeholders for the present impact assessment indicate that EU level action remains appropriate also for the

present proposal. In addition, the benefits of acting at EU level have been illustrated by the success and the impact achieved by the predecessors to the proposed initiative.

(b) Are there economies of scale? Can the objectives be met more efficiently at EU level (larger benefits per unit cost)? Will the functioning of the internal market be improved?

EU funded R&I activities, including those covered by the present proposal, produce demonstrable benefits compared to the corresponding national and regional initiatives, due to the scale, speed and scope achievable by acting at the EU level. This is the case both in terms of effectiveness in achieving intended policy objectives, but also in terms of efficiency. Positive impact is also visible in terms of competitiveness: recent data on EU funded R&I activities indicate that EU-funded teams grow 11.8% faster and are around 40% more likely to be granted patents or produce patents applications than non-EU funded teams. Efficiency gains are also visible in terms of dissemination of results to users beyond national borders, including SMEs, and citizens. EU funded R&I is more effective in leveraging private investment. Finally, there are clear additionality benefits (i.e. EU R&I funding does not displace or replace national funding), as the EU focuses on projects that are unlikely to be funded at national or regional level. Overall, this is beneficial to the functioning of the internal market in several respects, including human capital reinforcement through mobility and training, the removal of barriers to cross-border activity for economic players including SMEs, easier access to finance and to relevant knowledge and research, and increased competition in the area of R&I.

(c) What are the benefits in replacing different national policies and rules with a more homogenous policy approach?

A homogeneous policy approach in the various thematic areas covered by the present proposal would reduce fragmentation and increase efficiency and effectiveness in meeting the intended policy objectives. Indeed fragmentation, persisting barriers in the internal market and differences in the resources available to Member States are some of the key problems that stand in the way of fully achieving the intended policy objectives and reaching the required critical mass to obtain tangible results. Specific detail on how these issues differ in each thematic area are illustrated in Sections 1 and 2 of the individual impact assessments, so as to reflect the specificities of each case.

(d) Do the benefits of EU-level action outweigh the loss of competence of the Member States and the local and regional authorities (beyond the costs and benefits of acting at national, regional and local levels)?

The proposed initiative does not lead to a loss of competence of the Member States. In fact, the proposed initiative should be seen as complementary and reinforcing national and sub-national initiatives in the same area. Previous quantitative and qualitative assessments of Horizon Europe and Horizon 2020 have shown that the proposed EU-level action do not displace national ones and tend to concentrate on initiatives that would not have been funded by the Member States themselves, or would not have reached the same scale and ambition without EU-level intervention, due to their complexity and trans-national nature.

(e) Will there be improved legal clarity for those having to implement the legislation?

Yes. The proposed initiatives will be implemented in line with the Horizon Europe single set of rules for participation; this will ensure increased clarity and legal certainty for end beneficiaries, other stakeholders and programme administrators. It will also reduce the administrative burden for beneficiaries, and for the Commission services. In addition, the accessibility and attractiveness of the broader Horizon Europe programme, in particular for applicants with limited resources, would be sustained.

3. Proportionality: How the EU should act

3.1 Does the explanatory memorandum (and any impact assessment) accompanying the Commission's proposal contain an adequate justification regarding the proportionality of the proposal and a statement allowing appraisal of the compliance of the proposal with the principle of proportionality?

The principle of proportionality underpins the entire analysis of the candidate partnerships. Specifically, the analysis included in the accompanying impact assessment is structured along the following logic: 1. Justification of the use of a partnership approach in a given area (including considerations on additionality, directionality, link with strategic priorities) instead of other forms of intervention available under Horizon Europe; 2. If the partnership approach is deemed appropriate, proportionality considerations guide the assessment of which type of partnership intervention (collaborative calls, co-programmed, co-funded or institutionalised partnership) is most effective in achieving the objectives. This will also be reflected in the explanatory memorandum.

3.2 Based on the answers to the questions below and information available from any impact assessment, the explanatory memorandum or other sources, is the proposed action an appropriate way to achieve the intended objectives?

The proposed initiative only focuses on areas where there is a demonstrable advantage in acting at the EU-level due to the scale, speed and scope of the efforts needed for the EU to meet its long-term Treaty objectives and deliver on its strategic policy priorities and commitments. In addition, the present proposal leaves full freedom to the Member States to pursue their own actions in the policy areas concerned. This will also be reflected in the explanatory memorandum.

(a) Is the initiative limited to those aspects that Member States cannot achieve satisfactorily on their own, and where the Union can do better?

The proposed initiative only focuses on areas where there is a demonstrable advantage in acting at the EU-level due to the scale, speed and scope of the efforts needed for the EU to meet its long-term Treaty objectives and deliver on its strategic policy priorities and commitments.

(b) Is the form of Union action (choice of instrument) justified, as simple as possible, and

coherent with the satisfactory achievement of, and ensuring compliance with the objectives pursued (e.g. choice between regulation, (framework) directive, recommendation, or alternative regulatory methods such as co-legislation, etc.)?
For each of the candidate partnerships, the analysis carried out in the accompanying impact assessment has explored several options for implementation. A comparative assessment of the merits of each option also included an analysis of the simplicity of the intervention, its proportionality and effectiveness in achieving the intended objectives. This is reflected in the fact that a tailored approach has been suggested for each candidate partnership, ranging from looser forms of cooperation to more institutionalised ones, depending on the intended policy objectives, specific challenges, and desired outcome identified in each case.
(c) Does the Union action leave as much scope for national decision as possible while achieving satisfactorily the objectives set? (e.g. is it possible to limit the European action to minimum standards or use a less stringent policy instrument or approach?)
The proposed approach leaves full freedom to the Member States to pursue their own actions in the policy areas covered by the present proposal.
(d) Does the initiative create financial or administrative cost for the Union, national governments, regional or local authorities, economic operators or citizens? Are these costs commensurate with the objective to be achieved?
The proposed initiatives create financial and administrative costs for the Union, national governments and, depending on the chosen mode of implementation, for regional and local authorities. In addition, economic operators and other stakeholders potentially involved in the candidate partnerships will also incur some costs linked to implementation. The financial cost of the proposed initiative is covered under the Horizon Europe programme. Its exact amount is still subject to political decision. As regards the candidate partnerships and the different modes of implementation (co-programmed, co-funded, institutionalised), the relevant costs and benefits are assessed in the individual impact assessments covering each candidate partnership. The additional administrative costs of implementation via partnerships are limited, when compared to the administrative costs of implementation through traditional calls. As indicated by comparable experience with previous initiatives and in feedback provided by a variety of stakeholders, these costs are expected to be fully justified by the benefits expected from the proposed initiative. Where available, additional details on costs are provided in Annex 3 of the impact assessment.
(e) While respecting the Union law, have special circumstances applying in individual Member States been taken into account?
Where relevant, differences between Member States in capacity and stage of advancement of R&I in specific thematic areas have been taken into account in the individual impact assessments.

Annex 6 Additional background information

1. BACKGROUND INFORMATION FOR ALL INITIATIVES

1.1. Selection criteria of European Partnerships

Partnerships based on Article 185 and 187 TFEU *shall be implemented only where other parts of the Horizon Europe programme, including other forms of European Partnerships would not achieve the objectives or would not generate the necessary expected impacts, and if justified by a long-term perspective and high degree of integration.* At the core of this impact assessment is therefore the need to demonstrate that the impacts generated through a Partnership approach go beyond what could be achieved with traditional calls under the Framework Programme – the Baseline Option. Secondly, it needs to assess if using the Institutionalised form of a Partnership is justified for addressing the priority.

The necessity test for a European Partnership (as set out in the Horizon Europe regulation) has two levels:

1. **The justification for implementing a priority with a European Partnership** to address Horizon Europe and EU priorities. This is linked to demonstrating that a European Partnership can produce added value beyond what can be achieved through other framework programme modalities, notably traditional calls in the work programmes (Option 0 – Baseline).

2. **The justification for the use of the form of Institutionalised Partnership**: Once it has been demonstrated that a partnerships approach is justified, co-programmed and/or co-funded forms are considered for addressing the priorities as they are administratively lighter, more agile and easier to set-up (Options 1 and/or 2). As Institutionalised Partnerships require setting up a legal framework and the creation of a dedicated implementation structure, they have to justify higher set-up efforts by demonstrating that it will deliver the expected impacts in a more effective and efficient way, and that a long-term perspective and high degree of integration is required (Option 3).

The outcomes of the 'necessity test' is presented together with the preferred option.

Figure 5 Horizon Europe selection criteria for the European Partnerships

Common selection criteria & principles	Specifications
1. More effective (Union added value) clear impacts for the EU and its citizens	Delivering on global challenges and research and innovation objectives
	Securing EU competitiveness
	Securing sustainability
	Contributing to the strengthening of the European Research and Innovation Area
	Where relevant, contributing to international commitments
2. Coherence and synergies	Within the EU research and innovation landscape
	Coordination and complementarity with Union, local, regional, national and,

Common selection criteria & principles	Specifications
	where relevant, international initiatives or other partnerships and missions
3. Transparency and openness	Identification of priorities and objectives in terms of expected results and impacts
	Involvement of partners and stakeholders from across the entire value chain, from different sectors, backgrounds and disciplines, including international ones when relevant and not interfering with European competitiveness
	Clear modalities for promoting participation of SMEs and for disseminating and exploiting results, notably by SMEs, including through intermediary organisations
4. Additionality and directionality	Common strategic vision of the purpose of the European Partnership
	Approaches to ensure flexibility of implementation and to adjust to changing policy, societal and/or market needs, or scientific advances, to increase policy coherence between regional, national and EU level
	Demonstration of expected qualitative and significant quantitative leverage effects, including a method for the measurement of key performance indicators
	Exit-strategy and measures for phasing-out of the programme
5. Long-term commitment of all the involved parties	A minimum share of public and/or private investments
	In the case of institutionalised European Partnerships, established in accordance with article 185 or 187 TFEU, the financial and/or in-kind, contributions from partners other than the Union, will at least be equal to 50% and may reach up to 75% of the aggregated European Partnership budgetary commitments

1.2. Overview of potential functions for a common back office among Joint Undertakings

Functions	Current situation	Option of common back office	Comments
Organising calls for grant and proposal evaluations	Each JU organises this independently.	A central organisation of evaluation, logistics, contracting evaluators, managing the data of the evaluation results Central database of potential evaluators with domain expertise in thematic areas of partnerships	The evaluations would still need to be supervised by the Scientific staff of the individual Joint Undertakings (consensus meetings of expert evaluators etc)
Human Resources related matters	Each JU has own HR policy and resources Substantial resources spent on recruitment in some JUs Some HR facilities are procured from external contractors Some JUs have a Service Level Agreement with EC for HR	More generic resources and expertise for HR matters More consistency in HR policy Shared HR investment for specialised expertise (IP and legal)	Ensuring consistency with EC HR policies is already in place
Financial	Each JU conducts own financial	Financial management	Simplifies the harmonisation of

management	contract management; differences between JUs Each JU is audited separately. Auditing at project level more frequent than in other Horizon 2020 parts and outsourced by JUs thus differences ECA: too many audits on JUs	by one core team of financial staff Would reduce the number of interfaces for audits and simplifies the auditing of the all JUs Harmonisation of project auditing	financial management across JUs in line with Horizon Europe
Communication (internal and external)	Each JU has a separate communication strategies, team and resources	A common back-office can support activities such as event organisation, dissemination of results, setting up website communication Can help create a more visible European Partnership brand	A considerable share of communication activity is partnership specific (addressing particular target groups, synthesising project results) however there are generic communication activities that can be shared Needs to avoid duplication of efforts
Data management on calls, project portfolios, information on project results	Most JUs but not all use e-Corda for project data Overall IT integration of JUs still difficult	Harmonised data management Reduction of IT systems and support that is procured	This will need to happen regardless of the common back office but will likely be more smooth if managed centrally

2. COVID-19 IMPACT ON AVIATION AND AVIATION RESEARCH

2.1. The overall impact

At European level, and before the COVID-19 outbreak, Eurocontrol estimated that Europe would see 16.2 million flights in 2040, 53% more than 2017 – that is 1.9% average annual growth per year over the 2017-2040 period, a rather slower growth rate than before 2008.

On 22 March 2020, the European traffic was 75% less than on the same day last year. The current and post COVID-19 economic situation, with the connected national restrictions on travel has led to a situation where the air traffic is about 10% in comparison to before the crisis.

Initial reports suggest that coronavirus could wipe out up to USD 113 billion in worldwide airline revenues in 2020. This figure is nearly half of the five-year (2015-2019) cumulative profit of the airline industry, estimated at USD 269 billion – the best in airline history. The US government approved USD 2 trillion coronavirus stimulus and part of it will go to US airlines and US aircraft manufacturers (i.e. Boeing).

While previous pandemic outbreaks have demonstrated the resilience of the sector to bounce back relatively swiftly[27] it must be recognised that the COVID-19 crisis is of unprecedented scale and magnitude. The consequences of the COVID-19 pandemic may be felt strongly and long term in aviation, with reduced customer demand, shrinking civil

[27] https://www.iata.org/en/iata-repository/publications/economic-reports/what-can-we-learn-from-past-pandemic-episodes/

aircraft fleets and the manufacturing industry confronted with cancelled orders instead of overflowing order-books.

The industrial sector is not expecting a full recovery[28] before 2025-30.

2.2. Impact on research and innovation

The impact of coronavirus to the economy will also be felt in EU aviation R&I – hopefully in the short-term only. Many companies, in view of the expected downturn in aviation, have already announced plans to cut costs (including research activities). Research and market decisions, as well as the financial investments, have long-term impact in aviation. Preparation of new transformative R&I programmes entails big financial and technological risk, without any immediate market reward.

The Clean Sky 2 JU and main private partners reported during the Clean Sky 2 Governing Board meeting that COVID-19 and related health measures, already caused a 4-6 months delay across the board for the on-going research projects. It is foreseen that cuts in research and innovation (R&I) investments in the private sector will range from 25% to 40% in 2020.

2.3. Impact on deployment of research results

The COVID-19 crisis may delay the market entry of green technologies.

For airlines to invest in cleaner and more efficient aircrafts, four elements should be timely aligned: healthy air-traffic demand (high regional and/or global growth, limited geopolitical instabilities), high airlines profitability (over a number of years), low interest rates and high fuel prices. At times of high uncertainty (i.e. coronavirus, trade wars, increased geopolitical instabilities), these four parts of the "invest-in-more-efficient-aircrafts" equation do not add up. As a consequence, aircraft makers do not easily decide to invest EUR 20-40 billion for developing a new aircraft.

In addition to the nearly complete halt of air traffic, the recent (March 2020) drop in oil-prices due to coronavirus, exposed airlines to billions of euro of fuel hedging losses. These hundreds of billions of euro in total losses for airlines due to coronavirus will have a direct impact to ongoing as well as future orders and decisions. This makes the investment in aviation R&I even more urgent and more financially demanding. That's why the limited available European R&I investments should have clear ambitious and achievable objectives.

2.4. Research focus on health

Aviation, climate and economy are all inherently global. It contributes to European prosperity, national security, European social integration, single market and provides EU leaders the financial strength to absorb external shocks (e.g. financial crisis, coronavirus) and invest in climate neutrality and social challenges.

However, aviation has contributed as a carrier for the fast spread of the coronavirus from Asia to the rest of the world – as happened in the past with other infectious diseases (avian flu, SARS, etc). The COVID-19 crisis may thus also lead to new research efforts

[28] https://www.icao.int/sustainability/Pages/Economic-Impacts-of-COVID-19.aspx

in turning civil aircraft into early warning systems and for collecting health data on planes. This area can however be tackled by collaborative research outside the initiative.

This priority should follow a holistic approach between technologies and operations, at airport and aircraft levels. While, it will build on existing WHO, ICAO, and ACI recommendations on airport preparedness guidelines for outbreaks of communicable diseases, it will also focus on a clean-sheet technological approach to air cabin quality.

The objectives may include:

- breakthrough cost-effective air-cabin circulation technologies that will increase the effectiveness of cabin air circulation, before being filtered by HEPA filters;
- Real-time measurement technologies for pathogens should be developed, validated and tested in real aircraft environment;
- Air-circulation-altering devices for specific rows in the aircraft cabin, or for the whole aircraft should be explored as mitigating measures, especially for long-haul flights;
- Technologies already used in hospitals, based on ultraviolet light UV-C to sterilize rooms against viruses, including superbugs, should be further exploited and become cost-effective at airport and aircraft levels;

Aircraft technologies can act as early warning systems rather than virus spreading vehicles, if post-examination procedures for pathogens in the cabin and lavatories are in place.

2.5. Risks for the Clean Aviation initiative

When the Clean Sky 1 programme started in 2009, the coverage of its activities included nearly all commercial aviation segments and aircraft types (i.e. large passenger aeroplanes, regional aircraft, business jets, and helicopters). The post-2008 financial crisis shifted the centre of attention from the environmental challenges to include a broader focus on competitiveness issues. The result was, however, a less focused, more diverse and less impactful portfolio of technologies (both geographically and in terms of aircraft segments).

For Clean Aviation, the temptations of short-term solutions in response to the present crisis should be resisted as they risk locking the EU into a fossil fuel economy for the longer term. The limited research and innovation funds should not be subsumed into a wider COVID-19 recovery effort, for which there are better-suited instruments at EU and national level.

It should therefore be clear that the EU funding for the proposed Clean Aviation initiative does not aim to contribute to the aviation sector's cash flow balance nor will be able to resolve their post-COVID-19 financial difficulties, especially given that other EU and national programmes will be available for that purpose.

The added-value of the Clean Aviation initiative lies, rather, in providing a clear strategic direction for the aviation sector and its efforts to decarbonise.

3. ENVIRONMENTAL IMPACT OF AVIATION

3.1. Magnitude and trends

The civil aviation market has grown – as flying became much more accessible with the appearance of low-cost carriers and increased competition – combined with rising levels of disposable income, mobile student populations and few equivalent alternatives from other transport modes. While flying has become accessible to a wide audience, aviation is increasingly criticised for its perceived insufficient ambition to decarbonise.

The total impact of global aviation to greenhouse gasses (GHG) emissions in 2005 was estimated to represent 4.9% of total anthropogenic forcing, where 1.6% was attributed to CO_2 and 3.3% was attributed to non-CO_2 emissions. There are significant contributions, to better understanding the non-CO_2 emissions, which have both positive and negative radiative forcing effects and are not directly proportional to CO_2 emissions.

At European level, in 2016, aviation contributed to 3.6% of the total EU28 greenhouse gas emissions and to 13.4% of the total transport emissions. In absolute numbers, European aviation CO_2 emissions in 2016 were 171 million tonnes, while the total anthropogenic CO_2 emissions the same year were estimated to 36,000 million tonnes (or 0.4%). This shows that European aviation CO_2 emissions is not the only driving force of anthropogenic CO_2 emissions.

In 2017, Europe recorded strong and broad-based traffic growth taking flight totals to a record 10.6 million. In Europe, passenger traffic grew at an average rate of 4.4% per year between 2011 and 2018.

In 2018, over 1.2 billion passengers flew to and from over 500 airports in Europe. More than 3,500 intra-EU routes now provide access to both large cities as well as peripheral regions.

It is expected that flights in Europe will, post COVID-19, increase by 1.9% per year[29] to 2040, while at the global level flights may increase at 3.7% per annum.

Efficiency improvements are constantly being incorporated into newer generation aircraft, reducing fuel consumption and in turn reducing CO_2 and ufPM emissions, while improvements are also incorporated to reduce NOx and noise but these are insufficient to counter the growing air traffic.

3.2. Scientific

Aviation has significant impacts on the environment: it contributes to climate change through the emission of carbon dioxide (CO_2) and nitrogen oxides (NO_X), but also through the emission of contrails, sulphur dioxide (SO_2), carbon monoxide (CO), hydrocarbons, ultra-fine particulate matter (ufPM) and soot. All are a product of kerosene (fossil fuel) combustion.

The impact of aviation on the environment and climate is driven by long-term effects (several years to hundreds of years) from CO_2 emissions and shorter-term ones (several hours, days, weeks or years), also from non-CO_2 emissions.

[29] https://www.eurocontrol.int/sites/default/files/2019-07/challenges-of-growth-2018-annex1_0.pdf

The CO_2 effects are well understood and emissions are proportional to the fuel used in aviation. The non-CO_2 (mainly water, nitrogen oxides, sulphur oxides, soot, contrails and contrail cirrus) effects emissions relating to aviation are still poorly understood and their effect on climate change largely unknown.

Additional key environmental issues are the generation of noise and particulate matter, specifically in the vicinity of airports where it has impacts on the population living close to the airport area as well as under the main flight paths for take offs and landings. More than 4,2 million people are exposed to harmful noise levels leading to cardiovascular diseases and stress, and more than 1 million people have their sleep disturbed.

The total impact of global aviation on greenhouse gas emissions in 2005 (the most recent complete and reliable available measurements) was estimated to represent 4.9% of the total, where 1.6% was attributed to CO_2 and 3.3% was attributed to non-CO2 emissions.

There are no quick-fix solutions, but there are aviation research and innovations paths leading towards climate neutrality by 2050. Evolutionary and disruptive technological research, together with accelerated deployment of sustainable aviation fuels (biofuels and e-fuels) and operational optimisations (mostly related to air traffic management) are the key directions for aviation research to be supported under Horizon Europe.

3.3. Mitigation Measures

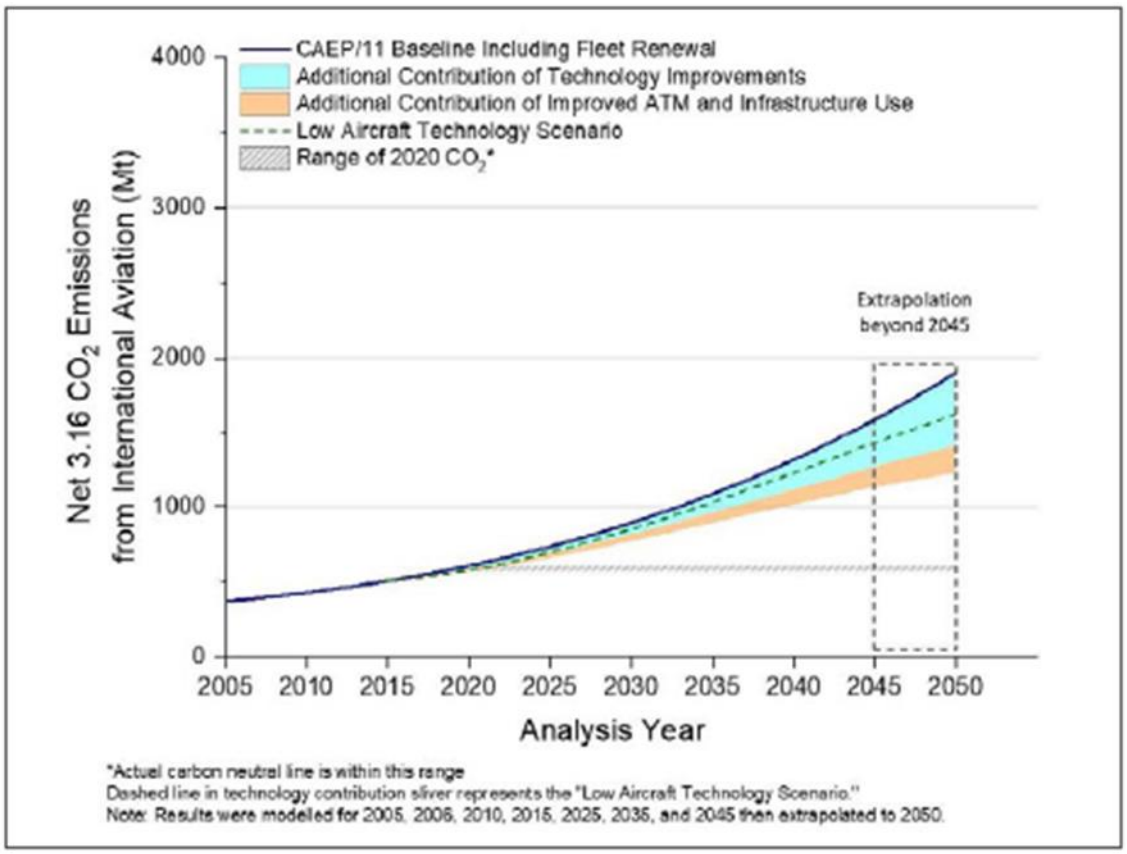
Airlines' operating business models are still driven by the cost per seat. Environmental issues have not been the central focus or have been considered as a side effect/ objective: for instance, the reduction in CO_2 emissions over the years has been driven by the incentive to reduce fuel costs (circa 25-35% of total operating costs) rather than reducing the environmental footprint. The full environmental costs of aviation are born by society rather than airlines and manufacturers, leading to sub-optimal investment in, and deployment of, new environmentally-friendly technologies.

The ICAO environmental report[30] (2019), based on extensive analysis and data, suggests that even under the most optimistic scenario, the projected long-term fuel efficiency of 1.37% per annum falls short of ICAO's aspirational goal of 2% per annum.

ICAO, in the 39th Assembly, recognised that despite the environmental benefits from aircraft technologies, operational improvements and sustainable alternative fuels, sufficient CO_2 emissions reductions to address the growth of international air traffic, will not be achieved in time (CNG2020). ICAO CORSIA - a global market-based measure was therefore designed to offset international aviation CO_2 emissions in order to stabilize the levels of such emissions. Provided that growth in passenger numbers and reductions in fuel consumptions continue at current rates, the overall effect is that emissions from the air transport industry will still continue to rise.

Figure Below: CO_2 Emissions from International Aviation - 2005 to 2050, (ICAO, 2019)

[30]https://www.icao.int/environmental-protection/pages/envrep2019.aspx



The response of the aviation sector needs to go far beyond the incremental efficiency improvements that are constantly being incorporated into newer aircraft generations, reducing fuel consumption and in turn reducing emissions but at a much smaller rate (+/- 1.5% annually) than traffic growth, thus leading to a growing environmental impact from aviation.

In doing that, it would continue to fulfil its economic and societal role as the safest mode of transport[31] & [32] and by far the most convenient one for medium and long-range distances.

4. POSITIONING OF THE EUROPEAN INDUSTRY IN AVIATION

Europe has become the global leader in the supply of large civil aircraft, as one half of the Airbus-Boeing duopoly. Two main European OEMs, Rolls Royce (UK/ D) and Safran (F), hold almost 40% of the world market for engines, and Safran and GE (USA) run a very successful joint venture (CFM) that dominates the global market for large civil aircraft engines. Europe is by far the international leader in the supply of civilian helicopters. Europe also plays a significant role in the market for maintenance, repair and overhaul of aircraft.

[31] The number of accidents in the EU-28 in 2013 for three transport modes were: 16 aviation accidents, 1 982 railway accidents and 144 inland water transportation accidents (data for Bulgaria, the Czech Republic, Croatia, Hungary, Austria, Poland, Romania and Slovakia). The total number of fatalities amounts to eight from aeroplane accidents (fatalities from accidents on national territory regardless of the nationality of the aircraft operator); 1 130 from railway accidents, and 16 932 from road accidents (data for 20 out of the 28 EU Member States).

[32] https://ec.europa.eu/eurostat/statistics-explained/index.php/Archive:Transport_accident_statistics

Four of the top ten aeronautical manufacturing companies by revenue are European; the others are US-based. The European industry also plays a key role in civil helicopters (Airbus Helicopters and Leonardo), engine manufacturing (Rolls-Royce-ITP, Safran, GE-AVIO, and MTU), and manufacturing, repairs and overhaul (MRO).

Through its direct, indirect and induced economic impact, aviation represents 3.3% of all employment and spurs 4.1% of the EU GDP in 2016[33].

Source: aviationbenefits.org/around-the-world/europe

The industry provides a positive contribution to the EU trade balance (EUR 96 billion in EU exports). In total, aviation supports 12.2 million European jobs and EUR 730 billion in European economic activity.

Compared to its key competitor, the USA, the European aeronautics industry has fewer companies of sufficient size and capability for large risk sharing projects, and crucially does not benefit to the same extent as US companies (such as Boeing, Lockheed Martin, and GE) from government-funded military and space research spill-over effects. R&D investments in the USA (from industry and government) are generally higher than in Europe[34]. Lastly, the European industry is more exposed to currency exchange risks with sales and revenues expressed in USD (the preferred currency of the global aviation market) and costs made in Europe calculated in EUR[35].

Other aircraft manufacturers – such as UAC in Russia and COMAC in China – may in the future weaken the EU and US positions with very price competitive products, backed up by their large and expanding home markets[36]. For example, in 2018 it was reported that the COMAC C919 aircraft, an A320neo and Boeing 737 competitor, has over 1,000 domestic

[33] https://aviationbenefits.org/around-the-world/europe

[34] https://ec.europa.eu/eurostat/statistics-explained/index.php/R_%26_D_expenditure

[35] https://bizfluent.com/facts-6818189-exchange-rate-affects-business.html

[36] https://www.rand.org/content/dam/rand/pubs/research_reports/RR200/RR245/RAND_RR245.pdf

orders[37] and is due to enter service in 2021. The aircraft's reported list price is USD 50 million, i.e. about half the cost of the equivalent Airbus and Boeing aircraft[38]. Russia and China are also collaborating on a new wide-body aircraft, the CR929, to be ready for 2027. Additionally, aeronautics companies are setting up engineering offices in India to access cheaper labour and be active in promising markets. MRO companies are moving to the Middle East, pulled by the growing airlines in that region. Potential risks also arise from off shoring, including possible forced technology or intellectual property transfers. Airbus has final assembly lines in China and the USA and Rolls-Royce in Singapore[39].

Table 2: International competitiveness of the global aeronautics industry

1	**2 Large Civil aircraft**	**3 Regional aircraft**	**4 Business /general aviation**	**5 Helicopter**	**6 Engines**	**7 MRO**
8 Market Situation	9 Airbus/ Boeing Duopoly	10 All dominant players linked with Airbus/Boeing	11 Dominance of North American players	12 Dominant European and US players	13 Rolls Royce and Safran (CFM) are significant players	14 Many independent and dependent players
15 Development	16 China and Russia entering the market	17 China, Russia and Japan entering the market	18	19	20	21
22 European Aeronautics Industry	23 Airbus has grown to compete for the market 50:50 with Boeing	24 Airbus purchased the C-Series from Bombardier. Airbus own a stake in ATR	25 Dassault and some smaller players	26 Civil market leader and technology leader	27 Rolls-Royce and Safran (through CFM) are major world players	28 Strong European position

Source: Competitiveness of the EU Aerospace Industry, Ecorys, 2009, updated by Steer to reflect market developments since (Technopolis, Steer, 2020).

The European aviation industry appears to be in a comfortable position. However, the EU aviation value chain is exposed to increasing international competition (from traditional competitors such as the USA, and from emerging countries like China and Russia) in a complex and global political environment.

In the US, the civil aeronautical industry benefits strongly from defence related research and development activities. The US Department of Defense[40],[41] and China[42] are investing huge

[37] https://www.bizjournals.com/seattle/news/2018/03/21/chinas-rival-to-boeing-737-nowhas-nearly-1-000.html
[38] It must be underlined though that the entry into market of this aircraft has been delayed several times
[39] https://www.rolls-royce.com/country-sites/sea/our-locations/singapore.aspx
[40] https://www.sbir.gov/content/high-temperature-materials-and-sensors-propulsion-systems
[41] https://www.nap.edu/read/10056/chapter/6
[42] https://www.sciencedirect.com/science/article/pii/S100093611730273X

sums on research and innovation for all the underlying technologies relevant to aircraft engines. The US Department of Defense R&D budget in Y2020 amounts to a total of USD 92.3 billion[43].

In China, the government has identified the development of a national civil aeronautics industry as a key priority and sponsored[44] domestic aircraft purchases by Chinese airlines. Over the last decade the patents filled by China have multiplied tenfold. A recent analysis, performed by the UK's Aerospace Technology Institute, on global aerospace patents shows that China's patent quota system, employed since 1999, encouraged vast volumes of patent applications that seem largely superficial as few are converted to publications. Western aerospace companies are increasing their patent[45] activity in China, recognising the significance of the aviation market there but also the competitive threat posed by a rapidly maturing homegrown industry.

Aircraft engines is also one of the very few advanced technologies that Asian industries have not yet succeeded in developing – therefore relying on European and American engines. Made in China 2025[46] pays particular attention to that. Because of the synergies between civil and defence, the level-playing field is difficult to achieve.

5. AERONAUTICAL SCIENTIFIC AND TECHNOLOGICAL RESEARCH IN EUROPE

5.1. Scientific and technological achievements

Aeronautical scientific and technological research in Europe, with a transformational impact to air transport and humanity, started more than 100 years ago[47]. Over a century, European aviation research led to scientific and technological advancements in new innovative aerostructures, engines and equipment. Today these innovations are found not only in aircrafts from European integrators (i.e. Airbus, Leonardo, Dassault, Saab). During the last three years, Boeing alone purchased European systems and equipment valued over EUR 25 billion from European suppliers providing employment to 190,000 Europeans[48].

The impact of **2,073 collaborative European aviation research projects** from FP2 to H2020 and the **demonstration and integration activities in two Clean Sky programmes** (under FP7 and H2020) has been particularly significant. Representative examples that have pronounced impact on clean aviation technologies include:

- ✈ **Lightweight composite aerostructures** R&I has peaked in FP7, where European research funding (330 ME total cost) enabled the development of new materials, new manufacturing technologies and new integration methodologies. Research efforts in FP6-ALCAS[49], FP7-MAAXIMUS[50], FP7-SARISTU[51] and FP7-LOCOMACHS[52] matured

[43] https://www.aia-aerospace.org/report/2019-facts-figures/

[44] https://ustr.gov/sites/default/files/Section%20301%20FINAL.PDF Page 33 onwards

[45] In aerospace, where long term technology maturity is often the case, patent filing numbers in isolation may not be conclusive and may not give a useful insight into technology strategies.

[46] https://www.merics.org/sites/default/files/2017-09/MPOC_No.2_MadeinChina2025.pdf

[47] The Rijks-Studiendienst voor de Luchtvaart, the predecessor of today's Royal National Aerospace Laboratory (NLR) in the Netherlands, was established in 1919 in the north part of Amsterdam.

[48] Communication from Boeing to Commissioner Gabriel – dated 02 December 2019.

[49] https://cordis.europa.eu/project/id/516092

[50] https://cordis.europa.eu/project/id/213371

composite and adaptive wing technologies. These technologies were developed further by the private industries and finally integrated in the Bombardier C Series, in Belfast[53] (now the Airbus A220) and in the Airbus A350 (fuselage and wing).

Research in H2020 further developed innovative concepts and will be demonstrated in the Adapted Wing Integrated Demonstrator Flying test bed[54] under Clean Sky 2 in 2022. These lightweight composite wings, fuselage and nacelles account for **53% of the empty weight for the A350[55]** and contributed to **25% greater fuel efficiency[56]** than the competition. Such performance gains are attributed to focused R&I activities over three decades[57] and contribute to environmental gains and European supply chain leadership.

✈ **Ultra-efficient engines** contribute more than anything else in the reduction of the environmental footprint of aviation. They also embed classified (confidential) and patented innovations. In addition, they often share technologies (e.g. internal aerodynamics, high temperature materials and thermal barrier coatings) between civil, defence and even space applications.

The European engine manufacturers (i.e. Safran, Rolls-Royce, MTU and GE-AVIO) together with their American counterparts (GE and P&W) have established joint ventures and deliver propulsion units for all market segments.

Aircraft engines is also one of the very few advanced technologies that Asian industries have not yet succeeded in developing – therefore relying on European and American engines. Made in China 2025[58] pays particular attention to that. Because of the synergies between civil and defence, the level-playing field is difficult to achieve. The US Department of Defense[59] &[60] and China[61] are investing huge sums on research and innovation for all the underlying technologies relevant to aircraft engines. The US Department of Defense R&D budget in Y2020 amounts to a total of $92.3 billion[62].

Research efforts in FP7-ENOVAL[63], FP7-LEMCOTEC[64], FP7-E-BREAK[65], FP7-NEWAC and an array of smaller low TRL R&I collaborative projects matured further low and high

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[51] https://cordis.europa.eu/project/id/284562

[52] https://cordis.europa.eu/project/id/314003

[53] https://www.materialstoday.com/composite-applications/features/bombardier-throws-down-the-gauntlet-with-cseries/

[54] https://www.cleansky.eu/sites/default/files/inline-files/CS-GB-2019-11-21%20Decision%20CS2DP%20adoption_0.pdf

[55] https://www.flightglobal.com/airbus-urged-to-rethink-composite-material-choice-for-a350-xwb/83560.article

[56] https://www.airbus.com/content/dam/corporate-topics/publications/backgrounders/Backgrounder-Airbus-Commercial-Aircraft-A350-XWB-Facts-and-Figures-EN.pdf

[57] While European R&I on composite aerostructures started in the early 80s, the A350 programme started in 2007 with entry into service in 2013.

[58] https://www.merics.org/sites/default/files/2017-09/MPOC_No.2_MadeinChina2025.pdf

[59] https://www.sbir.gov/content/high-temperature-materials-and-sensors-propulsion-systems

[60] https://www.nap.edu/read/10056/chapter/6

[61] https://www.sciencedirect.com/science/article/pii/S100093611730273X

[62] https://www.aia-aerospace.org/report/2019-facts-figures/

[63] https://cordis.europa.eu/project/id/604999

[64] https://cordis.europa.eu/project/id/283216

pressure compressor and turbine parts as well as their combustion cycles towards ultra-high by-pass ratio propulsion systems.

These technologies were developed further by the engine manufacturers and integrated in engines that propel single-aisle and long-haul aircrafts (from Airbus and Boeing). In addition to the collaborative research within FP6, FP7 and H2020, Clean Sky 2 is contributing to the validation and demonstration of Very High Bypass Ratio Large turbofan (TRL 6 in 2023), Ultrahigh Propulsive Efficiency (TRL 5+ by mid-2022) and Advanced Geared Engine Configuration (TRL 5 by 2023).

Examples demonstrating the contribution of the EU-funded research to clean aircraft engines have been documented in the open access deliverables (e.g. FP7-NEWAC[66], and E-BREAK[67], Clean Sky[68]) among other scientific publications. The success of the A320neo (New Engine Option) and possibly of B737max (after recertification) is/will attributed mainly to new engines from GE-SAFRAN and P&W-MTU.

Finally, the **impact of aircraft engines R&I to the environmental footprint of aviation** can be easily quantified. In 2019, civil aviation consumed 380 billion litres of jet fuel. Aircraft engines contribute on the average around 1% of jet fuel efficiency per annum (i.e. **3.8 billion litres of aviation fuel saved per annum,** because of new engine technologies), which is **12 million tonnes of CO_2 less** in the atmosphere.

By increasing the research and development in those technologies and accelerating the development of even cleaner gas turbines, combined with other breakthrough technologies (e.g. hybrid-electric), the European Commission aims to have **250-300 million tonnes less CO_2 over the next 10 years, from aircraft engines alone**. There are no other technologies in the world today (apart from renewable energy) that can achieve such impressive CO_2 reductions. The renewal of the aircraft fleet can also contribute to even more accelerated impact. It is estimated[69] that yearly emissions equivalent to CO_2 released by 3 million cars could be avoided if half of the global aircraft fleet was equipped with new efficient engines.

5.2. patents and scientific publications

In terms of aviation R&I performance and in particular on **patents and scientific publications**, Europe shows strong leadership, especially in peer-reviewed publications and references with high impact factor. Out of the 50 journals on aerospace engineering[70] worldwide, 26 are based in Europe, including a clear lead in the total cites over the last three years. The EU-based journal, Progress in Aerospace Sciences, has one of the highest impact factors (9.27), while the EU-based journal Aerospace Science and Technology has one of the highest citation indexes over the last three years (4,113).

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[65] https://cordis.europa.eu/project/id/314366/reporting

[66] https://trimis.ec.europa.eu/sites/default/files/project/documents/20121029_130736_70767_Publishable_Final_Activity_Report.pdf

[67] https://cordis.europa.eu/docs/results/314/314366/final1-e-break-project-summary-handbook.pdf

[68] https://www.cleansky.eu/the-uhbr-engine-flight-testing-programme-gathers-momentum

[69] https://www.eco-business.com/news/how-the-aviation-industry-is-lowering-its-carbon-footprint/

[70] https://www.scimagojr.com/journalrank.php?category=2202&area=2200&type=all

In terms of patents, leading European aeronautics companies hold an extensive portfolio (Airbus[71]: 37,000, Safran[72]: 38,000, Thales[73]: 15,000). In the EU-funded aviation R&I a considerable number of patents is requested – often after the end of the project (e.g in FP7-SARISTU and FP7-AFLONEXT). In the first Clean Sky programme[74] a significant number of requests for patent (196) were registered and most of them (166) have been granted.

However, over the last decade the patents filled by China have multiplied tenfold. A recent analysis, performed by the UK's Aerospace Technology Institute, on global aerospace patents[75] shows that China's patent quota system, employed since 1999, encouraged vast volumes of patent applications that seem largely superficial as few are converted to publications.

Western aerospace companies are increasing their patent activity in China, recognising the significance of the aviation market there but also the competitive threat posed by a rapidly maturing indigenous industry. In aerospace, where long term technology maturity is often the case, patent filing numbers in isolation may not be conclusive and may not give a useful insight into technology strategies.

Finally, additional anecdotal evidence **on the relative scientific and technological performance of Europe in aviation** and related clean technologies can be obtained by assessments performed outside of Europe. The government of Canada[76] assessed that the EU is a key partner in science, technology and innovation for Canada and a major source of new technologies, in particular in the areas of health and aeronautics.

5.3. 2019 Industrial R&D Scoreboard

As regards the R&D investment in the field, EU companies are well positioned compared to the rest of the world according to the 2019 Industrial R&D Scoreboard[77]. The 39 top companies of the Aerospace & Defence sector in terms of R&D investment invested close to EUR 20bn in R&D in 2018 worldwide, where EU companies represent 46% of the investments, slightly more than the USA. This followed a slight decrease over the last 10 years, whereas global R&D growth in 2018-19 was driven by the ICT and the health sector. The table below lists the key indicators for the top 20 companies investing in R&D categorised in this sector, highlighting the ones located in the EU.

Figure Top 2500 companies investing in R&D worldwide – Focus on Aerospace and Defence 20 top companies

World rank	Company	Country	Region	R&D 2018/19 (€million)	R&D one-year growth (%)	Net sales one-year growth (%)	R&D intensity (%)	Employees

[71] https://www.airbus.com/careers/working-for-airbus/innovations-of-tomorrow.html

[72] https://www.safran-group.com/media/safran-third-ranked-patent-filings-france-7th-year-row-20180406

[73] https://www.thalesgroup.com/en/group/journalist/press-release/thales-once-again-amongst-top-100-global-innovators-clarivate

[74] https://www.cleansky.eu/sites/default/files/inline-files/CS-GB-2018-06-29-AAR-2017_20180706.pdf

[75] https://www.ati.org.uk/media/o5zjy32j/insight_11-global-aerospace-patents-1.pdf

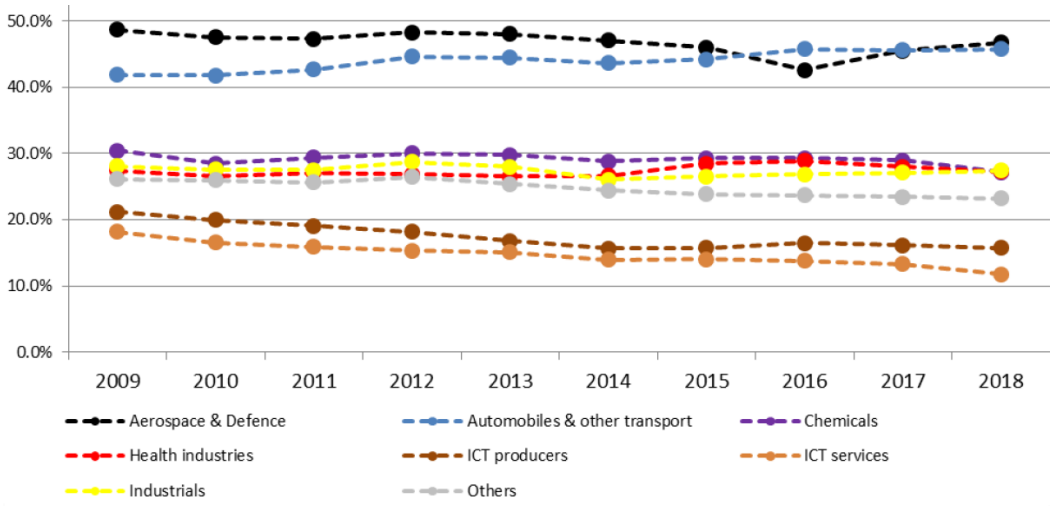
[76] https://www.tradecommissioner.gc.ca/european-union-europeenne.aspx?lang=eng&wbdisable=true

[77] *European Commission, JRC/DG RTD, The 2019 EU Industrial R&D Investment Scoreboard,* computing data on the top 2500 companies investing the largest sums in R&D in the world in 2018/19

48	AIRBUS	Netherlands	EU	3308,0	9,3	7,9	5,2	133671
56	BOEING	US	US	2650,7	5,0	7,6	3,0	153000
65	UNITED TECHNOLOGIES	US	US	2150,2	3,1	11,1	3,7	240000
107	LEONARDO	Italy	EU	1401,0	-7,5	6,2	11,4	46462
115	ROLLS-ROYCE	UK	EU	1269,5	16,0	6,7	7,3	54500
134	LOCKHEED MARTIN	US	US	1135,4	8,3	7,6	2,4	105000
141	SAFRAN	France	EU	1075,0	17,7	22,8	5,1	92639
161	BOMBARDIER	Canada	RoW	992,1	-8,0	0,2	7,0	64010
209	THALES	France	EU	714,9	13,2	4,1	4,5	66135
254	TEXTRON	US	US	561,6	1,4	-1,6	4,6	35000
309	GENERAL DYNAMICS	US	US	438,4	-3,6	16,9	1,4	105600
310	ROCKWELL COLLINS	US	US	438,4	53,5	27,0	5,8	31200
367	DASSAULT AVIATION	France	EU	359,3	28,4	4,5	7,0	11395
438	L3 TECHNOLOGIES	US	US	284,7	13,6	7,0	3,2	31000
477	EMBRAER	Brazil	RoW	262,7	-32,5	0,0	6,2	18520
489	ELBIT SYSTEMS	Israel	RoW	251,0	8,4	9,1	7,8	16149
496	BAE SYSTEMS	UK	EU	247,3	-21,2	-2,3	1,3	78000
543	SAAB	Sweden	EU	216,8	8,0	5,6	6,7	17096
715	TELEDYNE TECHNOLOGIES	US	US	162,1	4,4	11,4	6,4	10850

Source: The 2019 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD. The UK was classified as a EU country at the time of the computation and publication of the Scoreboard.

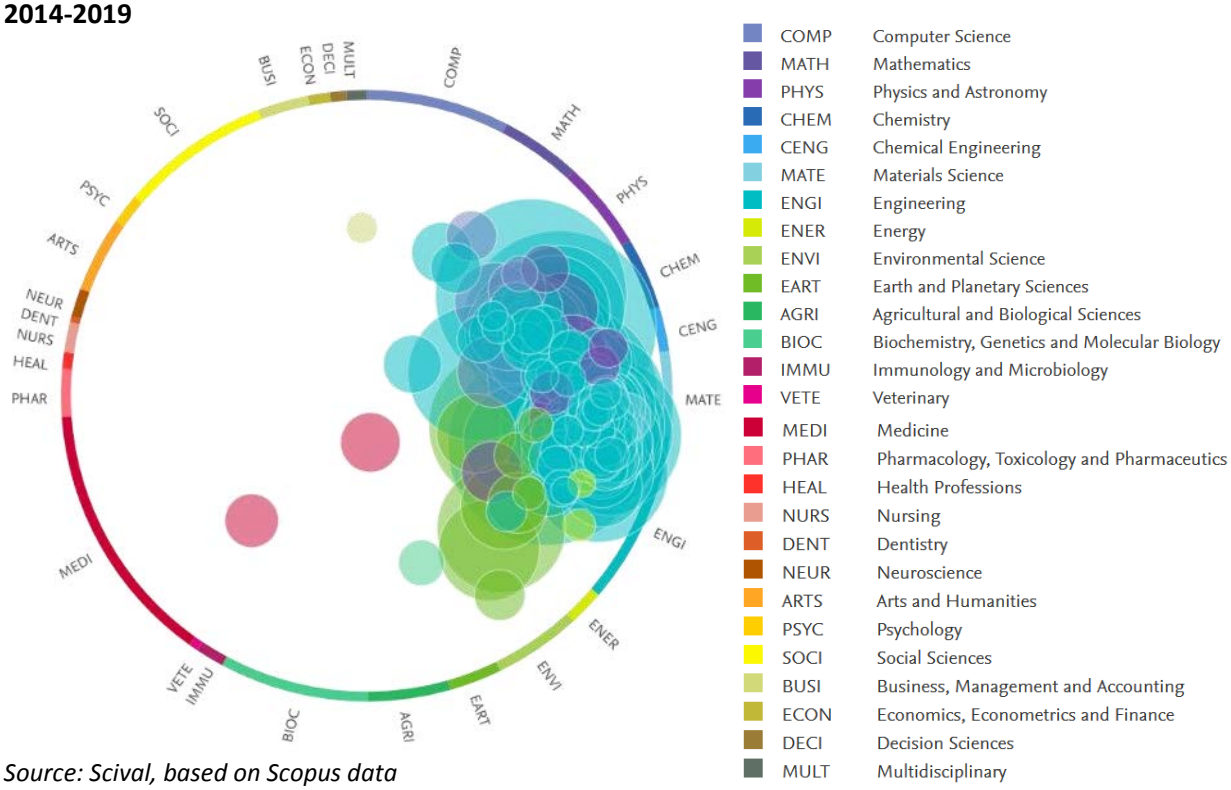
Figure 2.13 – Evolution of the global R&D share of EU companies for the main industrial sectors



Note: Figures displayed refer only to the 386 out of the 551 EU companies with R&D data available for the all period 2009-2018. These companies represent 86.6% of R&D whole sample in 2018. *Source: The 2019 EU Industrial R&D Investment Scoreboard. European Commission, JRC/DG RTD.*

In terms of scientific performance, the EU28 shows a good performance compared to the rest of the world based on scientific publications in the field of aerospace engineering. Based on Scopus data, EU28 publications represents 23 % of all publications in the field with close to 40,000 publications between 2014 and 2019, involving close to 60,000 authors. Worldwide the most prolific country is China with more than 50,000 publications, followed by the United States (40,000). Publications from authors with affiliations in Germany, the UK, Italy, and France are the best positioned in the EU. The Field Weighted citation Index shows that EU28 publications in the field are cited 23% more than the world average whereas the ones from China show a lower performance than the average. Looking at trends in the field, during the period 2014-2019, the main topics of prominence worldwide ("hot topic") in terms of publications appeared related to physics, chemistry, chemical engineering, materials sciences and engineering but also energy and environmental sciences.

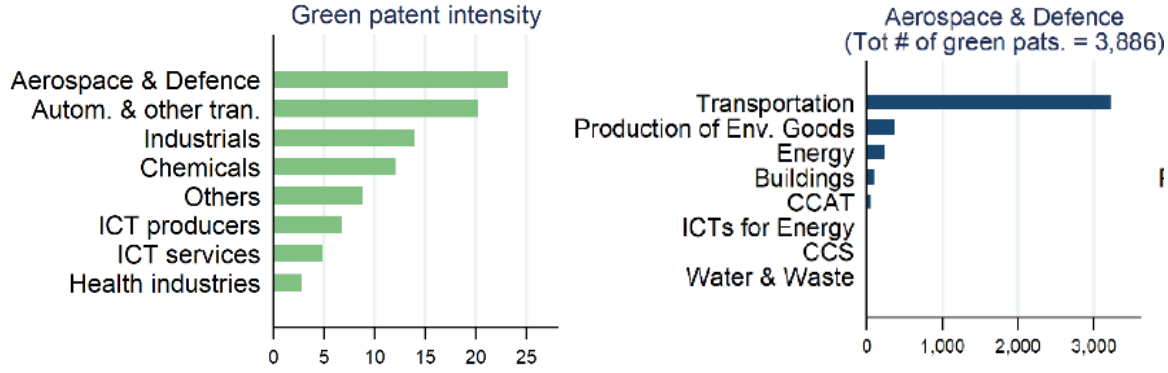
Figure - Research output in aerospace engineering worldwide – Top 25% topics of Prominence 2014-2019



Source: Scival, based on Scopus data

In terms of technological performance, between 2010 and 2016 the EU overall maintains a stable higher performance compared to the USA (details in the Figure below per specific technologies). When looking in the EU industrial R&D Scoreboard at the share of green patenting with respect to the total technological inventions of the biggest R&D investors worldwide, the highest share of green over total patents is revealed by companies operating in transport-related industries, including aerospace & defence (23.2%), totalising almost 3,900 green over more than 17,000 patents in the period 2012-2015, and automobiles and other transports (20.1%). These companies concentrate their green inventions in green transportation technologies. From the top 25 green inventors among the top R&D investors, green patents represent 28% of the patents of the company United Technologies (USA), 20% of the patents filed by Airbus (EU), and 34% of the patents filed by Rolls Royce (UK-DE).

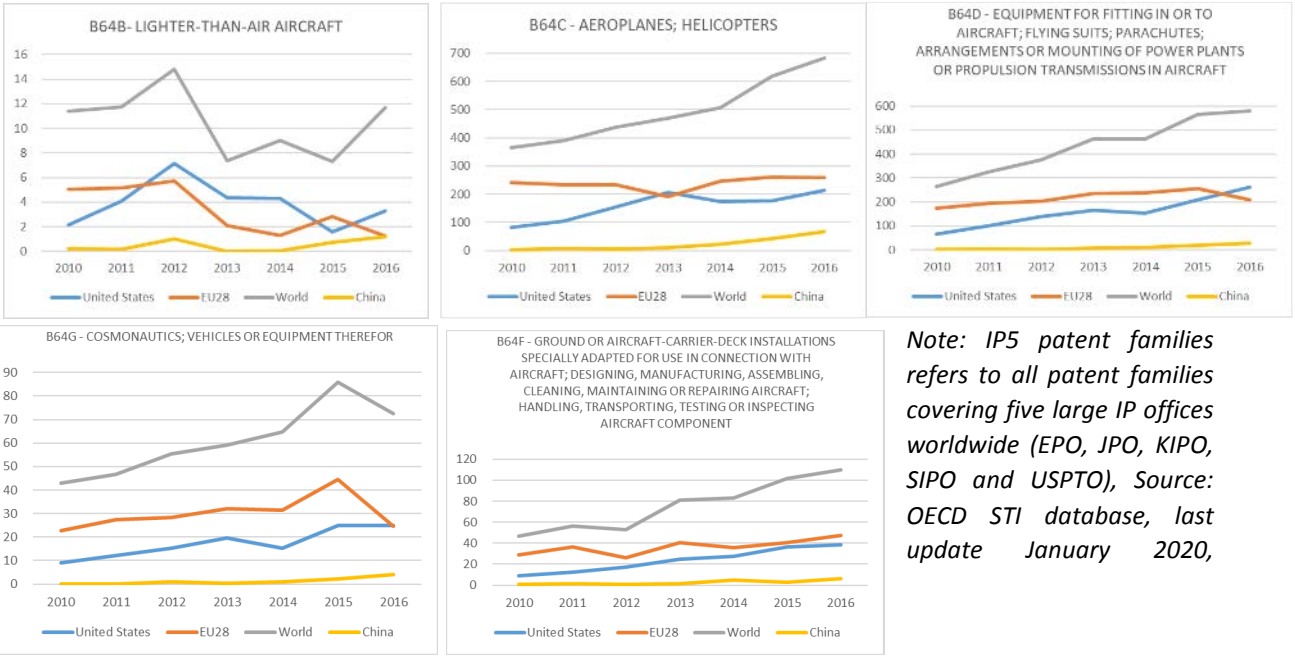
Figure - Green patent intensities of top R&D investors by industry and industry green-tech breakdown



Note: Share (left panel) and number of green patents (right panel) by industry (ICB) and environmental technology (CPC), 2012-2015. Caption: CCS = "Carbon Capture and Storage", ICT = "Information and Communication Technologies" CCAT =

"Climate Change Adaptation Technologies", ICB = "Industry Classification Benchmark". *Source: The 2019 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG RTD*

Figure: IP5 patent families in the IPC class AIRCRAFT; AVIATION; COSMONAUTICS (B64) by priority date, based on inventor's country of residence, for EU28, United Stes, China and the World



Note: IP5 patent families refers to all patent families covering five large IP offices worldwide (EPO, JPO, KIPO, SIPO and USPTO), Source: OECD STI database, last update January 2020, https://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=PATS_IPC

6. ROLE OF EASA IN RESEARCH AND INNOVATION

For new aircraft products, operations and services certification is the gateway from research and development to market uptake, as a compulsory guarantee of safety and environmental compliance. The cost, time and uncertainty related to certification are important factors in preparing new products and services.

The European Union Aviation Safety Agency (EASA) is in charge of certification in Europe, including for technologies developed in EU programmes. However, EASA participation in early R&D activities has been hindered due to the lack of dedicated resources. The solution has been addressed in the context of the revision of the EASA Regulation currently adopted by the Commission that aims – amongst other things – to strengthen the Agency's work in the field of certification.

It is important to shorten time-to-market and to decrease costs of the development and operation of new air transport products and services, notably for market-creating innovations. This would help increase the European share in the fast-growing global market despite increasing global competition.

The cycle from preparation to completion of certification tests for large aircraft can take more than five years. A six-month delay in delivery to an airline can lead to penalties for the manufacturer of up to 2% of the price of each aircraft, or cancellation of orders to the benefit of competitors. Development costs exceed EUR 10 billion for a new large aircraft. If a design issue is detected at a late stage of the certification process, the development costs can increase by 10%. The cycle design-build-test-redesign drives up costs and leads to delays.

Following the R&D stage, all new aviation products and services need to be certified for safety and environmental compliance before market uptake. Therefore, EASA participation is needed in early R&D stages to avoid issues and delays later at the certification level.

Early preparation of certification is particularly important in EU programmes supporting aviation research & innovation, deployment and investment e.g. Horizon 2020 (including Clean Sky 2 and SESAR 2020 JTIs), Connecting Europe Facility (including Single European Sky Deployment) and Structural Funds (at least 20 EU regions include aeronautics among the targeted sectors).

Research underpins the new certification processes and the new regulations, including those adopted internationally by the United Nations International Civil Aviation Organisation (ICAO), where EASA is called upon to play a more active role. The supporting technical evidence put forward firstly by one country (typically USA) is influential in the final decision. The act setting up the US Federal Aviation Administration includes provisions not only for safety regulation but also for the promotion of aeronautics and air-transportation in such a manner as to best foster their development adapted to US commercial needs.

The improvement of certification with EASA participation in early R&D activities can also contribute to three other policy objectives of the Commission, namely: strengthening Europe's role as a global actor, notably at ICAO, where global regulations are discussed among aviation authorities on the basis of evidence collected e.g. from R&D programmes. Timely involvement of EASA in R&D activities could accelerate the pace of setting European regulations and standards, which could then become a reference at global level.

The main issue relates to uncertainties in the timely and cost-efficient development and certification of innovative air transport products, operations and services if EASA is not involved at early stages of the R&I process. Certification issues increase costs and delays, put orders at risk, endanger market penetration, and reduce returns on investments for European companies. In a global market worth an estimated EUR 5000 billion over the next 20 years, each drop of 1% in market share equates to a potential loss of EUR 2.5 billion per year to the European industry.

7. CLEAN SKY BACKGROUND

7.1. The first Clean Sky programme:

The Clean Sky Joint Undertaking (JU)[78] was created in 2008 as a public-private partnership (PPP) between the European Union (EU) and the aeronautics industry. The first research programme, Clean Sky, had a value of EUR 1.6 billion and was launched under the Seventh Framework Programme, FP7. The EU and industry each contributed 50% of this budget. Clean Sky aimed to demonstrate and validate the technology breakthroughs that are necessary to make major steps towards the environmental goals sets by Advisory Council for Aeronautics Research in Europe (ACARE), the European Technology Platform for aeronautics and air transport, and to be reached in 2020:

- 50% reduction of CO_2 emissions through drastic reduction of fuel consumption.
- 80% reduction of NOx (nitrogen oxide) emissions.
- 50% reduction of external noise.

[78] http://www.cleansky.eu/

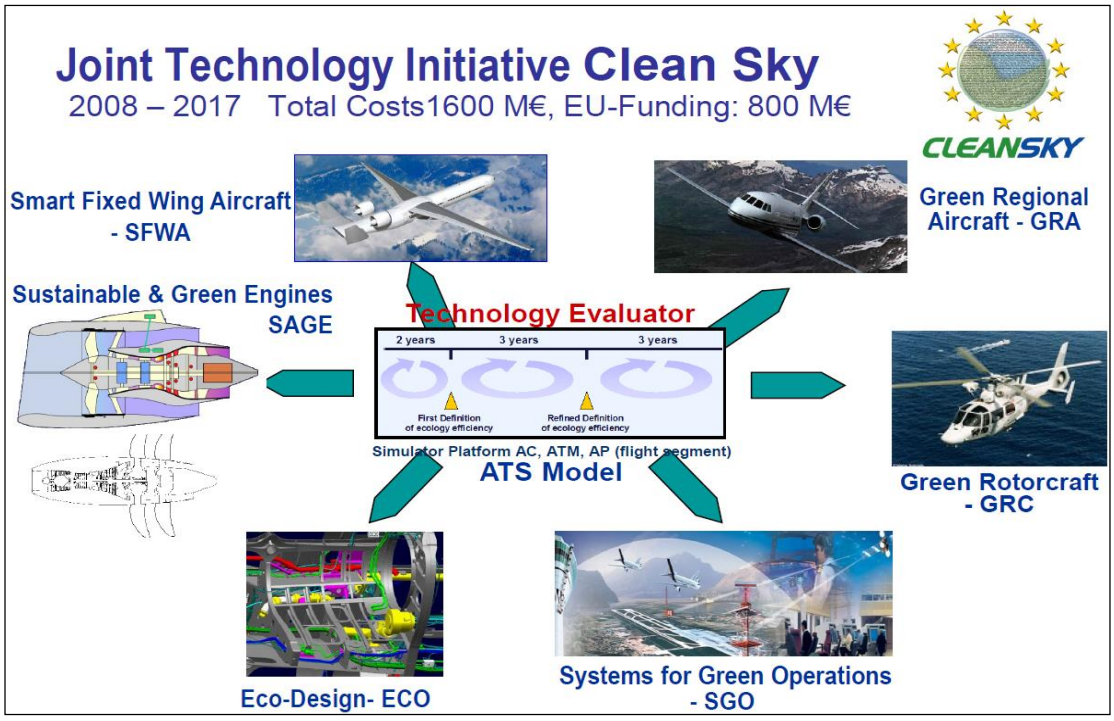
- A green product life cycle: design, manufacturing, maintenance and disposal/ recycling.

Clean Sky consisted of six Integrated Technology Demonstrators (ITDs):

1. Smart Fixed-Wing Aircraft.
2. Green Regional Aircraft.
3. Green Rotorcraft.
4. Sustainable and Green Engines.
5. Systems for Green Operations.
6. Eco-Design.

Clean Sky (FP7) had different levels of membership:

- Leaders – the 12 Leaders received 50% of the funding. Two key industry players were appointed to lead each of the six ITDs for the duration of the programme. The Leaders were listed in the Annex to the JU's founding Regulation[79];
- Associates – the 71 Associates received 25% of the funding. They were private or public organisations, selected through open calls, as permanent members of the Clean Sky JU. They committed to perform, and complete, certain essential work packages in one or more of the ITDs for the duration of the programme.
- Partners – the over 500 Partners received 25% of the funding. They were private or public organisations, selected via Calls for Proposals, that participated for certain specific tasks over a limited period in the programme.



[79] Council Regulation (EC) No 71/2008 of 20 December 2007 setting up the Clean Sky Joint Undertaking

7.2. The Clean Sky 2 programme

For the second programme under Horizon 2020, Clean Sky 2, a new Clean Sky 2 Joint Undertaking was established in 2014. It was responsible for carrying out the activities of both Clean Sky programmes until the first programme ended in 2017. The new Clean Sky 2 programme has a budget of approximately EUR 4 billion. The EU contributes EUR 1.755 billion and private members EUR 2.2 billion. Clean Sky 2 retains the three tiers of membership:

- **Leaders** – now 16 rather than 12. They receive 40% of funds.
- **Core Partners** – Associates have been re-named as Core Partners, of which 256 have been selected. They receive 30% of the funding.
- **Partners** – Selected via Calls for Partners and are not members of the JU, but contribute to a specific, time-limited, task. Over 730 organisations have been selected from the 10 calls. They receive 30% of the funding.

Clean Sky 2 aims to integrate, demonstrate and validate the most promising technologies capable of:

- increasing aircraft fuel efficiency and reducing CO_2 emissions by 20 to 30% compared to state-of-the-art aircraft entering into service as from 2014.
- reducing aircraft NOx emissions by 20 to 30% compared to 'state-of-the-art' aircraft entering into service as from 2014.
- reducing aircraft noise emissions levels by up to 5dB – using the recognised effective perceived noise levels decibel (EPNdB) standard – per operation compared to 'state-of-the-art' aircraft entering into service as from 2014.

These objectives follow-on from those of the Clean Sky programme but are however more ambitious as they use a more up-to-date reference year, i.e. 2014 rather than 2000. In particular, the fuel efficiency and CO_2 emissions reduction of up to 30% will overtake the average 10-15% reduction for a new generation of aircraft. This will accelerate twice the rate of improvement otherwise achievable and could result in 'skipping a generation' of nominal development.

An additional aim of the Clean Sky 2 programme is industrial competitiveness; it aims at global leadership for European aeronautics, with a competitive supply chain, which includes academia, research bodies and SMEs.

7.3. Interim Evaluation of the CS2 Joint Undertaking

The Interim Evaluation Report[80] of CS2 JU, published in 2017, noted that the scope of activity identified is still considered relevant. It observed that the scope of CS2 was expanded compared to that of CS1 and also highlighted that recent political developments (such as the 2015 Paris Agreement) underscore even further the need to do everything possible to accelerate the development and introduction of environmentally friendly products and services. The Interim Evaluation and stakeholder discussions held for this study highlighted a number of issues, include the following observations:

Governance: Technology Evaluator: its limited scope (i.e. only technology and only inside Clean Sky 2) is not ideal. It is also dependent on the goodwill of the CS2 SPDs to provide it with input and information. The fact that the Technology Evaluator is within

[80] Interim Evaluation of the Clean Sky 2 Joint Undertaking (2014-2016) operating under Horizon 2020, Experts Group Report https://ec.europa.eu/research/evaluations/pdf/cs2.pdf

Clean Sky 2 may also raise questions regarding its objectivity in assessing CS2's technological achievements;

Scientific Committee: This could have greater focus on technological challenges than on Clean Sky 2 internal management;

States' Representative Group (SRG): there is a need for stronger interaction between Governing Boards and its advisory bodies (States' Representatives Group and Scientific Committee). Efficient collaboration between these bodies is of critical importance to the purposeful functioning and successful outcome of the JUs. A concern expressed related to the low impact of the advisory bodies on the Governing Boards' strategic decisions. For example, the SRG did not seem to have fulfilled its full potential in ensuring a close relationship with Member States in order to influence the Clean Sky programme or to develop synergies with their national research strategies. The Commission needs to stimulate the States' Representative Group to contribute to maximising the leverage effect of research programme synchronisation. The statutory SRG is not actively contributing to Clean Sky coordination with aeronautics research funded by the Member States.

Openness: A more integrative programmatic approach to managing work would be more effective and that there should be greater transparency regarding accomplishments and funding. In particular, the Interim Evaluation highlighted:

- Easier and more proactive disclosure of the parties and their funding;
- The economic impact of the programme should be better promoted, even if this may take years to be realised;
- As a scientific programme, some questioned whether CS2 should not have been able to contribute to more research publications.

Research: Call topics should be less prescriptive and funds should be allocated to create opportunities in areas that CS2 does currently not operate;

- The evaluation suggested to optimise 'complementarity and synergy' with the demonstrator projects while nurturing the bottom-up inspired 'innovation pipeline'.

Technical: Relationships between research activity and the demonstrator objectives in the broad framework should be clearer. Alternative views of research are needed to create visibility in the intended application of each technology development, whilst alternative views of accomplishments are needed to provide an overview of technology maturity – increased insight.

Management and communications: Current administrative processes are not always suitable and add much complexity and rigidity to the management process. The following points were identified:

- Options aim at reducing administrative workload (including grant administration) should be considered.
- Concerns were raised regarding the suitability of the Delegation Agreement.
- Greater use should be made of subcontracting in high TRL projects;
- CS2 currently operates with a top-down structure. A mechanism could be in place to foster more bottom-up working.

7.4. Clean Sky 2 Interim Evaluation Recommendations

The report provided ten points regarding the operation and its environment as elements to take into consideration for the Clean Sky 2 programme, applicable for the design and implementation of large-scale aeronautics research projects, such as Clean Sky 2 at the same time it could apply for the proposed European Partnership on Clean Aviation. The solutions will depend on the combined talents of all the Clean Sky stakeholders to take the right steps for the short and long-term continuity of this programme.

The Delegation Agreement

It is clearly not in the best interests of the CS2 JU to implement the Delegation Agreement that was made with the Commission under its Establishing Regulation just for the sake of it. The Commission should motivate the JU on each point, with reference to their specific needs and the available support for these transitions. The management of the grant agreements for members and research product archive system are two areas that could be considered inappropriate to migrate but the CS2 JU is the best judge of what will best meet their needs and responsibilities.

The framework, rules and suitable derogations should be considered well in advance of the drafting of a Basic Act for future programmes.

Administrative Simplification

Other options for meeting financial controlling requirements in grant administration, at reduced administrative workload, for future large-scale projects should be explored. The governance structure and the dedicated Programme Office of the JU are unique JTI feature that should permit a higher level of trust based operation than would apply to grant management by an Executive Agency.

The Horizon 2020 Aeronautics Innovation Pipeline

The CS2JU's best efforts should be made to convert appropriate parts of the Clean Sky 2 research agenda into call topics that are much less prescriptive than their current practice. Thus, funds could be allocated – where feasible without negative impact on demonstrators objectives – to create opportunities for research in areas that Clean Sky 2 does not currently address, the gaps.

Stimulate Subcontracting

It seems obvious now that the call topics in high TRL development work are small, of short duration, and highly-specified work packages that are valued at less than a few million Euros in value. They are probably not worth the effort of the call for proposal and grant management process. There are adequate mechanisms in place for transparency of subcontracting and increased use of that approach to 'outsourcing' seems preferable. A substantial increase of efficiency should be realised.

A Holistic Approach for Aeronautics Research

The maturity of collaborative, cross border research in the aeronautics research community and the close supply chain integration of the participating entities would suggest that a more integrative programmatic approach to managing this research area would be very effective. An additional responsibility of the CSJU for a collaborative

research work programme would optimise complementarities and synergies' with the demonstrator projects while nurturing the bottom-up inspired innovation pipeline.

Increased Transparency

Finding the recipients of public funding is for Clean Sky can be found but not very easily. The accomplishments of Clean Sky 1 and the objectives of Clean Sky 2 merit substantial respect. The best place for disclosure of the parties and their funding is right next to the accomplishments of each element of the research programme as these are achievements, or goals, to be proud of. The dedicated followers of the Clean Sky electronic newsletter would be pleased to be the first to know about new grant awards.

Increase Insight

The relationships between research activity and the demonstrators' objectives in the broad Clean Sky framework are not always clear and this will not be solved by putting more detail in the breakdown of work based descriptions or the progress reports. Alternative views of research are needed to create visibility in the intended application of each technology development, to ensure that the baseline is indeed state-of-the-art and to prevent research from being duplicated. Alternative views of the *accomplishments* are needed for an overview of the technology maturity that was realised in the programme, the application (or not) of the research outcomes in the realisation of the demonstrators and the contribution of the research to a marketable product. These measurements of the ability of the partners to both choose targets and accomplish them are much stronger performance indicators than milestones and deliverables currently being monitored.

Synergies with National Research

The statutory SRG is not actively contributing to Clean Sky coordination with aeronautics research funded by the Member States. Although synergies are being created by the wake effect of Clean Sky's visibility, and the Clean Sky insights that the SRG members acquire, the Commission needs to further stimulate the SRG to contribute to maximising the leverage effect of research programme synchronisation.

Promote Economic Impact

In the end, the Clean Sky programmes will be judged on the basis of their real world impact and – although that will sometimes take decades to materialise in a new, green air transport fleet – there are still methods by which the predicted benefits of the Clean Sky programmes can be made more substantial. Improved monitoring of industrial uptake, both intended and actual, combined with the elaboration of the scope of the Technology Evaluator to include socio economic impact all promote the need for the programme.

Energise and Enable Academic Participation

Academic participation in demonstrator work tends to focus on established aeronautic research partners that have the facilities and experience to support 'high TRL' development work. Herein lies an opportunity to expand the aeronautics research support base for Clean Sky. The main avenues to exploit could be:

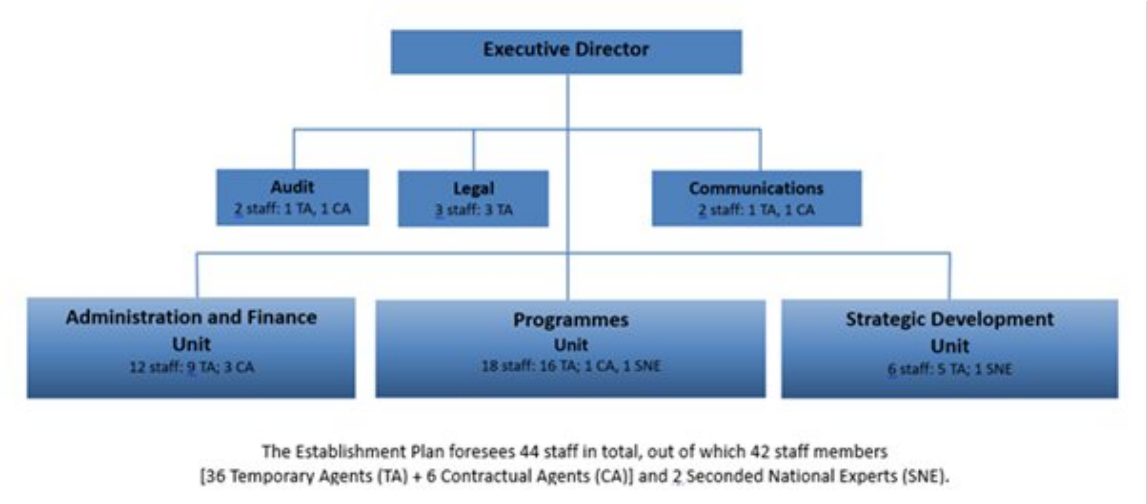
- Enable students to contribute in an industrial environment, particularly in SMEs, which would not otherwise have that luxury, as a subject for PhD research. The "Initial Training Network" approach of the Marie Skłodowska-Curie Actions (MSCA) is a good basis from which to develop a unique 'Clean Sky" approach.

- Engage with universities to explore the unexplained outcomes of Clear Sky research that the ITD/ IAPDs do not prioritise in their own scope of work.

- Import new knowledge, solutions and innovation potential by finding ideas in other sciences and sectors.

- Reward excellent academic performance in the area of transition from fundamental to applied research thru grants, awards, prizes that energize and enable the academic community.

7.5. Clean Sky 2 Joint Undertaking Organisational chart



Source: CS 2 JU

The governance of the CS2 JU comprises:

- A Governing Board, including representatives of the founding members, Core Partners and the Commission (with 50% of the voting rights); Observers of the Governing Board include the Chairs of the States' Representative Group, and Scientific Committee.
- An Executive Director, supported by three Heads of Unit (Strategy and Horizontal Affairs, Programmes, and Administration and Finance), responsible for day-to-day management.
- A series of Steering Committees responsible for the technical decisions taken within each Integrated Technology Demonstrators (ITD)/ Innovative Aircraft Demonstration Platforms (IADP) and in the Technology Evaluator as set out below.
- A Scientific Committee providing advice to the Governing Board.
- A States' Representative Group (SRG) acting as an advisory body to the Governing Board.
- Various Working Groups.

7.6. Clean Sky 2 Stakeholder analysis

Up to 40% of CS2's available funding is allocated to its 16 Leaders (and their affiliates), and up to 30% to Core Partners, leaving only 30% of the funding to be distributed through calls for proposals and calls for tenders for which industry, SMEs, research organisations and academia are all eligible.

A key objective for the CS2 JU, as defined in Council Regulation 558/2014, is the active promotion of the participation and close involvement of all relevant stakeholders from the full aviation value chain, including from outside the traditional aviation industry in aeronautics-related R&I. The Impact Assessment study analysed this, by NACE industry sector and type of entity. Note that this mapping of the partnership network is based on an identification of the participants in the partnership projects, derived from CORDA.

The results lead to a number of conclusions concerning participation in CS2:

The majority of funding went to private companies, specifically equipment manufacturers. On SMEs participation, information from stakeholders differs with ASD stating that 420 SMEs participated (with a SMEs Call for Partners funding share of 34% (of the 30% of funding reserved for Calls) with the SME average size of topics at EUR 600,000), and European Aerospace Cluster Partnership (EACP) noting that the current small allocation of funding to SMEs stifles innovation and that more funding should be allocated to foster innovation. Note that the 70% of budget that was pre-allocated to the Leaders and Core Partners included very few SMEs.

The JU has involved participation from organisations throughout the value chain, including aircraft manufactures, engine manufactures and avionic manufacturers, as well as research and educational institutions: ASD[81] indicates 373 research centres, 350 universities were involved in addition to 334 bigger industrial organisations.

The weightings of the participating organisations imply a relatively even spread in participation among the organisations, however it should be noted that if the constituent parts of Airbus were to be grouped into one entity it would clearly dominate.

Educational and scientific and research institutions are well represented although, participation is concentrated on a relatively limited number of organisations with NLR, Onera, CIRA, DLR, and *Fraunhofer Gesellschaft* (FhG) being the dominant research organisation, and the University of Nottingham and *Technische Universiteit Delft* being the dominant higher education institutions.

8. THE H2020 EUROPEAN AVIATION RESEARCH LANDSCAPE

Under H2020, two Joint Undertakings are active in the aviation research area. Both these Joint Undertakings have their own specific objectives.

8.1. SESAR

SESAR is dedicated to optimising air traffic management in Europe – in particular in terms of capacity, cost, and safety. This means air traffic management infrastructure, ground and air operations, and to a limited extent aircraft system functionalities. It is strongly linked to the Single European Sky policy.

Most of the industrial partners involved in SESAR have also a prominent role in Clean Sky 2, but SESAR has other important partners, such as Eurocontrol and representatives of airports who are not in Clean Sky 2.

For the future, air traffic management (ATM) has great room for efficiency improvements by progressing with the implementation of the Single European Sky

[81] ASD, 2019

(SES) and further R&I on the Digital European Sky. The fragmented, national organisation of ATM, and the ineffective regulatory framework hinder the technical solutions to be deployed. The legislative process for improving SES has been blocked at Council level for over six years. The proposed European Partnership on Integrated ATM would continue the work of the current SESAR Joint Undertaking. An optimised ATM could lead to a 5 to 10% reduction of emissions if deployed.

8.2. Clean Sky 2

Clean Sky 2 is about optimising the aircraft performance, in particular with regards to environment, [fuel] efficiency and emissions. Clean Sky 2 can be considered to be the predecessor of the Clean Aviation initiative.

The Clean Sky 2 Joint Undertaking has the following objectives:

- to contribute to the finalisation of research activities initiated under Regulation (EC) No 71/2008 and to the implementation of Regulation (EU) No 1291/2013, and in particular the Smart, Green and Integrated Transport.

- to contribute to improving the environmental impact of aeronautical technologies, including those relating to small aviation, as well as to developing a strong and globally competitive aeronautical industry and supply chain in Europe. This can be realised through speeding up the development of cleaner air transport technologies for earliest possible deployment, and in particular the integration, demonstration and validation of technologies capable of:

    - increasing aircraft fuel efficiency, thus reducing CO2 emissions by 20 to 30% compared to 'state-of-the-art' aircraft entering into service as from 2014;

    - reducing aircraft NOx and noise emissions by 20 to 30 % compared to 'state-of-the-art' aircraft entering into service as from 2014.

8.3. Cooperation

A memorandum of understanding between the two current H2020 partnerships was signed in December 2015 to exploit areas of mutual interest. The cooperation is leading to:

- coordinating call topics and check if parallel activity is underway, and if needed adapt or even drop the topic in preparation of the Annual Work Plans
- Information exchanges from projects where the analysis of topics shows a benefit to coordinate
- joint communications and coordination of messages
- Extra technical reviews to ensure the complementarity and avoid duplication.
- The two Scientific Committees are 'connected' and exchanges are encouraged
- Experts and reviewers are shared

For the future, some initial discussions between the two JUs including a number of private stakeholders have taken place to analyse possible areas of shared/joint interest between the proposed Integrated Air Traffic Management and Clean Aviation partnerships under Horizon Europe.

A number of areas of possible joint demonstration were identified. The cooperation between the two future programmes could be intensified to ensure that progress in aircraft technology is matched by and is in step with the evolution of ATM and infrastructure capabilities. This is particularly relevant given the evolution in the objectives of the ATM partnership towards 'Digital Skies' including areas of automation and autonomy in aircraft and/or ground systems.

The implementation of these joint demonstration activities can be clarified and more areas of cooperation can be defined, once the two programmes are up and running under Horizon Europe. A new memorandum of co-operation between the two new partnerships would then be established.

8.4. Collaborative research

Collaborative research in aviation and aeronautics has been funded by the EU since the fourth framework programme that started in 1994. Since the establishment of Clean Sky, collaborative research projects on aviation have continued to be funded under FP7 and then H202082. This is mainly because the projects' focus did not fall under the scope of the Joint Undertakings. For example, projects dealing with issues not covered by Clean Sky – for example, safety, international co-operation83, aviation within multi-modal transport, or providing a snapshot of EU aviation research infrastructure – or because they concentrated on more fundamental research at a lower TRL. Under H2020, apart from a few Coordination and Support Actions (CSA), the Commission has delegated the projects' management to its Innovation and Networks Executive Agency (INEA)[84].

8.5. Note: National research programmes

Next to the European aviation research and innovation programmes there are national aviation R&I programmes with significant budgets such as those of Germany (LuFo), France (CORAC) and the UK (ATI), with a budget of between EUR 2-3 billion for a period of five years.

However, an external study shows that these programmes were not sufficiently coordinated, neither at national level nor at European level. In some cases, national interest in local employment and technology, led to non-complementary policies, with a possible duplication of activities. The consultation showed that the situation has improved, however stakeholders recognised that there is room for further improvement.

9. STAKEHOLDER REACTION TO THE CLEAN AVIATION INITIATIVE

9.1. Joint Declaration of European Aviation Research Stakeholders

The earliest official recognition of the value of the Clean Aviation initiative by the private sector came under form of a "Joint Declaration of European Aviation Research

[82] https://ec.europa.eu/inea/sites/inea/files/aviation_brochure_2019-web.pdf

[83] Thirteen non-EU countries have been involved in international co-operation during H2020, including .Japan, China, Canada, United States, Russia and Brazil. https://ec.europa.eu/inea/sites/inea/files/aviation_brochure_2019-web.pdf , p36

[84] https://ec.europa.eu/inea/

Stakeholders"[85] handed over to Jean-Eric Paquet, Director-General for Research and Innovation, European Commission at the 2019 Le Bourget Airshow.

It was signed by twenty-three Aeronautics Industry leaders, Research Organisations and University Associations from across Europe to express their strong commitment to a future European partnership leading to a deep decarbonisation of aviation by 2050.

9.2. Shared vision

This Joint Declaration was further developed into a "shared vision", published in January 2020, that recognised that the sector the sector has a duty to act and the power to lead, given support of the European Union, in bringing aviation in line with the European Green Deal.

This shared vision was signed by a broad spectrum of industrial parties, universities, research and technology organisations, EASA, and several associations such as Pegasus, EREA and EASN.

This shared vision already underlined several of the key success factors that have also been addressed in this Impact Assessment.

- The importance of establishing an eco-system for aviation and actively seek and develop synergies with other European Partnerships, EU research programmes, national research and innovation programmes.

- The focus on integration, demonstration and validation of technology.

- The need to involve the wider aviation community to raise awareness, and instil the necessary confidence for long-term investments needed for product development, and to build confidence among airlines and operators.

- The need to align the technical research effort with policy and legislative elements and new infrastructure provisions required for early market acceptance efforts.

- Strong pro-active European Union support on global regulation, standards for and certification of future products, supported through a strong and strategic alignment with EASA.

It also contained a first brief description of the technical dimension of the Clean Aviation initiative including an integrated roadmap comprises four key thrusts aiming at the selection of best approaches and solutions for maturation:

- Full Electric Aircraft and Rotorcraft – maturing technologies towards demonstration of novel configurations, on-board energy concepts and flight control in the small/ commuter segment.

- Hybrid Electric Aircraft – driving research into ultra-efficient aircraft structures, configurations, novel power sources and management, and their integration; aiming predominantly at regional and short-range applications.

[85] https://www.cleansky.eu/news/aviation-industry-declares-commitment-to-future-clean-aviation-partnership

- Ultra-efficient Aircraft and Gas Turbines – to address the short, medium and long-range needs with highly integrated, ultra-efficient gas turbines.

- Sustainable Aviation Fuels-enabled Aircraft – driving the capability of aircraft and engines to fully exploit the potential of both drop-in and non-drop-in alternative low and zero carbon fuels.

9.3. Strategic Research and Innovation Agenda

The Shared Vision was intensely debated between private stakeholders, and with the Commission.

The private sector formed a working group, called CS3PG, responsible to deliver in a timely, open and transparent manner an aligned position from the European aviation stakeholders of an ambitious programme, in support of the Commission‘s strategic planning and preparatory work towards a legislative proposal on a potential European Institutionalised Partnership on Clean Aviation under Article 187 Treaty on the Functioning of the European Union.

CS3PG members include industrial companies, both large and small; academia; research organisations from across the EU; seven[86] of the 34 stakeholders preparing the SRIA are not members of the current partnership, including three associations from academia; and Member States.

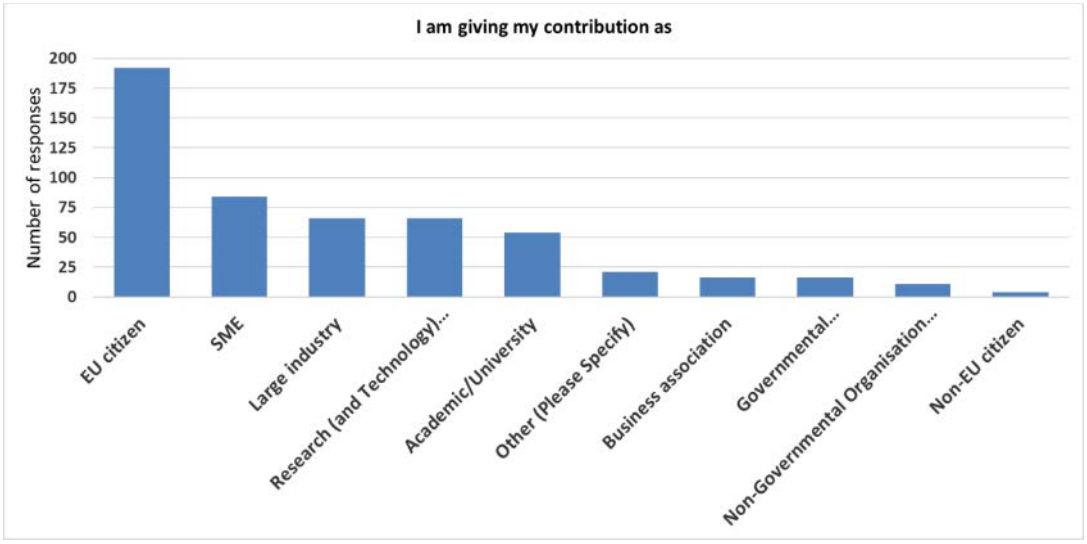
This significant and sustained effort led to a Strategic Research and Innovation agenda that was released on 1 July 2020.

9.4. Public consultation

The CS3PG organised a public consultation on the SRIA from 15 May -11 June 2020. The 530 respondents from 31 different countries provided more than 1500 comments contributed to the CS3PG analyses of the SRIA leading in some cases to new lines of approach.

Remarkable the high number of SMEs (16%) and private citizens (36%) that provided their feedback and showed interest in the potential European Partnership for Clean Aviation. This indicates that the survey was broadly communicated and reached also the general public and shows that the general public gives importance to the subject.

[86] Association of European Research Establishments in Aeronautics (EREA); European Aeronautics Science Network (EASN); European Union Aviation Safety Agency (EASA); KU Leuven; Lufthansa Technik; Pegasus (Partnership of the European aerospace universities); Pipistrel (an SME)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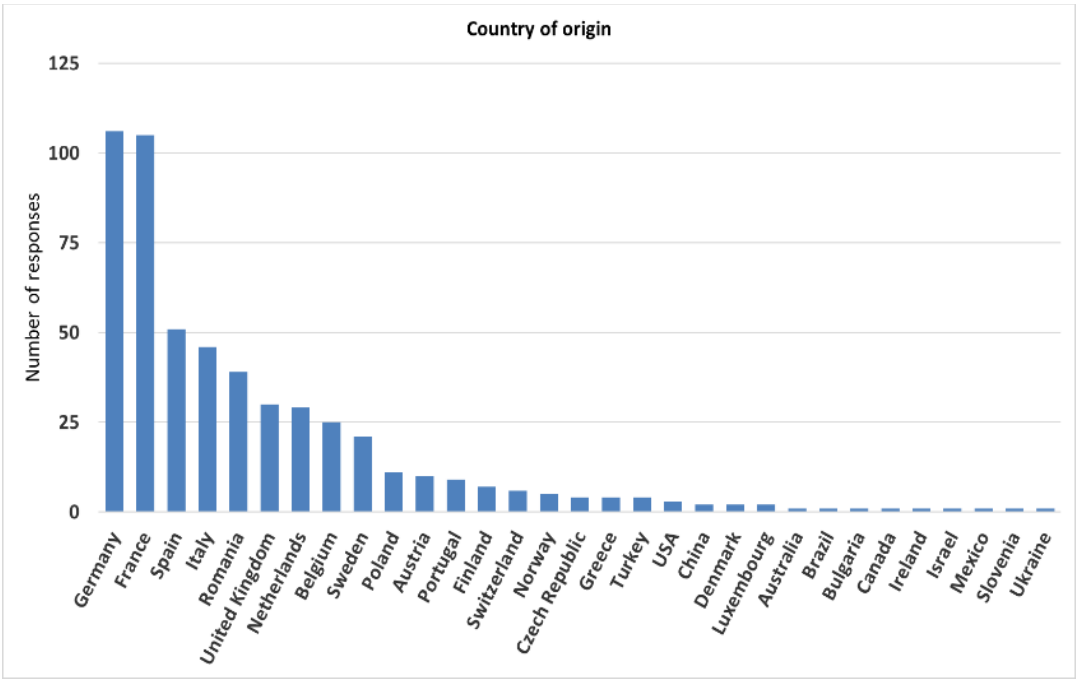
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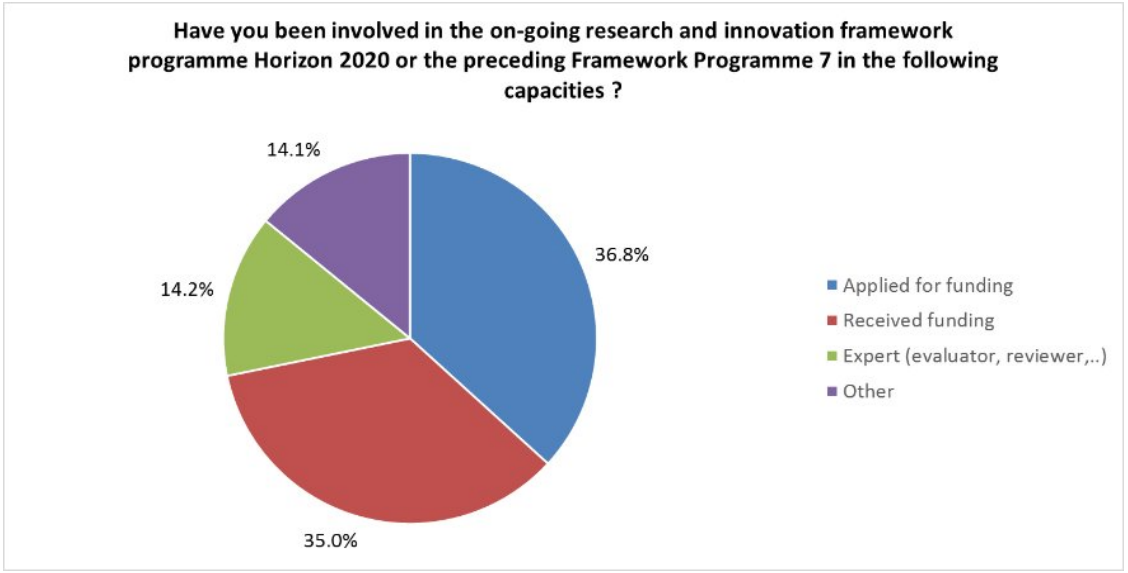
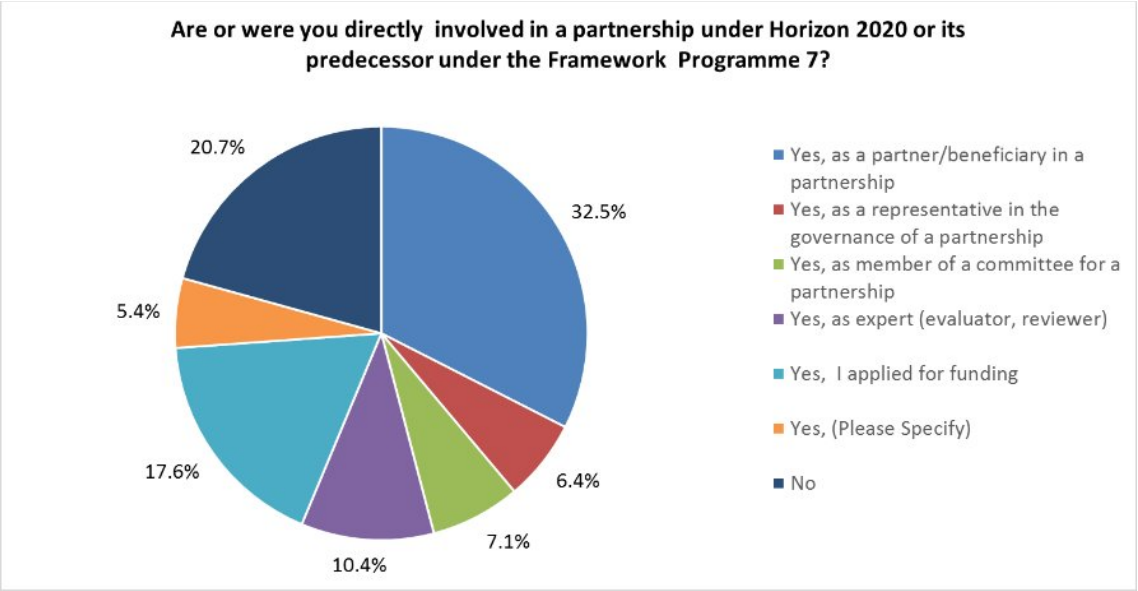
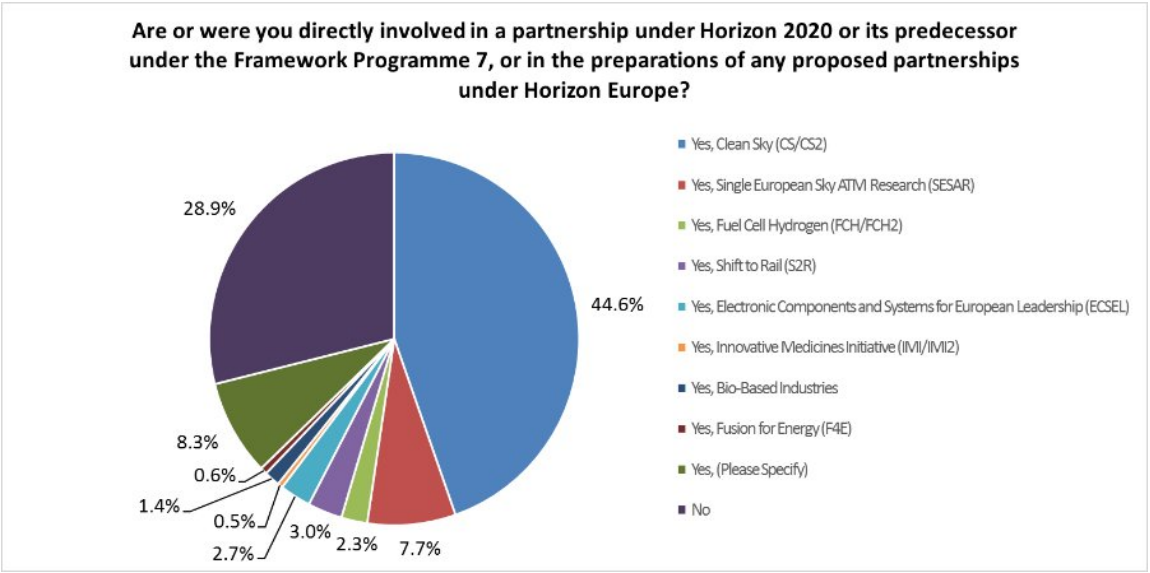
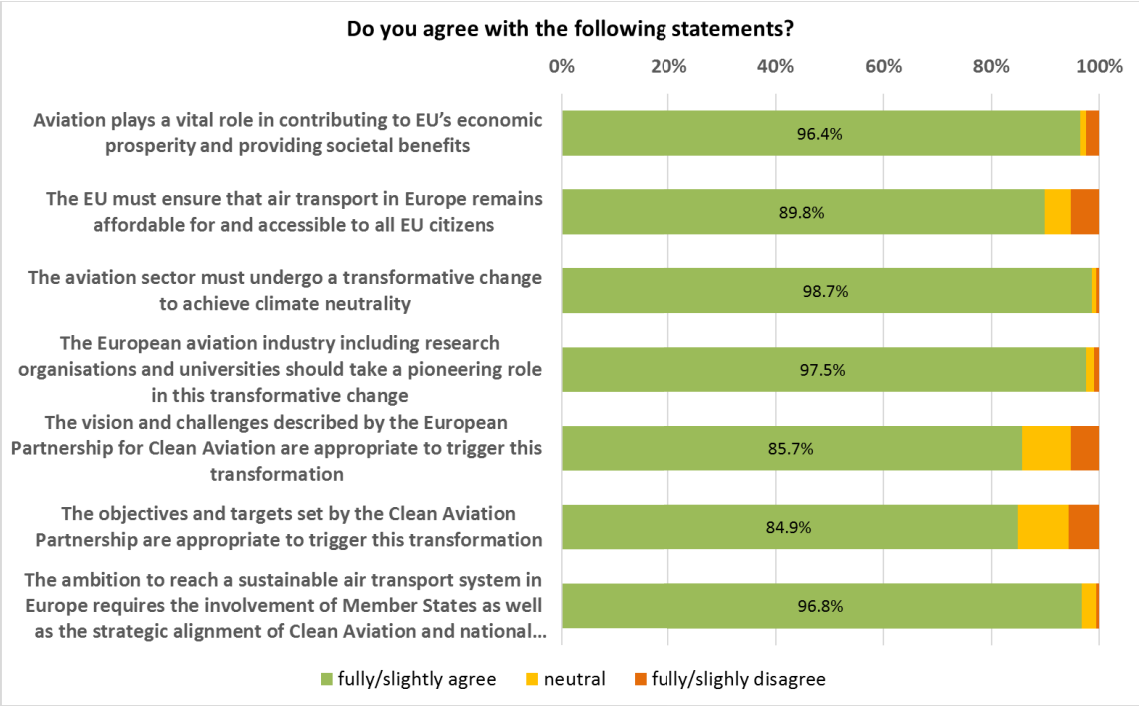
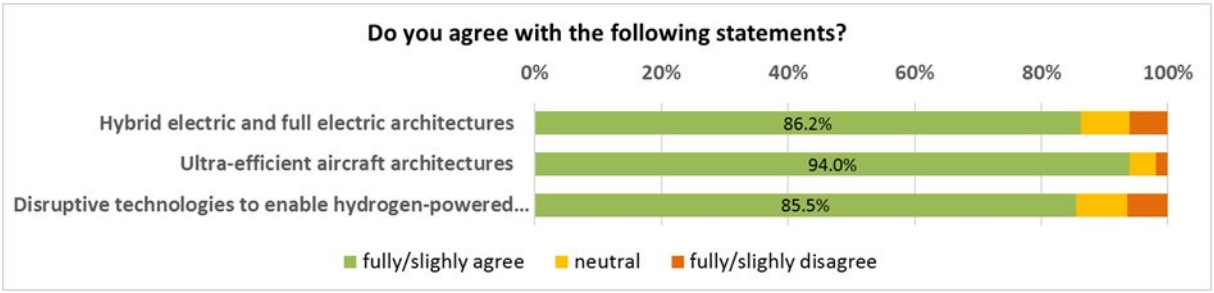
Ukraine

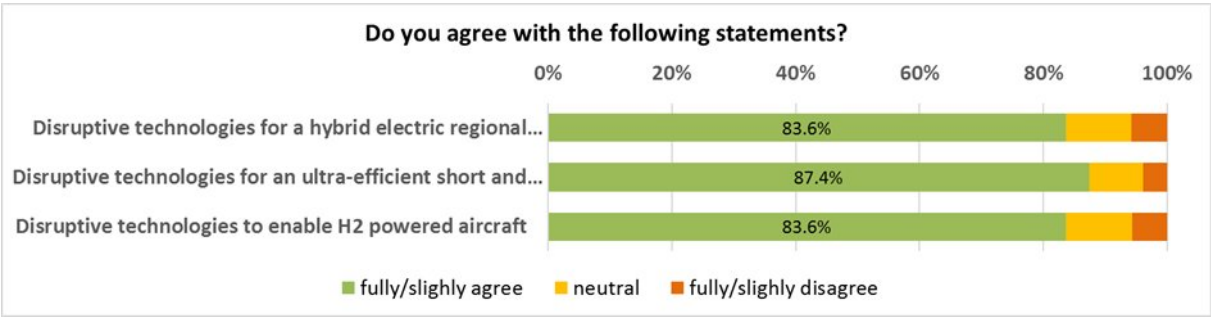

Have you been involved in the on-going research and innovation framework programme Horizon 2020 or the preceding Framework Programme 7 in the following capacities ?
14.1%
36.8%
14.2%
35.0%
Applied for funding
Received funding
Expert (evaluator, reviewer,..)
Other


Are or were you directly involved in a partnership under Horizon 2020 or its predecessor under the Framework Programme 7?
20.7%
32.5%
5.4%
17.6%
6.4%
7.1%
10.4%
Yes, as a partner/beneficiary in a partnership
Yes, as a representative in the governance of a partnership
Yes, as member of a committee for a partnership
Yes, as expert (evaluator, reviewer)
Yes, I applied for funding
Yes, (Please Specify)
No


Are or were you directly involved in a partnership under Horizon 2020 or its predecessor under the Framework Programme 7, or in the preparations of any proposed partnerships under Horizon Europe?
28.9%
44.6%
8.3%
0.6%
1.4%
0.5%
3.0%
2.3%
2.7%
7.7%
Yes, Clean Sky (CS/CS2)
Yes, Single European Sky ATM Research (SESAR)
Yes, Fuel Cell Hydrogen (FCH/FCH2)
Yes, Shift to Rail (S2R)
Yes, Electronic Components and Systems for European Leadership (ECSEL)
Yes, Innovative Medicines Initiative (IMI/IMI2)
Yes, Bio-Based Industries
Yes, Fusion for Energy (F4E)
Yes, (Please Specify)
No







10. POTENTIAL LINKS AND SYNERGIES WITH OTHER PARTNERSHIPS AND EU PROGRAMMES AND INITIATIVES

The Clean Aviation Partnership will work towards establishing strategic synergies with other European Partnerships and Horizon Europe cross-cutting initiatives:

Sustainable Aviation Fuels

Sustainable aviation fuels (SAF) will make a crucial contribution to mitigating the current and expected future environmental impacts of aviation. Thus, it is important that EU initiatives related to sustainable [bio]-fuels include a dedicated area to address the development, production and deployment of bio- or synthetic aviation fuels as well as the logistics and required adaptations of the airport infrastructure.

Clean Hydrogen

Fuel cells represent a unique opportunity to reduce CO_2 emissions thanks to their high system efficiency of about 50% and their higher power density compared to batteries, as well as not releasing NO_x or particulates. They have also a very low noise footprint. It is necessary, to prepare the next generation of innovations, products and services, in close alignment with the Clean Hydrogen and Fuel Cell Initiative, to ensure a European technology breakthrough of this value chain in air transportation.

European battery research

Batteries are a valuable solution for full or partial electrification through hybridisation, mixing electric engines with on-board electricity production. As fundamental battery research cannot be addressed in the Clean Aviation programme, European battery research should include a dedicated area to accelerate towards the very high requirements for aviation to contribute their potential towards climate neutral aviation.

Integrated Air Traffic Management

As autonomous operations are expected to be key drivers for the next generation of aircraft, the research programme activities dealing with the flight management of the vehicle need to be well aligned with research aspects and activities regarding air traffic management as tackled in the SESAR 2020 Programme and the Integrated Air Traffic Management Partnership proposed under Horizon Europe.

Artificial Intelligence

Artificial intelligence will be required to contribute to achieve the ambitious goals of Clean Aviation, starting from design, manufacturing, testing and certification, operation and maintenance of aircraft as well as efficient and secure passenger management.

Electronics / Semi-conductors

The proposed Clean Aviation Partnership agenda relies on several complementary research activities proposed under the Electronic Components and Systems for European Leadership Joint Undertaking (ECSEL JU) regarding electronic components and systems and semiconductor manufacturing.

Advanced Materials and Structures

New materials, their future production processes and assembly techniques are key complementary contributors to improved performance and reduced environmental footprint. An effective systemic approach between Clean Aviation and several Horizon Europe initiatives, such as Made by Europe, Climate Neutral and Circular Industry and the European Institute of Innovation and Technology (EIT) Manufacturing and EIT Raw Material is key to maximise the results.

Security

As in many other sectors, increased automation and autonomy in systems of aircraft are expected to significantly increase the competitiveness. Security and increasingly cybersecurity are prerequisites for making use of the fast-increasing potential of new automated functions in aviation. Large-scale use of digital data/ data transfer e.g. wideband data link between aircraft and ground will require an increased focus of cybersecurity. Here the inherent safety and security of the on-board systems is at stake. Therefore, the fundamental issues of cyber resilience will be tackled in the Global Challenges Digital Europe and dedicated Horizon Europe initiatives, but it needs to be

ensured that their respective work programmes will assign appropriate topics and that their resources will cover the challenging aviation specific requirements.

11. CLEAN AVIATION RESPONSES TO CLEAN SKY 2 PERCEIVED SHORTCOMINGS

As explained in the impact assessment, the H2020 CS2 Joint Undertaking has a number of weaknesses that should be addressed when establishing a new Article 187 Partnership.

The most prominent weaknesses are:

- The scope of the Clean Sky 2 Joint Undertaking research and innovation programme has demonstrated being **too broad**; lacking the focus needed for achieving strategic disruptive results and for making a substantial contribution to the objectives described in the Clean Sky 2 Basic Regulation. The research effort revolves around incremental improvements to existing technologies and not on new technologies with potential step change capabilities.
- Further shortcomings are its **governance** with a Governing Board overloaded with administrative issues, a scientific body and a state representatives group with purely advisory functions, and a technology evaluator embedded in the Joint Undertaking and dependent on the goodwill of the private partners for information.
- It lacks **openness** with 70% of the Clean Sky 2 budget pre-allocated to the leaders (40%) and core partners (30%), leaving only 30% of the budget for open calls. This strongly limits flexibility and the possibility for new parties (including SMEs) to join the partnership.
- The funding imbalance between traditional calls (20%) and Joint Undertaking funding allocation (80%).

The analysis shows that the institutionalised European Partnership option would be the best-suited, provided it takes into account all lessons from the experiences with Clean Sky and Clean Sky 2 – both positive and negative. In particular:

- The dedicated programme office providing in-house programme management capacities would allow **closer monitoring and swift adaptation** of the research effort,
- Demonstrator selection will be based upon **open calls** (no pre-allocated budget), including criteria to assess real-world impact and providing a business case for market uptake. This should also lead to new Clean Aviation **partners outside the core players** (academia, SMEs, countries without a strong aviation industry) to bring technologies that are not common knowledge for aviation.
- In addition, much more attention will be paid to embedding supporting functions such as **environmental and safety certification**, (close collaboration with the European Union Aviation Safety Agency is envisaged) also on an international level, into the research effort. Managing these aspects in parallel to the research effort, instead of the current sequential approach, would ensure that all conditions are met for swift market introduction at the end of the programme.
- A strong governance is envisaged under the JU basic act to monitor progress with the help of an **independent assessment instrument** and steer the research effort on basis of achieved results, and to **maximise synergies with other initiatives** such as the initiatives on batteries or hydrogen, and with national research programmes.

- The strong involvement of the EC services will ensure alignment with EC priorities and policies.

A list of the perceived shortcomings of Clean Sky 2, as outcome of the mid term evaluation, is included in the impact assessment. This list is copied below with a brief description of how these shortcomings could be prevented in future by the Clean Aviation partnership.

Clean Sky 2
Project participation rates are distributed in favour of a relatively limited number of organisations. A large share of the funding is reserved to Leaders and Core Partners. There is a risk that SMEs or EU-13 Member States participants may find it difficult to join it, as project participation in the CS 2 JU is concentrated among a relatively limited number of players reflecting the composition of leaders and core partners
collaborative aviation R&I, over the last decade, compared to the large budget for demonstration, has adversely affected the availability and spectrum of lower technology readiness levels
Aspects of the design and implementation of the CS 2 JU have limited effectiveness: certain aspects of its governance arrangements such as the role of the States Representative Group
negative impact on the “time to market”, which benefits from the assessment of potential safety risks and environmental standards related to certification of new products and technologies. Safety topics and certification issues regarding
Similarly, elements of CS2 JU procedural infrastructure are constraining the R&I effort. There is arguably a need for greater flexibility and for reduction in the administrative burden. There are also some communication improvements that could be made
It is not always easy to establish what the precise outcomes of CS1 and CS2 have been

Clean Sky 2	Clean Aviation proposal
There is a lack of multi-level policy coordination, whilst horizontal coordination between research, technology and innovation policies is good in the European aviation sector	All project and demonstrator selection through open calls.
Although some Member States have quite elaborated aviation research programmes, one of the weaknesses of the European research landscape is that there is no systematic alignment, and no single roadmap, of the various aviation related research programmes leading to overlaps,	Exploit synergies with other partnerships, and research initiatives that could contribute to Clean Aviation.
Overall, the CS2 programme has not contributed to the alignment of national and EU aviation research programmes – apart from creating some synergies with EU regional funds as outlined in the CS2 2018 Annual Activity Report. In addition, efforts to develop more electric systems as well as composite aero structures were often duplicated by partners, while opportunities for synergies were not exploited	collaborative research and the Clean Aviation initiative. Strong focus of the Clean Aviation partnership on high TRL demonstrator projects while collaborative research will concentrate on low TRL research mainly unrelated to the
	Updated Governance structure giving the governing board the direct responsibility for maintaining and evolving the strategic research and innovation agenda, for monitoring projects and demonstrators
	All other groups such as Impact assessment group, states representatives group, stakeholders group to report directly to the Governing Board.
	EASA structurally involved from the outset of the initiative for monitoring and impact assessment, advice on safety related issues and assessing the potential environmental performance of the new technologies
	Simplification of the governance and increased focus on the management of the research programme and projects instead of administration that could be dealt with by the Executive Director of the Programme Office
	Increased transparency and evaluation of progress against the Green Deal ambitions and deadlines. Demonstrator projects could be expected to introduce realistic roadmaps for bringing their technologies to market

Clean Aviation proposal
Increased involvement of the Commission to ensure the link between European policy initiatives and research.
Development of a European strategic research and Innovation roadmap. Involvement of ACARE as stakeholders group in identifying opportunities for synergies and cooperation.
States Representatives Group with dedicated mandate to ensure the alignment of the European research effort with the national research programmes.
Dedicated related communication effort describing European research needs which could be met by national research activities.