

The position of Research and Technology Organisation (RTOs) in the EU Framework Programmes

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Abstract:

The aim of this paper is to give an overview of the position of Research and Technology Organisations (RTOs) in the EU framework programmes (FPs). EU grants to RTOs are relatively much larger than RTOs' share in the total number of FP participants. RTOs have a leading position and driving role in FPs' multi-disciplinary and collaborative projects. FP projects where RTOs are active have a larger participation from industry than projects without RTOs. In this analysis, the list of RTOs has been limited to the members of EARTO (the European Association of Research and Technology Organisations) which, in this context, is a subset of the Research Organisations' (REC) category in the FPs. The analysis is based on official available dataset from the eCorda contract database for FP7 and Horizon 2020. It demonstrates the key role played by RTOs as ecosystems' connectors within such competitive funding programmes, especially in collaborative projects at European scale.

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Executive Summary – RTOs’ Position in EU FPs in a nutshell (focus on H2020)

<p>1. EARTO members strongly contribute to EU FPs</p>		
<p>EARTO members received 8% of H2020 EC funding</p> <p>while EARTO members represent 1% of all H2020 beneficiaries</p>	<p>Projects involving at least one EARTO member received 44% of H2020 EC funding</p>	<p>15% of all H2020 projects include at least one EARTO member</p>
<p>2. EARTO members foster industry participation in EU FPs’ projects</p>		
<p>The average industrial involvement in H2020 projects increases to 34% when EARTO members are involved in the project from 24% when they are not part of the consortium</p>		
<p>3. EARTO members are involved in EU FPs’ large multi-stakeholders collaborative projects</p>		
<p>H2020 projects with EARTO members receive €5.4m of EC funding on average in H2020</p> <p>while the average EC funding per project in H2020 is €1.9m</p>	<p>H2020 projects with EARTO members count 15 partners per project on average in H2020</p> <p>while the average in H2020 is 5 partners per project</p>	
<p>4. EARTO members strongly contribute to the H2020 Industrial Leadership pillar</p>		
<p>In the Industrial Leadership pillar EARTO members count 8 of the top 10 participants in terms of EC contribution</p> <p>and 7 of the top 10 coordinators while there are 14,000+ beneficiaries in total in this pillar</p>	<p>In the Industrial Leadership pillar 27% of the projects include at least one EARTO member</p> <p>and those projects received 61% of the EC funding available in this pillar</p>	<p>In the Industrial Leadership pillar EARTO members received 13% of H2020 EC funding available</p> <p>while EARTO members only represent 1% of the beneficiaries in this pillar</p>
<p>5. EARTO members actively contribute to the H2020 Societal Challenges pillar</p>		
<p>In the Societal Challenges pillar EARTO members count 7 of the top 15 participants in terms of EC contribution</p> <p>while there are 21,000+ beneficiaries in total in this pillar</p>	<p>In the Societal Challenges pillar 24% of the projects include at least one EARTO member</p> <p>and those projects received 56% of the EC funding available</p>	<p>In the Societal Challenges pillar EARTO members received 8% of H2020 EC funding available</p> <p>while EARTO members only represent 0.8% of the beneficiaries in this pillar</p>
<p>6. EARTO members take the lead in EU FPs’ projects</p>		
<p>Each EARTO member receives €577k of EC contribution per project on average in H2020</p> <p>while the average EC contribution per participation is €384k</p>	<p>EARTO members coordinate 5% of all H2020 projects</p>	<p>EARTO members coordinate 1/3 of all H2020 projects in which they participate</p>

1. Introduction

The EU framework programmes (FPs) are the biggest competitive arenas for Research Development and Innovation (RD&I). The seventh framework programme (FP7) distributed funds in the period 2007-2013 and Horizon 2020 (H2020) allocated funds in the period 2014-2020. The funds are awarded after a thorough evaluation and the success rate for receiving funding for a project proposal has fallen from 19% in FP7 [ref 14¹] to under 12% in H2020 [ref 8 & 16]. The proposals that receive funds show high quality and the organisations that are behind the proposals are considered to be the best in Europe to solve the targeted challenges.

Analysis of participation and funding has been done on a regular basis on the initiative of both the European Commission [ref 7, 8] and national authorities [ref 15]. These analyses have been largely focused on the participation of nations, the grouping of beneficiaries and on individual beneficiaries. Participation in the EU Framework Programme is divided by type of beneficiary [ref 9]. The larger groups of beneficiaries are higher or secondary education establishments (HES), private for-profit entities (PRC) and research organisations (REC).

Several reports discussing the participation of research organisations in the FPs focus on the REC category, but the role of Research and Technology Organisations (RTOs) has never specifically been looked into. The difficulty has been to find out which research organisations can be classified as RTOs without carrying out a thorough and demanding analysis of more than 5,000 research organisations that have received funding in H2020 and FP7 so far. In this analysis, we have chosen to use the list of EARTO members as a proxy for the list of RTOs participating in the framework programme, EARTO being the European Association of Research and Technology Organisations [ref 3].

1.1 Methodology

This paper provides information on RTOs' participation to the EU RD&I Framework Programmes so far, looking both into FP7 and H2020. The data used for this analysis has been gathered from the European Commission eCorda (external Common Research Datawarehouse) contract database October 2020 [ref 6] for the H2020 data, and from October 2014 [ref 5] for the FP7 data. The contract database of eCorda contains official available information about grant agreements in the FPs, and is updated twice a year (autumn and spring). The data sample presented and analysed in this paper includes 25,238 projects with an EU contribution of €45bn for FP7 and 30,630 projects with an EU contribution of €57bn for H2020.

In this analysis, we used the list of EARTO members as proxy to RTOs. Founded in 1999, EARTO promotes RTOs and represents their interest in Europe. The EARTO network counts over 350 RTOs in more than 29 countries. EARTO members represent 150,000 highly-skilled researchers and engineers managing a wide range of technology infrastructures [ref 3]. It is important to note that EARTO membership enlarged between FP7 and H2020. To ensure comparability between the data for FP7 and H2020, the actual list of EARTO members of 1st January 2021 has been used retrospectively for the FP7 data.

All EARTO members that participated in FP projects were tagged in the eCorda database, so that specific data on their participation in the Framework Programme could be singled out and analysed. They represent 1% of the total number of beneficiaries in the FP. Most of them are classified in the REC (Research Organisations) category. For the EARTO members that consist of more than one legal entity, these entities are combined into one organisation. This is the case for Helmholtz, Tecnalia, RISE, SINTEF, Fraunhofer and Imec.

Finally, it is also important to note that in the H2020 data, the focus has been put on the three pillars of the programme (Excellent Science, Industrial Leadership and Societal Challenges). However, the total figures presented for H2020 also include other sub-programmes such as Euratom, Science with and for Society, Spreading Excellence and Widening Participation.

¹ These numbers between square brackets refer to the references listed on page 16.

1.2 Main Findings

This analysis based on the eCorda database first focuses on the overall participation of RTOs in the FPs, then on the sub-programmes that are associated with collaborative research and industry participation. The analysis will also show RTOs' role as coordinators of the projects in which they participate. These are the main findings:

- **RTOs are major beneficiaries of such programme: despite representing only 1% of the large number of participants, they receive about 8% of the EU contribution in the framework programmes**, and the projects they participate in receive a much larger share of the total EU contribution: 43% in FP7 and 44% in H2020.
- **The data specifically highlights RTOs' active role in the collaborative pillars of the framework programmes.** 82% of the FP7 EU contribution received by EARTO members was for projects in the Cooperation pillar, and 72% of H2020 EU contribution received by EARTO members was for projects in the Industrial leadership (35%) and the Societal Challenges (37%) pillars.
- **RTOs' projects tend to be large multi-stakeholders' collaborative projects.** In H2020 for instance, projects with EARTO members receive €5.4m EU funding and count 15 partners per project on average, which is far above the H2020 average of €1.9m and 5 partners per project.
- **In particular, RTOs play an essential role to ensure industry participation in the EU FPs, finding the relevant industrial partners to be involved in EU projects.** The average industrial involvement in FP projects increases to more than 32% when RTOs are involved in the project from between 17% (FP7) and 26% (H2020) when they are not part of the consortium.
- **RTOs also take the lead and often adopt a coordinator's role in the FP projects in which they participate.** They also coordinate roughly 1/3 of the projects in which they participate, that is to say more than 5% of all H2020 projects so far.

2. RTOs' role in the RD&I Ecosystem

The core mission of RTOs is to harness fundamental science to develop knowledge and technology in the service of innovation, to improve quality of life and strengthen economic competitiveness with high impact for society. [ref 4] RTOs are in between the public and private spheres, and they are not-for-profit organisations: their revenues are re-employed to fund new innovation cycles. They mainly carry out applied research, supporting both fundamental and close to market research with the aim to bridge the gap between basic science and systemic market solutions. RTOs thus distinguish themselves from universities whose predominant activity is education, and from enterprises, whose predominant activity is the production and sales of goods and services, but they have close links with them both, as well as with local, regional and national governments for which they have the key role to provide policy advice and foresight.

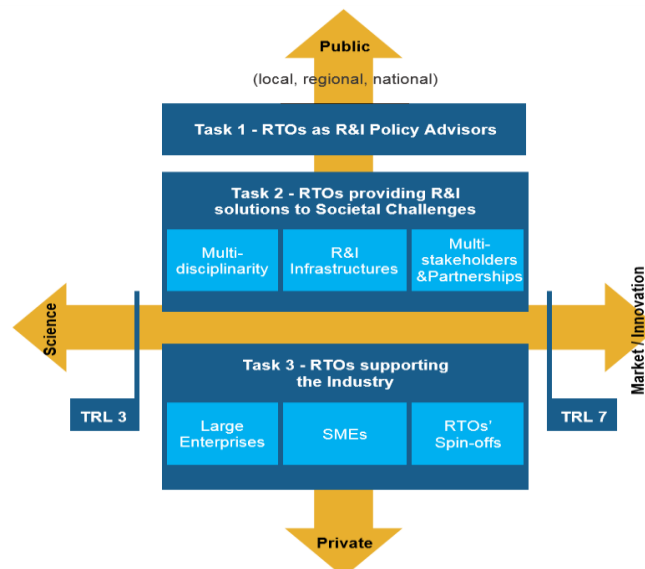


Figure 1: RTOs' activities and business model (source: EARTO)

RTOs' technologies cover all scientific fields and their work ranges from (basic) research to the development of new products, processes, services, and systemic solutions. RTOs thus take a unique position in the deployment process from science to innovation. With their open-innovation business model, they closely cooperate with industries, large and small, as well as a wide array of public actors. Indeed, as technology becomes more complex and interdisciplinary, collaboration and co-creation in RD&I is even more crucial today. To capture the full value of innovation, companies increasingly collaborate and rely on RTOs for their multi-disciplinary understanding of technology and its maturation process, their technology infrastructures and their market insights. RTOs today are essential instruments for building long-term and trusted ecosystems of RD&I partners all along key industrial value chains [ref 1].

RTOs distinctive mission is further reflected in their three-fold funding scheme that is broadly correlated with their three-stage innovation dynamic [ref 2]:

- RTOs' competence building: "Activities bringing the future - these are typically funded without industrial sources but rather with basic funding by national/regional governments and open institutional funding. RTOs have very strong links with their national and regional governments in defining strategic innovation plans and they collaborate closely with universities to harvest ideas from their basic research and bring them to higher Technology Readiness Levels (TRLs) as a result of applied research. Core funding, granted conditionally or unconditionally, is essential for RTOs to perform such strategic roles, with high-risk research of medium- to long-term duration, in-house competence development, and acquisition and maintenance of large-scale facilities and specialised equipment".
- Technology development: "Activities addressing the pre-competitive - These are typically applied research programmes jointly funded with 40-70% external funding. They provide short-term return on investments and are tailored to relevant funding and competition rules. These RD&I activities are performed through collaborative projects under regional, national or European competitive calls. RTOs will automatically partner with industry as well as any other stakeholders to maximise impact and dissemination of research results". These activities at European level will be further analysed in this chapter.
- Knowledge application: "Activities addressing the immediate - These are typically based on research contracts with 100% external funding. Here, RTOs provide immediate added value and foster knowledge dissemination with access to validation, testing and certification. In close to market applications, clients are typically industry, although partnerships with regulators are not unusual. These activities are the core business of RTOs, where an in-depth understanding of the industry is key. In this context "industry" includes large, medium and small companies both in the RTO's country of origin and abroad".

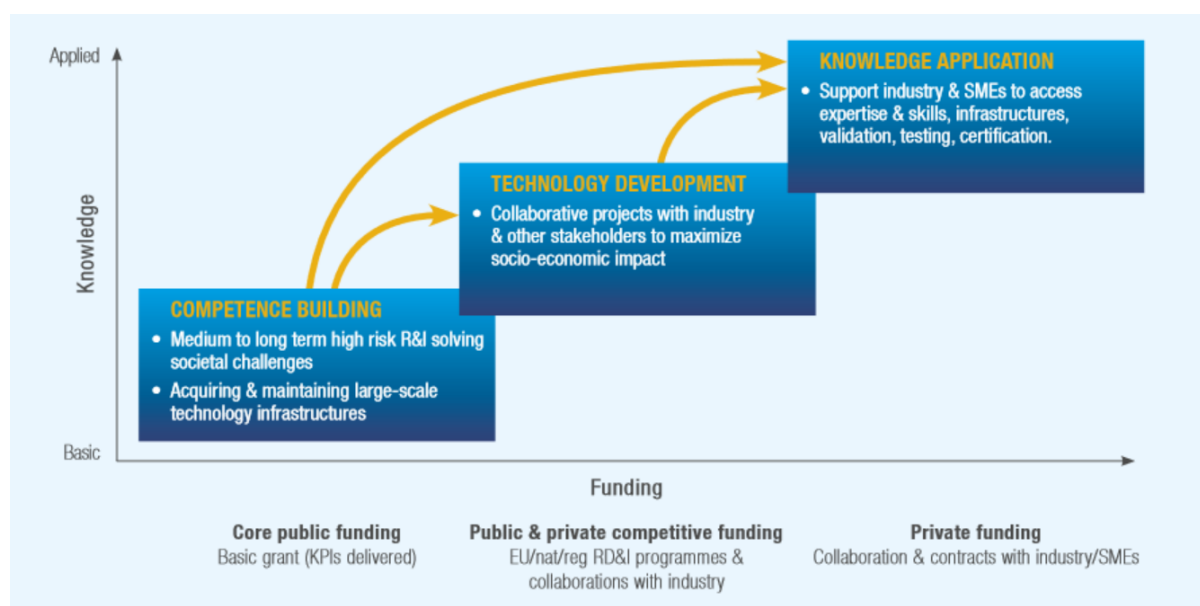


Figure 2: RTOs' three-stage innovation dynamic (source: EARTO).

3. Overall contribution to the EU framework programmes

With the recent technology trends, collaboration and co-creation in RD&I are becoming essential. As knowledge is now global, RTOs have increasingly gone beyond their national borders to collaborate with their European counterparts. RTOs play a strategic role in competitively funded collaborative FP projects at EU level.

EARTO members received on average 8% of the total EU contribution in the FPs, while they represent less than 1% of all FP beneficiaries. This has been stable between FP7 and H2020, corresponding to a total EU contribution of €3.6bn in FP7 and €4.6bn in H2020 so far. It is also interesting to note that industrial participation (PRC) has risen from 24% in FP7 to 28% in H2020.

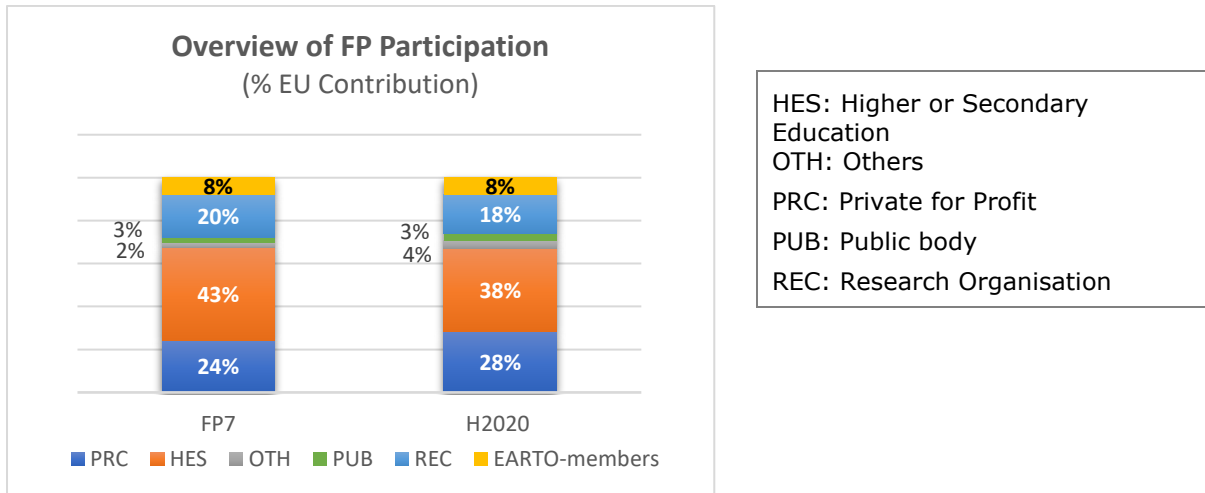


Figure 3: Distribution of EU-contribution in FP7 and H2020 among the groups of beneficiaries

When looking at the projects in which at least one EARTO member is involved, those receive 44% of FP funding, and once again this is quite stable between FP7 and H2020. That is to say that those projects in which EARTO members are involved received €19.7bn in FP7 and €25.3bn in H2020. It is also important to note that in many cases several EARTO members are involved in the same project, demonstrating the high level of cooperation between RTOs in the FPs.

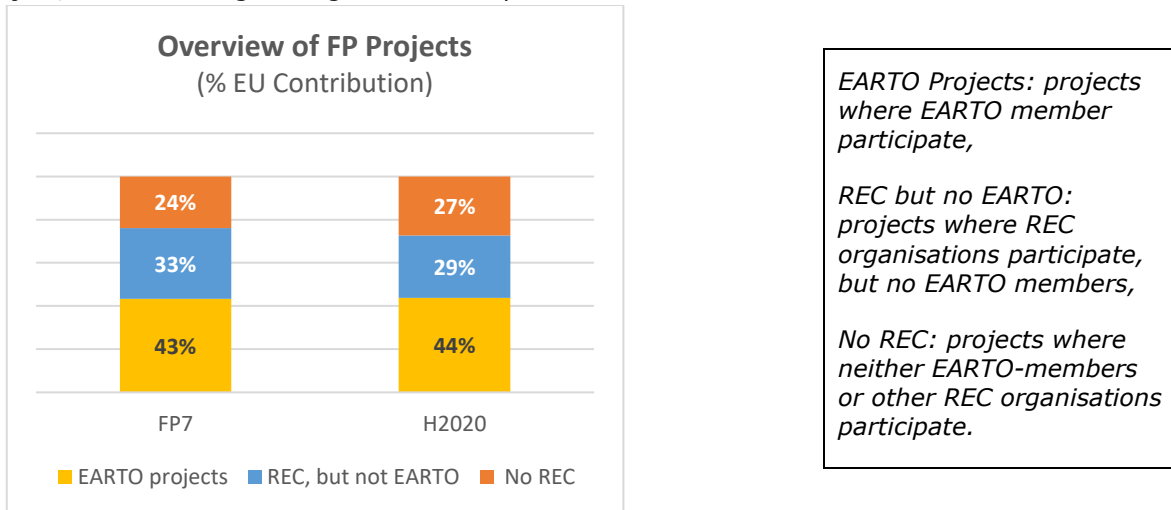


Figure 4: EU-contribution in FP7 and H2020 split into three groups

4. RTOs' contribution in the collaborative pillars of EU FPs

4.1 Collaborative Research in EU FPs

Collaborative research is an important flow of knowledge transfer. Indeed, promoting competitive RD&I ecosystems linking together key industrial value chains across borders enables to strengthen Industry (large and small)'s capacity to further absorb and scale up the technologies matured into

new solutions, maximising impact for society. Therefore, interaction between RTOs and industry adds substantially to the innovative performance and economic development of a region or country.

Each year, RTOs attract an important amount of competitive funding for Research, Development and Innovation. According to the EARTO Economic Footprint Study [Ref 12], 9 of the largest European RTOs attracted €1.6bn of such competitive funding in 2016 only, which includes 72% from national (or subnational) sources, 21% through European FPs, and 7% from other international sources.

EU FPs fund both multi-beneficiaries' collaborative projects, and mono-beneficiary ones. When looking into RTOs' participation in the FPs in more details, the data clearly shows RTOs' strong involvement in collaborative projects. This corresponds to the Cooperation pillar in FP7, and to both the Industrial leadership and the Societal Challenges pillar in H2020 [Ref 10 & 11].

- The FP7 Cooperation programme "provided support to international cooperation projects across the European Union and beyond. In 10 thematic areas, corresponding to major fields in science and research, the programme promoted the progress of knowledge and technology. Research was supported and strengthened to address European social, economic, environmental, public health and industrial challenges, serve the public good and support developing countries".
- The H2020 Industrial Leadership pillar "aims to speed up the development of the technologies and innovations that will allow European companies, including SMEs, to retain and gain competitiveness and capitalise on new markets, to grow into world-leading companies. One of the main objectives of such pillar is to provide dedicated support for research, development, demonstration, and eventually standardisation of Key Enabling Technologies (nanotechnologies, advanced materials, biotechnology, etc.). Such technologies have a transversal role in the FPs, since they are essential to address both the challenges of European Industry (global competition, need for efficient energy and resources), but also to address the Societal Challenges targeted in H2020 pillar 3".
- The H2020 Societal Challenges pillar "reflects the policy priorities of the Europe 2020 strategy, which addresses citizens' major concerns such as Health, Food, Energy, Transport, Climate, Security, etc. It involves a challenge-based approach bringing together a wide range of different actors across different disciplines and covering activities from research to market".

4.2 RTOs' Share of EU Contribution in the collaborative pillars of EU FPs

In total, 82% of EARTO members' FP7 EU contribution was for projects in the Cooperation pillar (Figure 5), and 72% of EARTO members' H2020 EU contribution was for collaborative projects in both the Industrial Leadership (35%) and the Societal Challenges (37%) pillars (Figure 6).

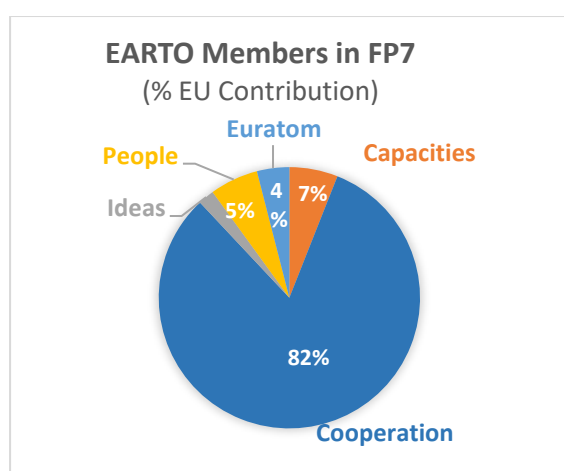


Figure 5 : EARTO members' EU Contribution from FP7 – share across the different pillars

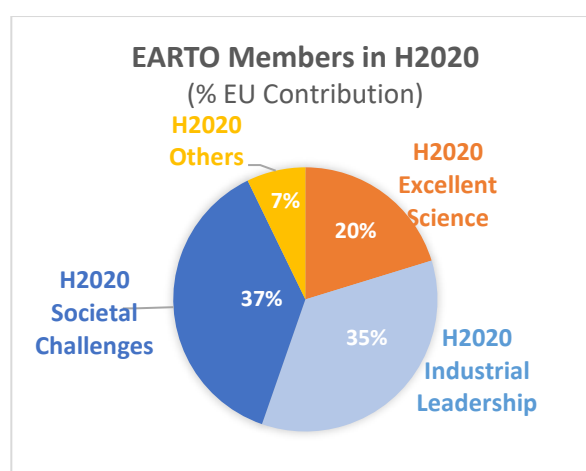


Figure 6: EARTO members' EU Contribution from H2020 – share across the different pillars

When looking closely into RTOs' involvement in collaboration pillars, RTOs' role is quite noteworthy:

- In FP7 Cooperation pillar: 10% of the EU funding available for this pillar was given to EARTO members (Figure7), which represents €3.0bn, while EARTO members account for only 0.8% of the total number of beneficiaries in this pillar. Besides, 57% of the EU funding available

for this pillar was given to projects involving EARTO members, which represents a total EU contribution of €16.2bn.

- In H2020 Industrial Leadership pillar: 13% of the EU funding available for such pillar was given to EARTO members (Figure 8), which represents €1.6bn, while EARTO members account for only 1% of the total number of beneficiaries in this pillar. Besides, 61% of the EU funding available for this pillar was given to projects involving EARTO members, which represents a total EU contribution of €7.4bn.
- In H2020 Societal Challenges pillar: 8% of the EU funding available for such pillar was given to EARTO members (Figure 8), which represents €1.7bn, while EARTO members account for only 0.8% of the total number of beneficiaries in this pillar. Besides, 56% of the EU funding available for this pillar was given to projects involving EARTO members, which represents a total EU contribution of €12.0bn.

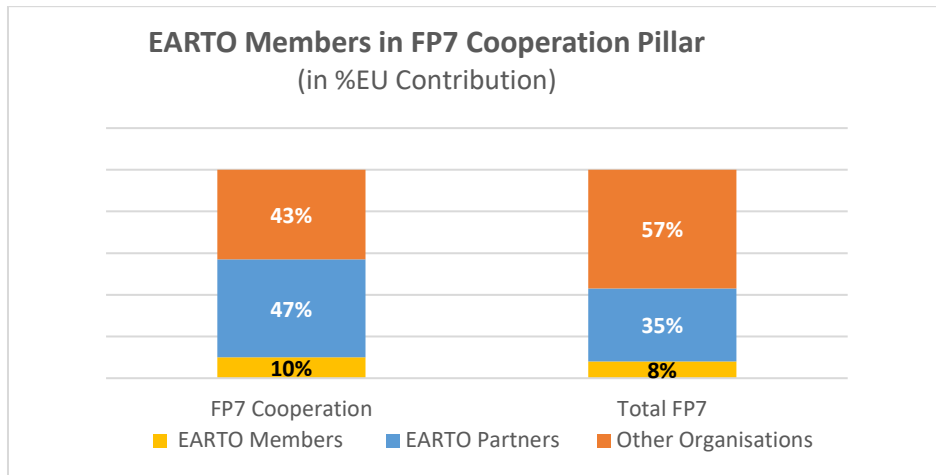


Figure 7: Share of EU funding given to EARTO members and partners' per collaborative pillar and total in FP7.

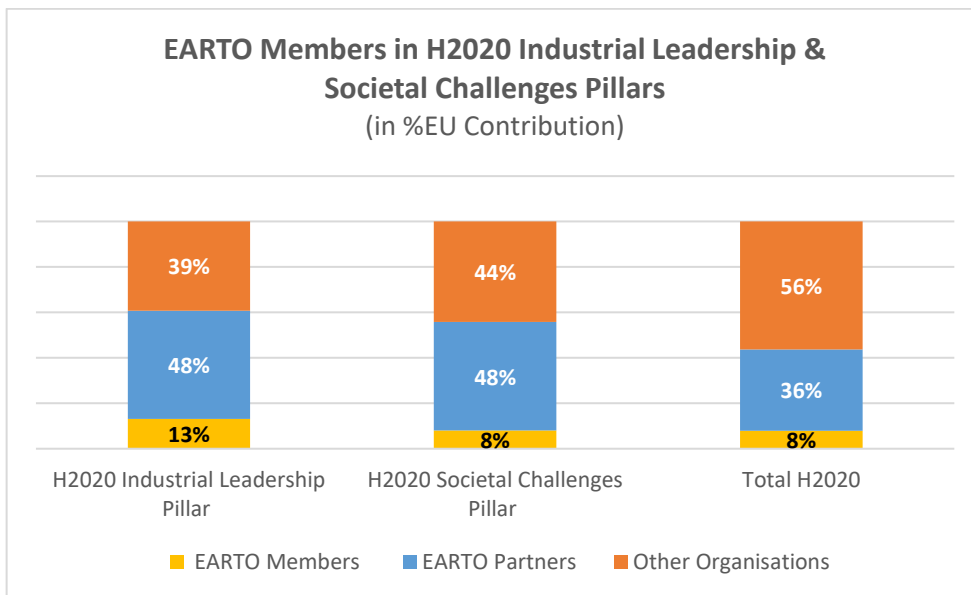


Figure 8: Share of EU funding given to EARTO members and partners' per collaborative pillar and total in H2020.

4.3 RTOs' Ranking in the top beneficiaries of FP Collaborative pillars

EARTO members are also in the top participants of collaborative research pillars in FPs.

- In FP7 Cooperation pillar, EARTO members count 7 of the top 15 participants in terms of EU contribution (Figure 9), including the 3 top ones, while there are more than 21,000 beneficiaries in this pillar.

- In H2020 Industrial Leadership pillar, EARTO members count top 8 of the participants in terms of EU contribution (Figure 10), while there are more than 14,000 beneficiaries in this pillar.
- In H2020 Societal Challenges pillar, EARTO members count 7 of the top 15 participants in terms of EU contribution (Figure 11), including the 2 top ones, while there are more than 21,000 beneficiaries in this pillar.

Rank	Organisation	EARTO Member
1	Fraunhofer*	Yes
2	HELMHOLTZ*	Yes
3	CEA*	Yes
4	FONDATION EUROPEENNE DE LA SCIENCE	No
5	CNRS	No
6	TNO*	Yes
7	VTT*	Yes
8	INSERM	
9	CNR	No
10	UNIVERSITY COLLEGE LONDON	No
11	SINTEF*	Yes
12	IMEC*	Yes
13	KATHOLIEKE UNIVERSITEIT LEUVEN	No
14	IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	No
15	DANMARKS TEKNISKE UNIVERSITET	No

Figure 9: Top 15 Participants in FP7 Cooperation pillar (in EU contribution)
*EARTO members

Rank	Organisation	EARTO Member
1	Fraunhofer*	Yes
2	CEA*	Yes
3	IMEC*	Yes
4	HELMHOLTZ*	Yes
5	VTT*	Yes
6	Tecnia *	Yes
7	TNO*	Yes
8	SINTEF*	Yes
9	FUNDINGBOX ACCELERATOR SP ZOO	No
10	CERTH	No

Figure 10: Top 10 Participants in H2020 Industrial Leadership pillar (in EU contribution)
*EARTO members

Rank	Organisation	EARTO Member
1	HELMHOLTZ*	Yes
2	Fraunhofer*	Yes
3	INSERM	No
4	CEA*	Yes
5	FINMECCANICA - SOCIETA PER AZIONI	No
6	SINTEF*	Yes
7	KATHOLIEKE UNIVERSITEIT LEUVEN	No
8	UNIVERSITY OF OXFORD*	No
9	VTT*	Yes
10	UNIVERSITY COLLEGE LONDON	No
11	STICHTING DIENST LANDBOUWKUNDIG ONDERZOEK *	No
12	TNO*	Yes
13	IMPERIAL COLLEGE*	No
14	Tecnia*	Yes
15	UNIVERSITY COLLEGE LONDON	No

Figure 11: Top 15 Participants in H2020 Societal Challenges pillar (in EU contribution)
*EARTO members

RTOs tend to be involved in large, multi-stakeholders' collaborative projects, with higher-than-average EU contribution and number of partners.

4.4 Average EU Contribution and number of partners per project

In FP7, projects with EARTO members received €3.6m of EU funding on average, which is far above the average EU funding per project in FP7 of €1.8m. This difference is even more striking in H2020, with projects with EARTO members receiving on average €5.4m EU funding per project, while the H2020 average is €1.9m per project.

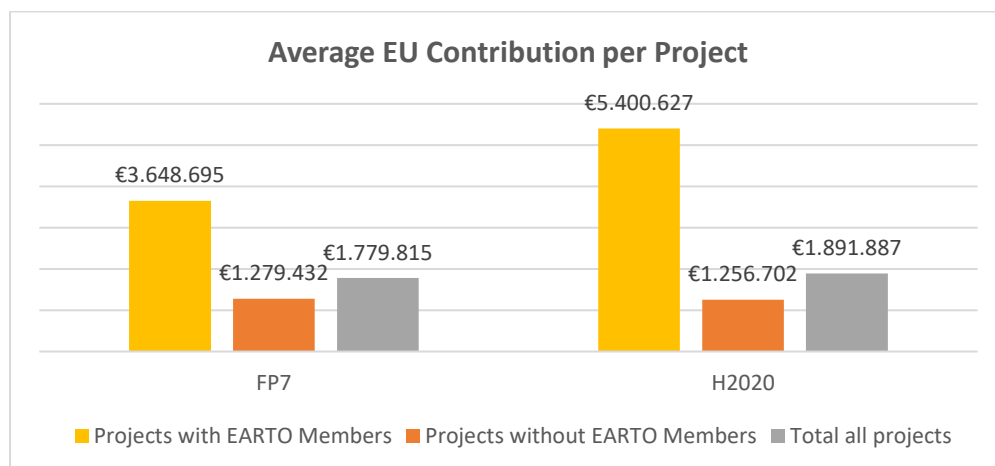


Figure 12: Average EU Contribution per project with and without EARTO members

Similarly, FP7 projects with EARTO members count on average 12 partners per project, which again is far above the average in FP7 projects of 5 partners per project. EARTO Members' projects are even larger in H2020, with projects with EARTO members counting 15 partners on average, whereas the H2020 average is only 5 partners per project.

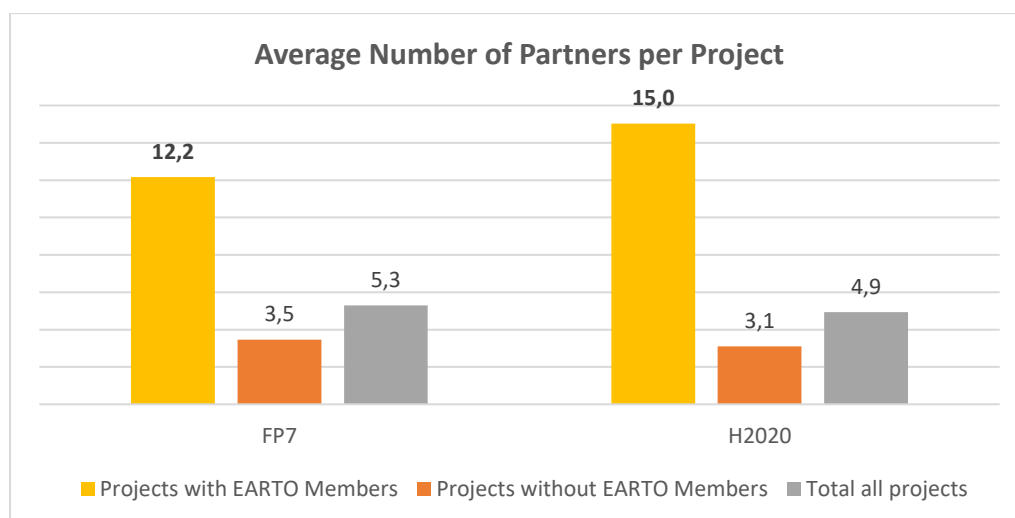


Figure 13: Average number of partners in projects with and without EARTO members

4.5 RTOs in collaborative projects: analysis

Such data quite efficiently demonstrates RTOs' strength in organising large multi-stakeholders collaborative research projects. RTOs are essential actors to foster EU-level cross-border collaboration with a wide variety of RD&I actors, from basic to close-to-market research. This is an indispensable element to build long-term and trusted partnerships between those European RD&I actors, which in turns fosters technology development and maturation into new products and services.

For instance, RTOs' role in the H2020 Industrial Leadership pillar is closely linked to RTOs' business model. Private RD&I investment is low in Europe. Competences within companies are therefore not

only limited but also typically very focused on the existing business, and inadequate for developing new technologies or exploiting new opportunities on their own. When looking for renewal, new solutions, or product/process improvements, such companies (large and small) rely on RTOs' broad understanding of technology, large scale technology infrastructures and knowledge of the market. RTOs indeed house competences which are needed to take the users' point of view into account and support the deployment of technology in its actual operational environment, and they have the research facilities and technology infrastructures that allow the development of specific products or systems. Collaborating with RTOs within the EU FPs enables to lower the risks and therefore to boost private investment in RD&I, especially for SMEs.

Similarly, RTOs' role in the H2020 Societal Challenges pillar is also very much linked to their business model. Indeed, RTOs' core activities are based on interactions between disciplines, trans-disciplinary and user-centric approaches. Such multi- and inter-disciplinary approaches are key strengths of RTOs when developing solutions for societal challenges. By combining the knowledge built while supporting the industry and collaborating with academia, RTOs are capable of identifying the potential of new technology developments as solutions to societal challenges that may not have been yet identified by the industry as their key priority and that will not be picked up directly by the market, therefore solving market failures. With such role, RTOs are great supporters of the crossing of the so-called "valley of death", also in areas not covered by industrial interests. This facilitates the development of technological systemic solutions and, later on, the production of products by bringing different types of public and private stakeholders together to find a European-scale response to societal challenges.

5. RTOs Fostering Industry Participation

Besides being very actively involved in large-scale collaborative projects, RTOs play an essential role to ensure industry participation in the EU FPs, finding the relevant industrial partners to be involved in EU projects.

The participation of EARTO Members in EU FPs is positively correlated to the involvement of industrial partners in such EU funded projects. The average industrial involvement in FP7 projects increases to 33% when EARTO members are involved in the project from 17% when they are not part of the consortium, with an average industrial participation of 24% in the overall FP7. This trend is similar in H2020, even though in general industrial participation has risen between FP7 and H2020: industrial participation in H2020 projects increases to 34% when EARTO members are involved in the project from 24% when they are not part of the consortium, with a total average industrial participation in H2020 of 28%.

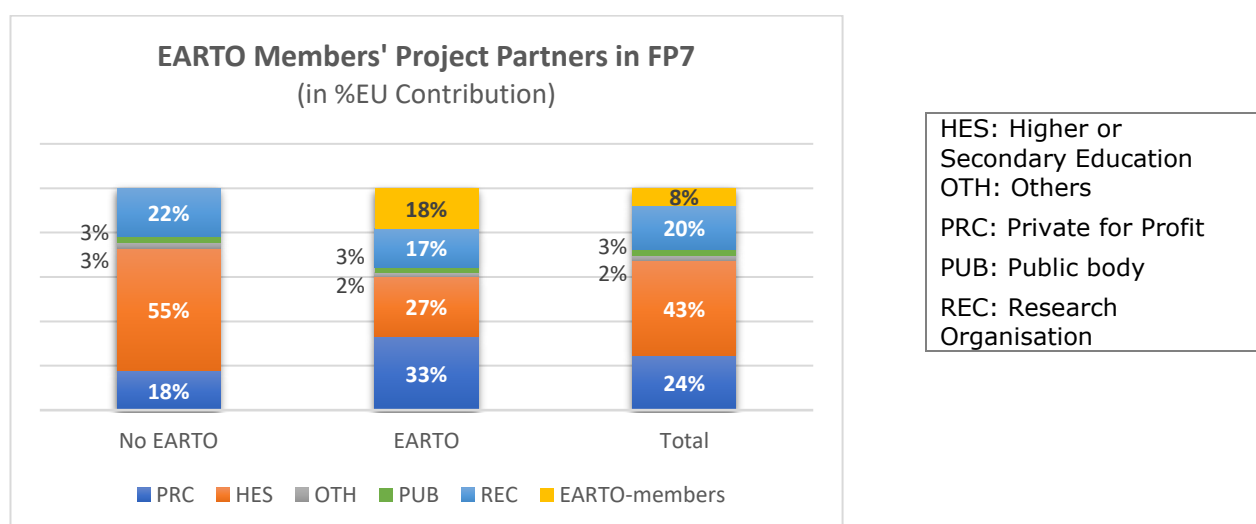


Figure 14: Share of the different types of partners involved in projects with EARTO members in FP7

Thanks to their key role of connector in the Research & Innovation ecosystem, this data clearly highlights RTOs crucial mission to make the link between the different actors of the academic and industrial spheres. In both FP7 and H2020, projects with EARTO members involved are indeed quite

balanced on average in terms of participating organisations, with roughly 1/3 industrial partners, 1/3 academic partners and 1/3 RTOs.

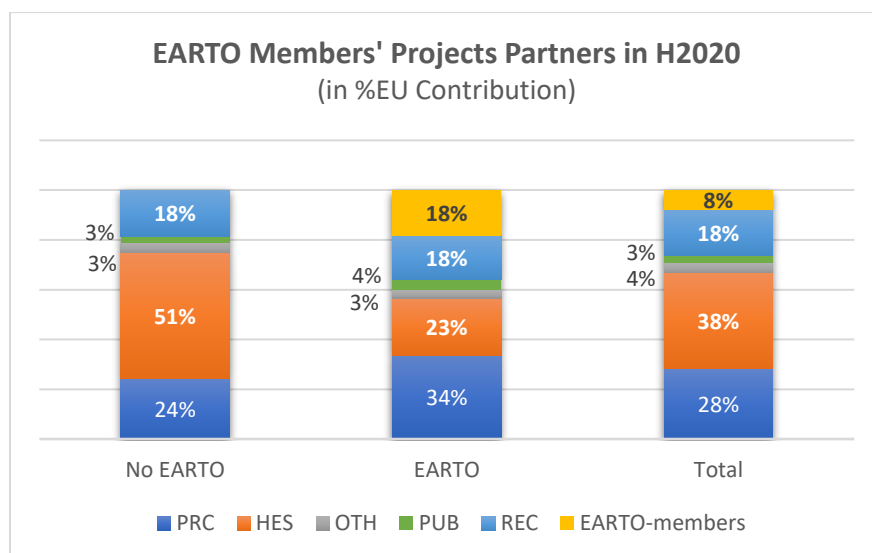


Figure 15: Share of the different types of partners involved in projects with EARTO members in H2020

Such trend is quite coherent with the considerations made previously and the connector's role of RTOs within RD&I ecosystems, contributing to lowering the risks of industrial investment in RD&I and accelerating the uptake of innovation by companies, large and small. The role of RTOs is, therefore, essential to maximise the participation of industry in the programme and foster private RD&I investment in Europe in an efficient co-creation process. Such role for RTOs needs to be further leveraged for Europe to keep being competitive at global scale.

6. RTOs' contribution as project coordinators

Such connector role of RTOs is also reflected in the responsibility they undertake in the projects they are involved in. EARTO members have a prominent position shown by the high EU contribution they receive and their role as coordinators of many projects.

On average and in general, each EARTO member received €413k EU contribution per project in FP7, which is above the total FP7 average EU contribution of €336k per participation. This trend is similar in H2020, with an even bigger gap, since each EARTO members receives an average €577k per project in H2020, while the total average EU contribution per partner is €389k.

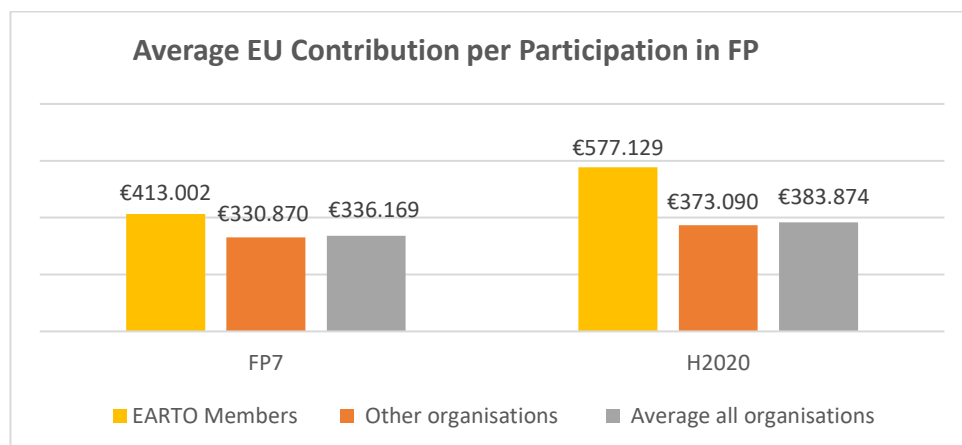


Figure 16: Average EU Contribution per project for EARTO Members in FP7 and H2020

EARTO members coordinated 1698 FP7 projects and 1530 H2020 projects so far, which corresponds respectively to 32% of the projects in which they participate in FP7 and 33% in H2020.

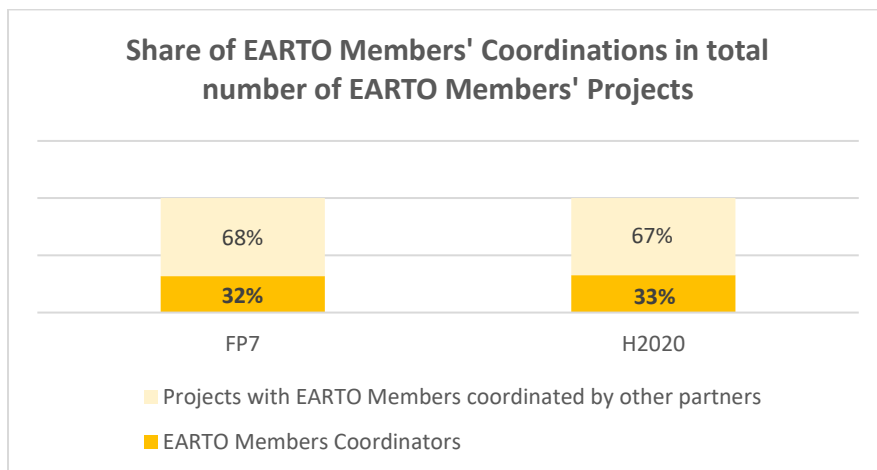


Figure 17: EARTO members' share of project coordination in FP7 and H2020

In total, EARTO members coordinate 6.7% of all FP7 projects in terms of number of projects and 5.0% of all H2020 projects.

The data shows RTOs' active role as driver and orchestrator of RD&I ecosystems. RTOs efficiently connect and facilitate the relations between all the relevant actors that are essential for technology maturation and to enable efficient and sustainable technology uptake and scale-up, boosting industry productivity and competitiveness with high societal impact.

7. Conclusion

The way companies carry out RD&I in Europe is changing. Private investment in RD&I remains low, and industry's in-house capacity to carry out RD&I is decreasing. Besides, the increased complexity and speed, as well as the interdisciplinarity required by any technological development makes it even more difficult for industry to fully capture its value creation potential on its own. Collaboration and co-creation in RD&I are therefore becoming essential. Companies increasingly collaborate and rely upon RD&I actors like RTOs for their multi-disciplinary understanding of technology and its maturation process, their technology infrastructures and their market insights. RTOs are essential instruments for building long-term and trusted ecosystems of RD&I partners all along key industrial value chains [Ref 1].

One of RTOs' ways of doing so is through competitive funding for collaborative research, at national (and sub-national) but also at EU level. **As knowledge is now global, European RTOs have increasingly gone beyond their national borders to collaborate with their European counterparts.**

- **This analysis demonstrates RTOs' strategic role in the European research and innovation framework programmes:** despite representing only 1% of the total number of participants, they receive 8% of the EU contribution allocated to FPs, and the projects they participate in represent close to 44% of such EU funding. This has been quite stable along the years. RTOs' involvement in the future EU FPs is expected to stay strong, even though the number of applicants keeps increasing and the success rate has been decreasing. The EU budget invested in RD&I would need to be significantly scaled-up if the EU wants to keep funding the best top-quality EU RD&I projects.
- **The data specifically highlights RTOs' active role in the collaborative pillars of the framework programmes.** 82% of the FP7 EU contribution received by EARTO members was for projects in the Cooperation pillar, and 72% of H2020 EU contribution received by EARTO members was for projects in the Industrial leadership (35%) and the Societal Challenges (37%) pillars. EARTO members are involved in the majority of projects and count among the top participants in these collaborative pillars. RTOs' core activities are based on interactions between disciplines, trans-disciplinary and user-centric approaches. By combining the knowledge built while supporting the industry and collaborating with academia, RTOs are capable of identifying the potential of new technology developments as solutions to societal challenges that may not have been yet identified by the industry as their key priority and that will not be picked up directly by the market, solving therefore market failures. In this role, RTOs are great supporters for the

crossing of the “valley of death” also in areas not covered by industrial interests, facilitating the development of technical solutions and, later on, the production of products by bringing different types of public and private stakeholders together to solve societal challenges. This enables to find a European-scale response to those societal challenges, which is more than ever needed.

- **Besides, RTOs’ projects tend to be large multi-stakeholders’ collaborative projects.** In H2020 for instance, projects with EARTO members receive €5.4m EU funding and count 15 partners per project on average, which is far above the H2020 average of €1.9m and 5 partners per project. RTOs are essential actors to foster EU-level cross-border collaboration with a wide variety of RD&I actors, from basic to close-to-market research. This is an indispensable element to build long-term and trusted partnerships between those European RD&I actors, which in turns fosters technology development and maturation into new products and services. The scale of those effects is, however, very dependent on the size of the EU budget dedicated to RD&I, as well as the proportion dedicated to cross-border collaborative RD&I, which is now uncertain for the next Multiannual Financial Framework (MFF 2020-2027).
- **In particular, RTOs play an essential role to ensure industry participation in the EU FPs, finding the relevant industrial partners to be involved in EU projects.** The average industrial involvement in FP projects increases to more than 32% when RTOs are involved in the project from between 17% (FP7) and 26% (H2020) when they are not part of the consortium. RTOs indeed house competences which are needed to support the deployment of technology in its actual operational environment, in particular via their state-of-the-art technology infrastructures (TIs) which are a very important piece of the RD&I process. Industry relies on such TIs to lower the costs and risk of technology maturation, validation, upscaling, prototyping and validated new solutions before they enter the market, but they cannot afford the costs of such TIs on their own. These TIs need to be housed by RTOs and their long-term sustainability requires a high level of public investment and highly skilled technical staff to remain at the forefront of innovation. The role of RTOs is, therefore, essential to maximise the participation of industry in the programme and foster private RD&I investment in Europe in an efficient co-creation process. Such role for RTOs needs to be further leveraged for Europe to keep being competitive at global scale.
- **RTOs also take the lead and often adopt a coordinator’s role in the FP projects in which they participate.** They receive an average €577k per project in H2020, while the total average EU contribution per partner is €384k. They also coordinate roughly 1/3 of the projects in which they participate, that is to say more than 5% of all H2020 projects so far. RTOs have taken an active role as driver and orchestrator of RD&I ecosystems along the years.

To conclude, allocating consequent funding to competitive collaborative programmes at EU but also national (and sub-national) levels is crucial today in order to promote a competitive RD&I ecosystem strengthening European Industries’ capacities to further absorb and scale up technologies. This is key to lower the risk and boost industry’s investment in RD&I, increasing their productivity and their competitiveness on a global scale. This is also key to solve the societal challenges of today, in areas such as Healthcare, Food security, Energy, Climate, etc. This analysis demonstrates the key role played by RTOs as ecosystems’ connectors within such competitive funding programmes, especially in collaborative projects at European scale. In such frame, supporting RTOs with the basic funding they need to maintain both their excellent technological competences and skills, and ensure the long-term sustainability of their technology infrastructures should therefore be set as a priority by all national (and sub-national) governments. This would enable RTOs to keep their strategic and driving roles in European RD&I ecosystems and to stay active participants in EU FPs.

RTOs - Research and Technology Organisations: *From the lab to your everyday life. RTOs innovate to improve your health and well-being, your safety and security, your mobility and connectivity. RTOs’ technologies cover all scientific fields. Their work ranges from basic research to new products and services development. RTOs are not-for-profit organisations with public missions to support society. To do so, they closely cooperate with industries, large and small, as well as a wide array of public actors.*

EARTO - European Association of Research and Technology Organisations: *Founded in 1999, EARTO promotes RTOs and represents their interest in Europe and beyond. EARTO network counts over 350 RTOs in more than 29 countries. EARTO members represent 150,000 highly-skilled researchers and engineers managing a wide range of technology infrastructures.*

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