ERA LEARN 2020

15 Years of European Public-Public Partnerships in Research & Innovation

Great achievements with stronger potential

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Foreword

In their 15-year course Public-Public Partnerships (P2Ps) have managed to mobilise and connect substantive resources across Europe. A great deal has been achieved especially in terms of enhancing transnational collaboration of research and mobilising national and European investments in jointly dealing with common challenges. There are numerous P2Ps that present clear evidence of impressive outcomes and a variety of impacts that go beyond 'rate of return' interests but are considered equally important.

The P2P community acknowledges the value of the different impacts achieved that range from influencing the national and European and even international policies, to making national Research and Innovation (R&I) systems more effective through coordination and alignment, as well as to dealing with certain societal challenges and improving competitiveness of European industries. It is important to document the relevant evidence to inform decision-making at both European and national levels, and this is exactly what this publication has tried to do.

Naturally, the level of interest and commitment of different countries has been varying but also changing across time. This inevitably affects the level of success in achieving objectives and delivering the envisaged impacts. This publication has brought together all existing evidence of impacts that has been collected over the years (including through the specific impact assessment activities of ERA-LEARN). The constantly increasing trend in national and European investments, even in the middle of a financial crisis, is undeniable and the wealth of achieved impacts is unquestionable, although it may not be widely known given the lack of systematic evaluation activities and publications.

A strong momentum has clearly been created, even by those more reluctant to join, that should be built upon. The role of the Commission has been and will continue to be vital. Implementation challenges are gradually being solved, and the discussions for the new framework programme offers a great opportunity to assign P2Ps the strategic role they are worthy of in fully tapping their potential for coordinating and orienting European research efforts in jointly dealing with common challenges.

What is certain is that in the challenging future that lays ahead of us these partnerships and the spirit of trust and true collaboration they build may be the only effective and concentrated means of addressing the grand challenges that cross our national borders.

I would like to thank in particular Effie Amanatidou from the University of Manchester for reviewing the available material and writing this report as well as Hayley Welsh and Angus Hunter from Optimat for the data collection and analysis. Thanks are due also to the rest of the ERA-LEARN 2020 partners and the Advisory Board members for commenting earlier drafts of this document.

Roland Brandenburg

FFG, Coordinator of ERA-LEARN 2020

P2Ps in the ERA landscape

Public-Public Partnerships (P2Ps) in research and innovation are networks of public organisations (Ministries, funding agencies, programme managers) from interested EU countries and beyond, that join forces to support research activities under an agreed vision or research and innovation agenda. In this way, P2Ps align national strategies, helping to overcome fragmentation of public research effort. P2Ps include partnerships supported by the European Commission such as ERA-NETs and Art 185s as well as Member State-led initiatives, the Joint Programming Initiatives.

ERA-NETs are networks of research funders and ministries that join forces across borders, to design and implement specific activities in order to jointly fund transnational research projects in open and competitive calls. They have been supported in different forms over the Framework Programmes (FPs). Initiated under FP6, the first ERA-NETs focused on the coordination of national/regional activities by supporting the development and implementation of joint calls for trans-national proposals. Under FP7, the ERA-NET scheme was reinforced by ERA-NET Plus that allowed the topping-up of joint trans-national funding for calls with European Union funding in a limited number of high European added value cases. The ERA-NET Cofund instrument under Horizon 2020 merges the former ERA-NET and ERA-NET Plus into a single instrument with the central element of implementing one substantial call with top-up funding from the Commission. The focus of ERA-NETs has thus shifted from the funding of networks to the top-up funding of joint calls. The European Joint Programme (EJP) Cofund is a new instrument under Horizon 2020 with the purpose to implement a joint programme of activities over a period of 5 years, including direct research activities, i.e. research based on calls for proposals as in the ERA-NETs, but also coordination, networking, training, etc.

Table 1 : Total number of P2Ps created since 2002 (including active and non-active P2Ps)

Network Type	Number
ERA-NETs	160
ERA-NET Plus	22
ERA-NET Cofunds*	46
EJP Cofund	3
Art 169/185s	10
JPIs	10
Self-sustained	14
Total	265

Source: ERA-LEARN 2020

* 10 Cofunds are initiated by JPIs

Article 169/185 initiatives are multiannual research and innovation (R&I) programmes jointly implemented by several EU Member States, including countries associated to the EU's framework programmes in which the Union participates by providing a financial contribution. They are named after Article 185 of the Treaty on the Functioning of the European Union (TFEU), ex Article 169,[1] which enables the EU to participate in research programmes undertaken jointly by several Member States, including participation in the structures created for the execution of national programmes. Implementing Article 185 initiatives implies that the involved EU Member States integrate (rather than simply coordinate) their research efforts by defining and committing themselves to a joint research programme.

Joint Programming is a structured and strategic process whereby Member States agree, on a voluntary basis and in a partnership approach, on common visions and Strategic Research (and Innovation) Agendas to address major societal challenges. Joint Programming Initiatives (JPIs) are Member State-led initiatives where participating states implement together commonly agreed research work-programmes including joint calls as well as other activities (such as knowledge hubs, capacity building, evaluation, dissemination, etc.).

1 Initially these initiatives were named after Article 169 of the Treaty on European Union (1992) dedicated to initiatives in the field of research. Following the revision of the Lisbon Treaty, the article became Article 185.

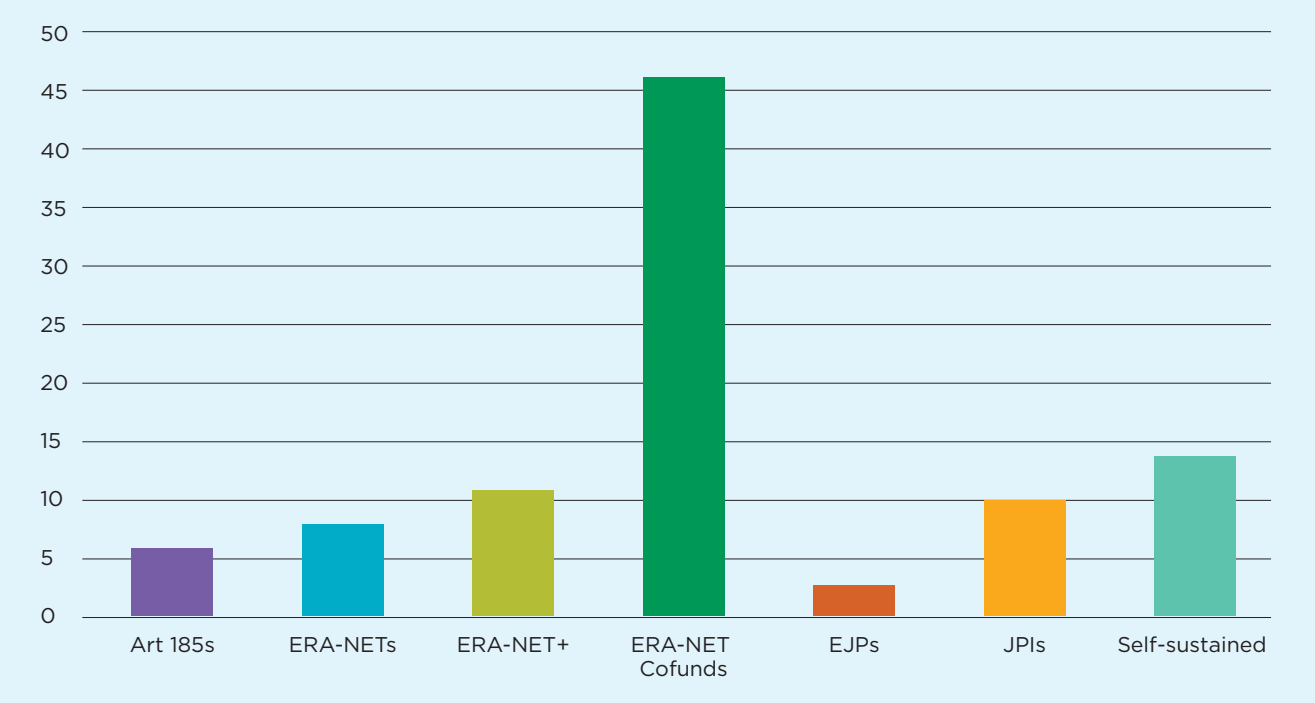
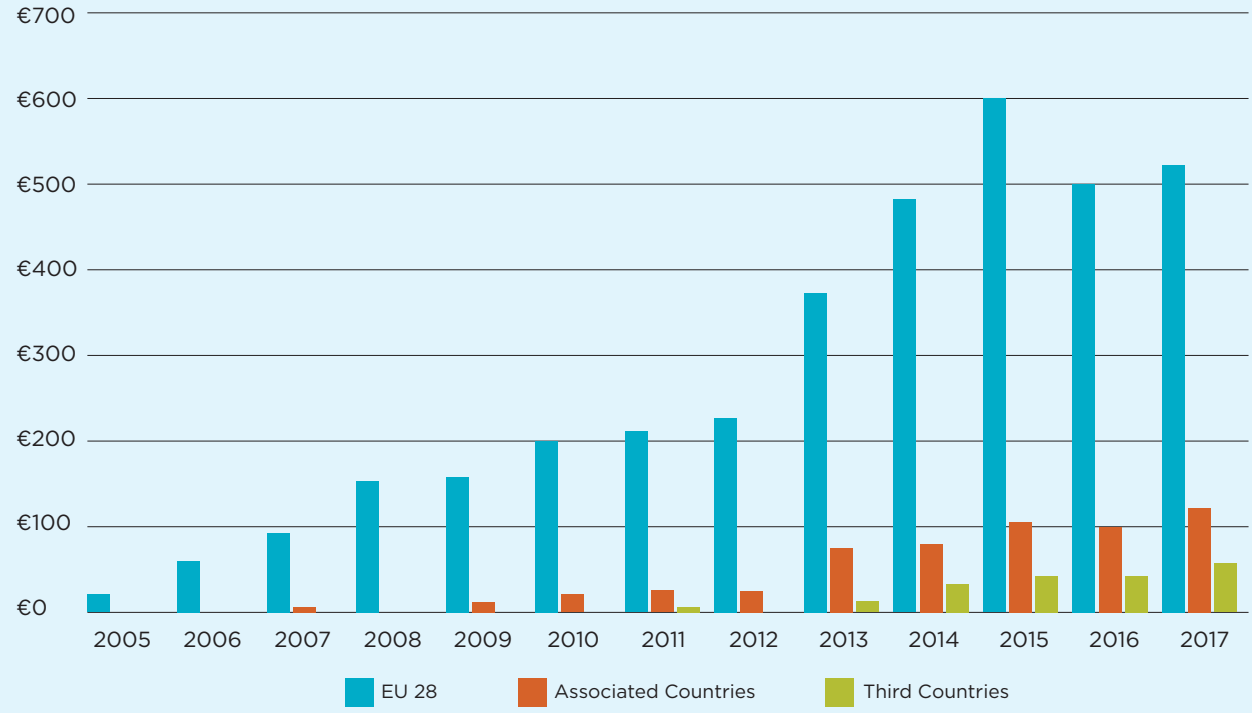


Figure 1: Active P2Ps (2017)

The past years have seen a proliferation of P2Ps. From the initial 71 ERA-NETs created in FP6, a total of more than 260 networks have now been supported (cf. Table 1). Currently there are 98 active networks including: 6 Art 185s (including the newly created PRIMA), 8 ERA-NETs and 11 ERA-NET Plus from FP7, 46 ERA-NET Cofund Actions (10 of which are initiated by JPIs), 3 EJP Cofund Actions and 10 JPIs as well as 14 other networks that became self-sustained.

Great achievements in an evolving ERA

P2Ps include different kinds of networks that have appeared at different times. Naturally the degrees of achievements vary across the different types as well as from one network to another. However, the interest of countries in participating and investing in P2Ps has been continuously rising since the launch of the first ERA-NET scheme in FP6. It is characteristic that in the last five years (2013-2017) in addition to the 28 EU Member States a total of 13 Associated Countries and 50 Third Countries have participated in P2P calls. This is more impressive considering that in the first five-years (2004-2008) the numbers were 24 Member States, 10 Associated Countries and only 4 Third Countries. This shows a strong contribution of P2Ps to the internationalisation of European research.



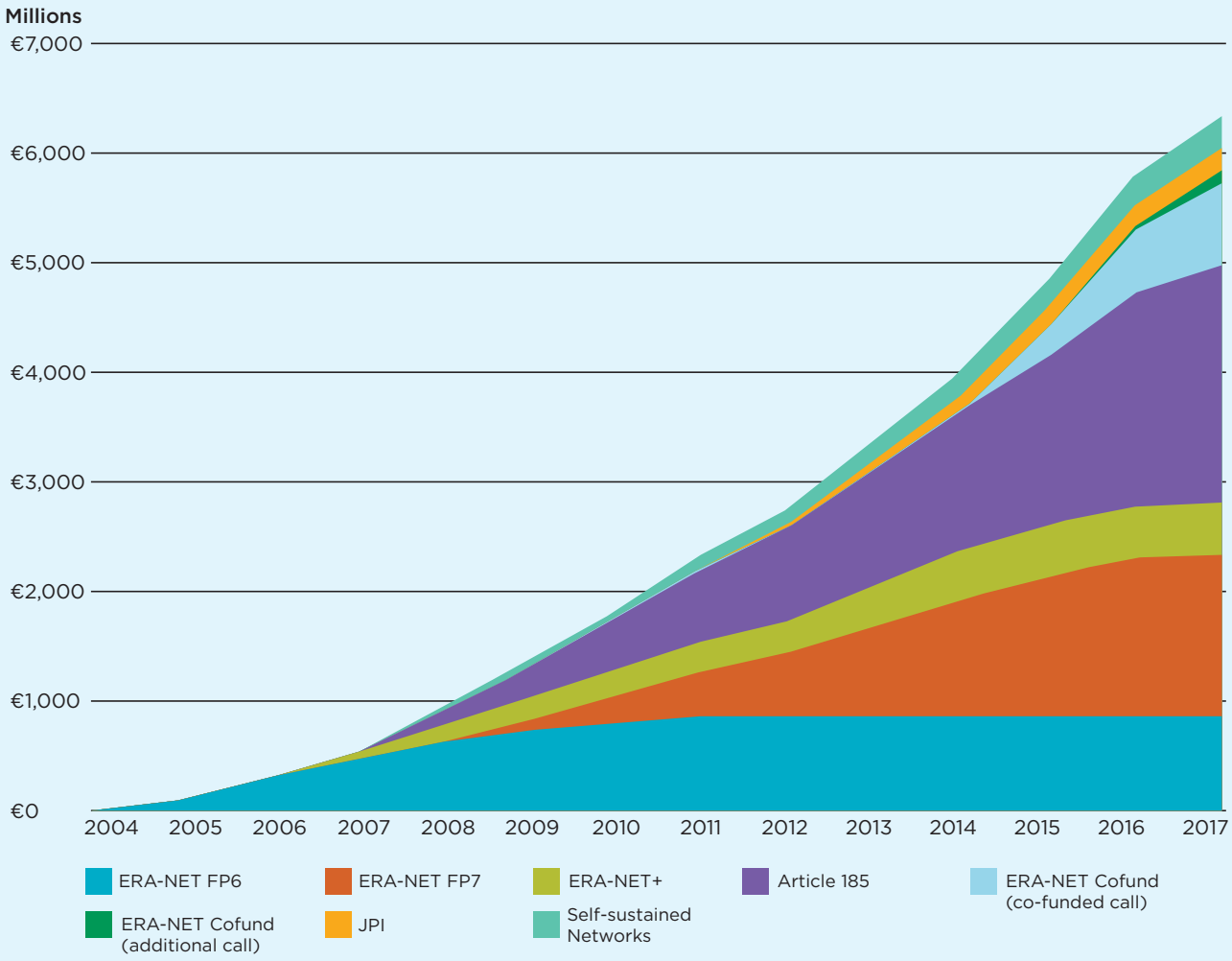
Source: ERA-LEARN 2020 database, Sept. 2017

Figure 2: Evolution of national investments in P2P calls (€million)

Accordingly, the level of national investments in P2P calls has been constantly increasing and is estimated to reach a total of €717 million in 2017 (including JPIs, FP7 ERA-NETs, Cofunds, A185s and self-sustained P2P networks) (cf. Figure 2). The EU support of P2Ps across the different FPs has also increased significantly, from €380 million in FP6 (2.1% of the FP6 budget) to €802 million (1.4% of FP7 budget) in FP7. In Horizon 2020 it is estimated to reach approximately €2.5 billion (around 3.1% of the budget). This investment has mobilised national contributions that have increased exponentially over the years, i.e. €1.25 billion of national funding under FP6 and around €2.9 billion under FP7, to between €6-8. billion in Horizon 2020 (Horizon 2020 Interim Evaluation).

Despite the financial crises since 2008, the public funding of transnational research by ERA-NET and ERA-NET Plus actions has been growing steadily since the first calls in 2004. The Union funding of ERA-NETs has created substantial effects on research coordination with the average leverage effect increasing from 6 in FP6 to more than 10 in FP7* (ERA-LEARN 2020: 2016).

* The leverage effect is the amount of additional Euros that is invested for each Euro of Union contribution.

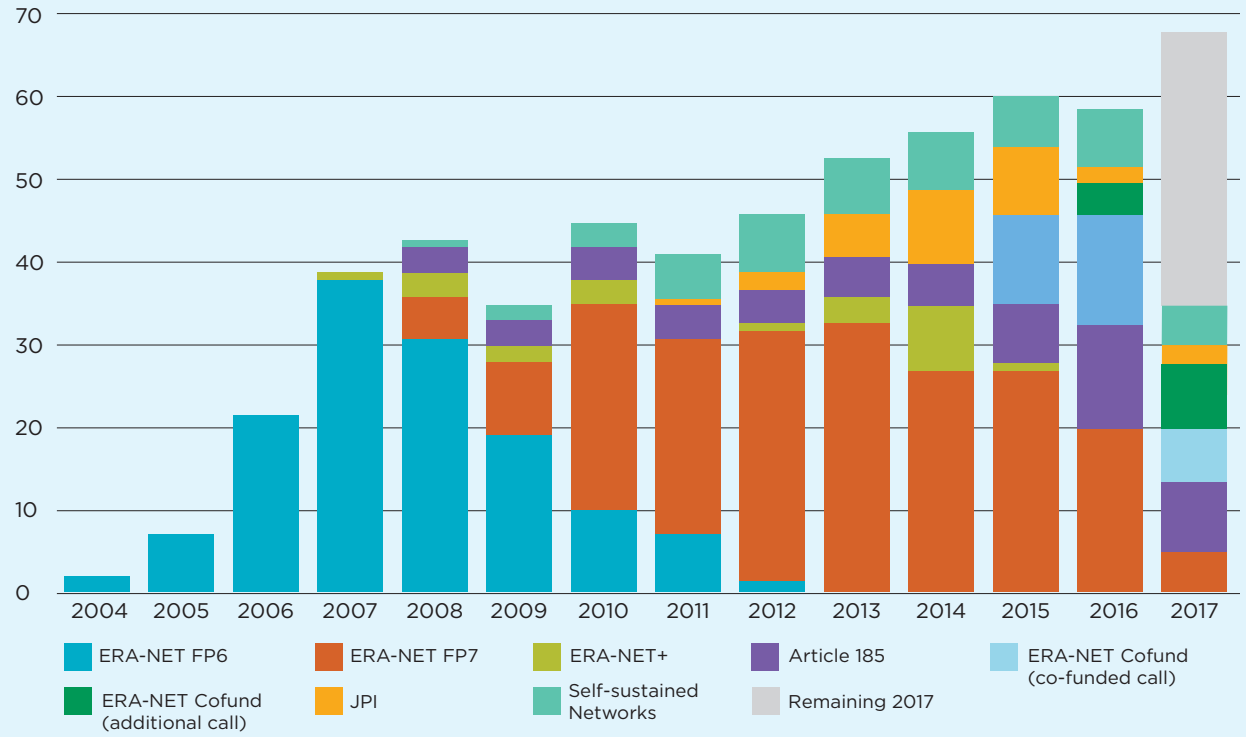


Source: ERA-LEARN 2020 Annual Report 2017

More than €252 million of the cumulative investment in Cofund calls comes from JPI-initiated Cofund actions.

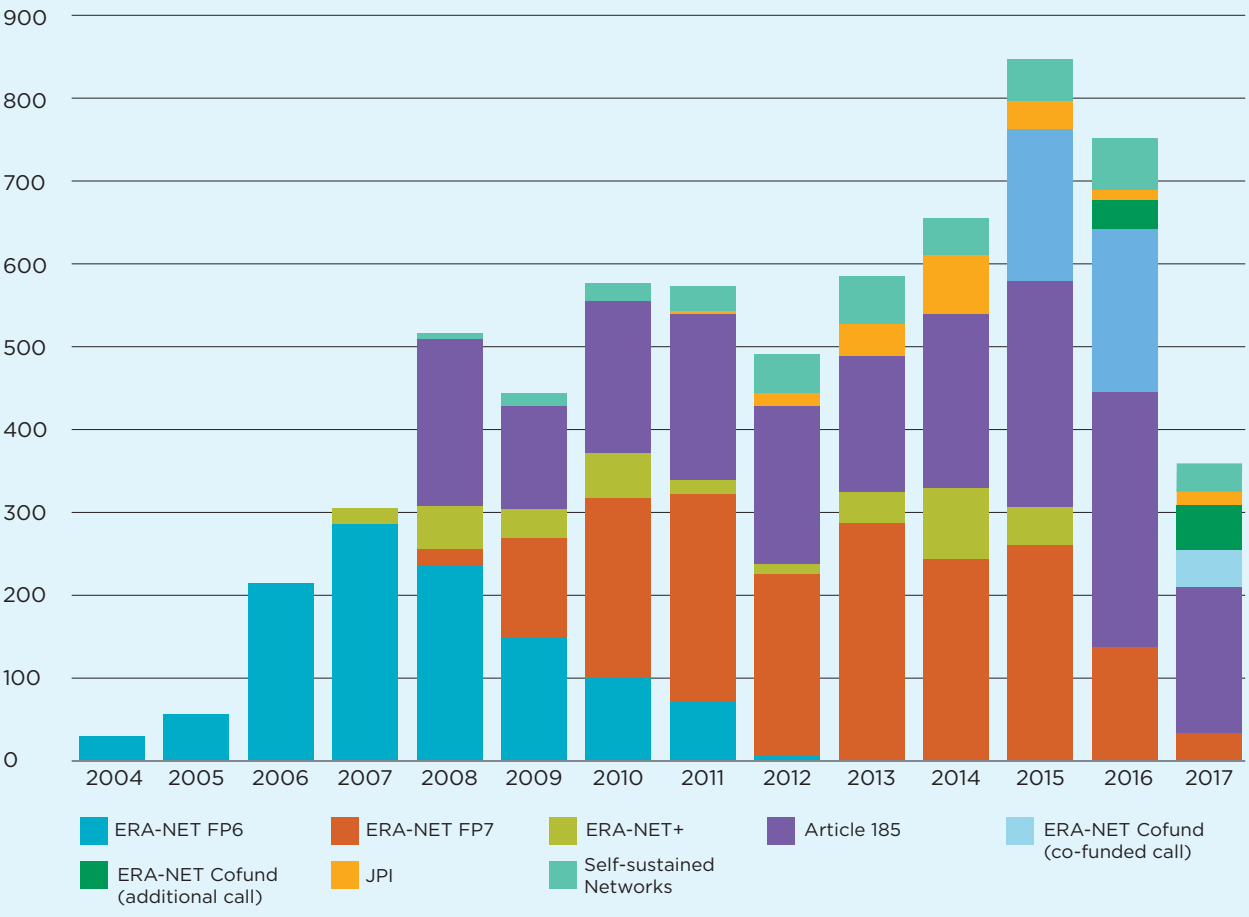
Figure 3: Cumulative Investment in Joint Calls, including EU Contribution, 2004-2017

Since 2004 more than 6,400 projects (cf. Figure 5) with a cumulative budget of about €6.3 billion have been supported by P2Ps (cf. Figure 3). This was the result of calls that increased from two calls in 2004 to 68 calls in 2017, leading to a cumulative total of 576 P2P calls that closed by the end of 2017 (cf. Figure 4).



Source: ERA-LEARN 2020 Annual Report 2017
The ERA-NET Cofund figure includes 16 calls of JPI-initiated Cofund actions.

Figure 4: Number of Joint Calls (closed) between 2004 and 2017, by Network Type



Source: ERA-LEARN 2020 Annual Report 2017
The ERA-NET Cofund figure includes 162 projects funded by JPI-initiated Cofund calls (until Sept. 2017).

Figure 5: Number of Transnational Projects, by Year and by Network type

"Public-public partnerships are a cornerstone for a more coordinated implementation of national and European research programmes, aligning resources and policies on common challenges."

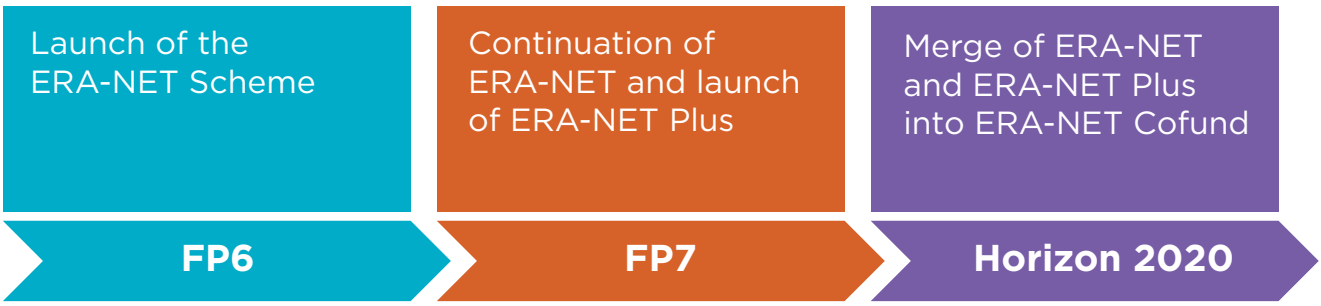
(ERAC opinion on H2020 interim evaluation)

Member States increasingly acknowledge the value of P2Ps. On average, 20% of national R&D funding invested in transnational cooperation (mostly competitive) is invested in European P2Ps. Interestingly, the larger Member States usually invest less as a share of the total national R&D investments in trans-national (competitive) cooperation. In Germany, for instance, the share is 10%, while in smaller Member States such as Cyprus it is nearly 100%.[2]

As an example of how the research community feels, Finnish researchers funded through P2P schemes agree that the advantages of P2P-funded projects include the possibility of collaborating within compact international consortia and the relatively low administrative and reporting work loads that are involved. P2P networks are important and constitute possibly the only EU-wide funding instrument for international collaborative basic scientific research. They also provide the possibility of receiving funding for bottom-up research topics, compared to the more top-down EU framework programme calls (Academy of Finland, 2017).

2 Issue Paper for the High-level Expert Group on Maximising the Impact of EU Research and Innovation Programmes, https://ec.europa.eu/research/evaluations/pdf/hlg_issue_papers.pdf

The ERA-NET instrument



Starting as early as 2002, the key objectives of the ERA-NET scheme during FP6 were to strengthen the cooperation and coordination of national and regional research activities through linking national and regional research programmes, including their mutual opening-up and the development and implementation of joint activities. In order to achieve these objectives, the ERA-NET scheme followed a four-step approach that included:

1. The systematic exchange of information and good practices on existing programmes;
2. The identification and analysis of common strategic issues;
3. The development of joint activities between national and regional programmes; and
4. The implementation of joint transnational research activities.

As they were implemented as Coordination and Support Actions, the EC funded the costs of participation and coordination. The participating countries covered any additional funding or in-kind contributions required for the implementation of the prescribed activities.

Based on the FP6 ERA-NET evaluation study (Matrix and Rambøll, 2009) the large majority of participants recognised the value of the ERA-NET scheme and were prone to invest additional resources in order to participate fully in the ERA-NET coordination actions. By December 2008, ERA-NETs had undertaken 115 joint calls, representing more than €773 million in estimated funding across 42 countries; 15 joint programmes representing more than €376 million; and 22 pilot calls representing more than an estimated €14 million. The study concluded that the FP6 ERA-NET scheme was as a success in terms of achieving its initial objectives, namely fostering cooperation between, and coordination of, national research activities through the linking of national research programmes. It formed a backbone of funding for transnational research and made national stakeholders realise the benefits associated with transnational R&D cooperation, leading in some cases to increases in the budgets invested in transnational R&D projects and other impacts on national research policies. Yet, attaining higher-level ERA objectives, e.g. overcoming the fragmentation of research and the harmonisation of national programmes, proved challenging.

The most tangible impact of the FP6 ERA-NET scheme on national programmes related to the creation of new opportunities for research beneficiaries who would otherwise be excluded from the regular FP to engage in transnational research. It filled a gap between national research policies and the transnational research agenda generated at European level through the FPs.

(Matrix and Rambøll, 2009)

The FP7 strategy promoted clear alignment with the priorities of the EU Framework Programme, with ERA-NET Plus as the primary tool to realise this top-down strategy. The objective was to provide a specific EU financial contribution to joint calls for proposals and thus encourage the pooling of resources

The additional funds provided by the Commission under ERA-NET Plus acted as an incentive for member states to align their national resources to tackle specific research challenges.

(Lock, et al. 2010)

of national funding bodies. The ERA-NET Plus Review Report (Lock, et al. 2010) highlighted the success of the new instrument in terms of increasing the level of cooperation between member states and mobilising additional resources at the national level. At the same time, it was acknowledged that there was a need for national strategies and the coordination of international participation in an ERA funding landscape that had already started to become overpopulated.

The ERA-NET Plus scheme focused only on the implementation of joint calls and did not provide any resources for strategic networking activities. Thus, the Horizon 2020 programme proposed a new tool, the ERA-NET Cofund, which merged the former ERA-NET and ERA-NET Plus. The central and compulsory element of ERA-NET Cofund is still the implementation of one joint call with top-up funding from the Commission, although the implementation of other joint activities, as in the classical ERA-NET, is also possible (without EU co-funding) and used by many networks that implement up to four additional calls. By the end of 2017, 59 ERA-NET Cofund actions will have been launched under Horizon 2020, bringing together a total Union support of around €470 million and an estimated contribution from the participating states of €1.5 – 2 billion. This will result to more than 1,500 transnational projects being funded under these initiatives under Horizon 2020 alone.

The vast majority of national representatives state that their countries will retain their current level of participation in ERA-NET Cofund, while the majority of EU-13 national representatives are planning to increase their involvement by a moderate amount.

(Gøtke, et al. 2016)

Based on an analysis of the first Cofund actions supported under the Horizon 2020 (Gøtke, et al. 2016) the ERA-NET Cofund contributes significantly to the strengthening of transnational cooperation by establishing lasting cooperation among countries and creating a critical mass of resources to tackle EU societal challenges. The co-funded calls implemented by the first ERA-NET Cofund actions resulted on average in the much broader participation of countries (16 compared to 10 under FP7 ERA-NETs) and substantially larger call budgets (on average €21.6 million) compared to FP7 ERA-NET Plus (€19 million) or ERA-NETs (€7 million). The internationalisation of research communities along with capacity building benefits were highlighted as benefits. Interestingly, the benefits associated with participation in Cofund actions were appreciated even in the cases where they were considered to perform worse than national programmes in terms of administrative burden or success rates. ERA-NET actions also brought about the increased visibility of previously unnoticed research areas. (Boekholt, et al 2017) In addition, ERA-NETs promoted international collaboration beyond the EU more successfully than Horizon 2020. (Gøtke, et al. 2016)

Today ERA-NETs span a wide range of thematic areas. Some ERA-NETs have created a strong legacy that persists from one framework programme to the next with a rich range of different impacts on policy, the economy, and society. Some examples are briefly presented below covering the areas of health, environment and climate change, bioeconomy, and industrial technologies.

E-RARE (Health)

Health ERA-NETs have managed to achieve research excellence as well as research results relevant to users' needs and long-lasting collaboration. Research excellence has been reflected in high-impact publications. For many project consortia, researchers reported sustained collaborations even beyond the project lifecycle. In the case of E-Rare, this was valid for almost 80% of the supported researchers. In E-RARE, since 2007, the participation of funders in joint transnational calls has increased from 6 to 23 funding agencies. For 70% of the funders, E-Rare is the unique programme to finance Rare Disease (RD) research. E-Rare invested €78 million in 7 calls to finance 98 transnational consortia including 449 research teams. The publication output of the funded projects results in an outstanding publication record with average impact factor of 9.5. Hundreds of new genes were identified, new diagnostics protocols and guidelines established and three patents filed. E-Rare has also had remarkable results on the internationalisation front by involving several international partners (Canada, Japan, USA).

BiodivERsA (Environment and Climate Change)

BiodivERsA, now in its third phase (2015-2019), addresses the need to develop science-based approaches to better preserve and sustainably use biodiversity and to develop nature-based solutions while promoting European innovation and competitiveness. BiodivERsA has had a series of impacts, starting with long-standing cooperation of the partners since 2005 and increased numbers of participating countries and partners, rising from 13 and 20 at the outset to 19 and 32 in 2015. With almost regular annual calls since 2008, BiodivERsA has managed to spend a total of €80 million in cash (€134 million in cash and in kind). Capacity building among the network partners receives high attention through staff exchanges and special activities for the successful integration of new partners and 'low performing countries'. This network also had an impact in terms of the way in which the participants approached the challenge addressed. From dealing with threats to bio-diversity, they turned to finding opportunities for biodiversity and nature-based solutions by escaping the linear model of basic – applied research and applying a multi-stakeholder approach that helped bridge the gap between different perspectives on biodiversity. This was facilitated by a foresight exercise that led to a vision on the common themes of interest and resulted in a revision of the challenge tackled by BiodivERsA.

WoodWisdom-Net and ERACoBioTech (Bio-economy)

A project supported by WoodWisdom-Net (WW-N) 2, called FireInTimber, led to the very first European wide guideline on the fire safe use of wood in buildings. The new models developed were used as input for the next revision of the European standard for structural fire design of timber structures (EN1995-1-2). In addition, the scientific excellence of the project was acknowledged by the award of the Count Carl Bernadotte Forestry Prize (Sweden) to researcher Birgit

Östman, the FireInTimber Coordinator. Other projects that achieved notable impacts include TES Energy-Façade (2008-2009) and the WW-Net follow-up projects smartTES (2010-2013) and E2ReBuild (2011-2014). The results of the WWN projects led to the creation of a special renovation system (by Paroc Group Oy) that is used in retrofit projects in several European countries. In addition, Arbonaut Oy Ltd was able to develop new products and services and further improve its forest inventory service ArboLiDAR, a remote sensing technology for timberland management. These projects also received a number of excellence awards, including the Schweighofer Preis 2011 and the European Innovation Award for the Forest Based Sector.

ERACoBioTech builds on three previous ERA-NETs in the area of biotechnologies, i.e. ERA SynBio, ERA IB and ERA Sys App. As an example of impact, the SysMilk project, which was supported under the first call for proposals of the ERA Sys App, brought together leading academic and industrial partners and provided access to state of the art technologies in both academia and industry. The research carried out enabled the production of GMO-free kefir which led to an estimated 15% growth rate in the Chr. Hansen company, a global market leader in dairy ingredients that took up the results.

M-era.NET and MANUNET (Industrial Technologies)

The M-ERA.NET project, which deals with materials science and engineering, provides an example of successful international cooperation beyond the EU. Taiwan, Russia, South Korea, Brazil and South Africa were involved in a number of M-ERA.NET calls and the number of submitted participations by international partners increased from 16 in 2012 to 48 in 2016. The total funding of projects with international partners reached €8.2 million (international partners: €2.9 million) out of a total funding of €70 million for all projects in 2012-2015.

The MANUNET, in the field of advanced manufacturing, has launched 10 calls for proposals since 2007, with an average of €19 million per call. In total, 963 proposals were received, involving more than 2500 SMEs. With EC support of €4.2 million, the network has mobilised more than €211 million, of which more than €121 million is national/regional public funding. A survey sent to 1500 applicants and filled in by 464 revealed the following impact on beneficiaries: 75% of applicants had innovative results (especially in products, process and methods); 61% of respondents confirmed that the results had been commercialised; 47% of the project results commercialised had reached the market in a period of 2 years. In addition, 65% of beneficiaries increased their R&I expenses and R&I personnel, while 46% of the cases allowed non-permanent personnel recruited during the project to get permanent positions. In relation to economic benefits, 41% of the respondents experienced an increase in turnover.

Article 169/185 initiatives

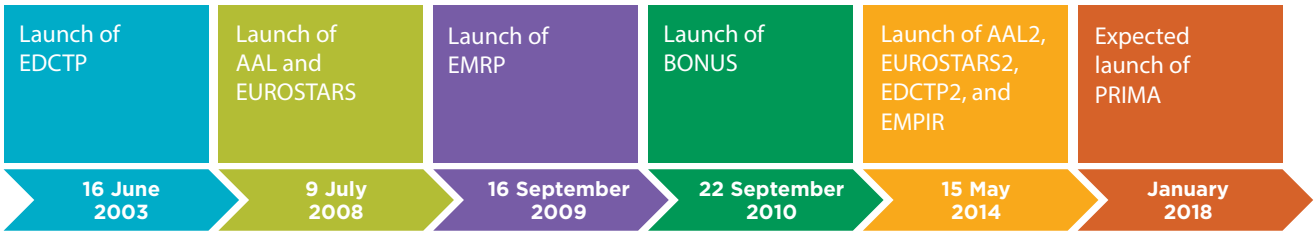


Table 2 : Art 169/185S In FP7 And Horizon 2020

Art 185	Members	EU contribution (€million)	National contribution
AAL2 (H2020)	17MS+3AC	175	175
AAL (FP7)	20MS+3AC	150	200
EDCTP2 (H2020)	13MS+1AC	683	683
EDCTP (FP6)	14MS+2AC	200	200
EMPIR (H2020)	23MS+5AC	300	300
EMRP (FP7)	19MS+3AC	200	200
EUROSTARS2 (H2020)	28MS+5AC	287	861
EUROSTARS (FP7)	26MS+5AC	100	300
PRIMA (H2020)	11MS+3AC+5TC	220	220
BONUS (FP7)	8MS	50	50
TOTAL (H2020)		**1665**	**2239**
TOTAL (FP7)		700	950

Source: European Union 2017

Throughout their lifetime Art 169/185 initiatives funded around 2,100 projects with a total investment of more than €5 billion; 42% coming from the EU and 58% from the Participating States.

Since 2003 five Art 169/185 initiatives have been created, out of which four[3] have been renewed under Horizon 2020. Starting with a total investment of around 1,700 € million in FP7, the overall budget of Article 185 initiatives (both EU and national contributions) more than doubled under Horizon 2020.

The success rate of eligible applications under Art 185 initiatives ranges from 23% in AAL2 to 33% or 34% for EDCTP2 and EUROSTARS2 respectively.[4] This is significantly higher than the average success rate of Horizon 2020 application[5] (11.6%) or that of FP7[6] (18.5%).

3 BONUS Art. 185 started later than the others and plans to follow with a successor programme at a later stage during Horizon 2020.
4 This is excluding the success rate for EMPIR that reaches 53%. However, this is due to EMPIR specific features due to the underlying institutional programmes of the participating states.
5 Based on selected projects for funding 2014-2016 (cut-off: December 2016).
6 Based on selected projects for funding 2007-2013 (cut-off: December 2013).

The Article 185 initiatives demonstrate convincing impacts in a variety of areas; AAL2, EMRP/EMPIR and EUROSTARS2 are oriented towards innovation/economic impacts, while BONUS and EDCTP2 are contributing to scientific and societal impacts. Policy related impacts are not insignificant.

Based on the stakeholder survey carried out during the meta-evaluation of Art 185 initiatives (Meyer-Krahmer, et al. 2017) the added-value from participation in Article 185 initiatives lies in the supplement to national R&D funding that EU co-funding provides; the higher impact of national R&D investments when embedded in transnational programmes; better national R&D capacity building and/or access to foreign knowledge; and higher political visibility for joint programmes at national and European level.

The Ambient Assisted Living (AAL) Art 185 Initiative focuses on addressing the needs of the ageing population by using ICT and other technological solutions to enhance the quality of life for older adults. AAL is characterised by an orientation towards innovation backed by the strong participation of SMEs and end-users. In AAL the implemented products, solutions and service concepts should come to the market within two to three years of the end of the funding period. This is not wishful thinking. Based on the impact assessment survey of AAL projects conducted recently (Faria and Varnai, 2016) more than 50% were involved in the commercialisation of solutions and components, and around 30% had generated and/or expected to generate revenues from AAL solutions and components.

AAL PROGRAMME

AAL has identified a number of success stories[7] that demonstrate the high potential of the solutions offered by AAL for commercialisation. As an example, the 2PCS Personal Protection and Caring System is a wearable technology designed to tackle the underlying causes of immobility. The specific system also incorporates Fearless, a sensory alarm system that detects accidents in the homes, which was also created in another AAL project. As another example, the ROSETTA project has developed an innovative, integrated system aiming at prevention and management of the problems that can occur in elderly persons as a result of chronic progressive diseases (such as Alzheimer). At the end of the project, the AAPS surveillance was almost market ready and was therefore scheduled to be launched in The Netherlands in 2013.

7 AAL Project Success Stories http://www.aal-europe.eu/about/success-stories/; http://www.aal-europe.eu/success-stories/

Based on the stakeholder consultation, Article 185 initiatives are recognised to allow for easier cross-country cooperation than national programmes or Horizon 2020 (90% of stakeholders) and allow projects that otherwise would not be realised, neither at national (86%) nor at European level (64%).

The latest evaluation of EMRP/EMPIR (Rossi et al. 2017) estimated that 50% of dedicated national budgets on metrology research were coordinated within EMRP (European Metrology Research Programme). To date, for the 25 projects selected in 2009 and 2010, new or improved products and services that can be attributed to EMRP/EMPIR have led to a European turnover of €109 million. A further €463 million of total sales is also projected, demonstrating that EMPIR is likely to reach its objective of at least €400 million of European turnover from new or improved products and services that can be attributed to EMPIR and its predecessors.

EMRP/EMPIR also contributed to 17 published and 103 draft standards and resulted in 36 patents. Additionally, 42 out of 119 EMRP projects contributed to the implementation of EU regulations in relevant grand challenges, i.e. energy, environment and health. As an example, EMRP research in advanced measurement techniques has resulted in an end-to-end traceability chain (from European National Measurement Institutes to end–users). This enables instrumentation manufacturers to verify the performance of new highly sensitive equipment that vehicle manufacturers and testing authorities will use to demonstrate compliance with a new EU regulation limiting emissions, which requires for the first time a test procedure to assess emissions under real driving conditions.

EUROSTARS aims to foster transnational cooperation among R&D intensive SMEs and create rapidly marketable innovations. Based on an analysis of EUROSTARS projects, the median time to market achieved so far is 1.2 years. By mid-January 2017, 77% of the products, processes and services have already been brought to market. A thorough econometrics-based impact assessment survey that was carried out in 2014 by an independent expert group (Makarow, et al. 2014) found a number of impacts on participating SMEs. These included: an average 3% to 3.5% higher growth rate in turnover; an employment growth rate for R&D-performing SMEs that was nearly twice as high as that for equivalent non-funded firms; nearly 8,000 jobs created based on projects completed in 2012 or earlier; and increased innovative outputs as measured by patent filings. Eurostars2 was also found quite complementary to other SME oriented public interventions, covering a specific niche for SME support. (European Commission, 2017) EUROSTARS publishes success stories showcasing the different types of impacts achieved. One example is Mendeley, the well-known service that started from the MAKIN'IT project that produced free software to manage and share research papers, coupled with a social media-type website. In 2003 Mendeley was sold to Elsevier for up to $100 million. At the national policy front, thanks to Eurostars, 12 national programmes have been newly created following the Eurostars approach and 14 have been adapted to accept the use of a central independent evaluation and to fund the projects according to a common ranking list.

Based on the Final Evaluation of the Joint Baltic Sea Research Programme (BONUS) (Arnold, et al. 2017) it is estimated that about 14% of all Baltic Sea related R&D is integrated in the programme. This indicates a significant contribution to the coordination of research in this area. BONUS contributes to policy and regulation in the battle against overfishing and to the sustainability of the Baltic Sea fish populations. As an example, the BONUS fisheries projects InSPIRE and GOHERR are actively providing scientific information to define the total allowable catch and maximum sustainable yield of fish population in the Baltic Sea. As well as policy impacts, BONUS has had important scientific impacts. Based on the bibliometric analysis of BONUS publications that supported the final evaluation, the scientific quality of BONUS projects is clearly higher than of non-BONUS projects. Scientific contributions from BONUS projects helped provide advice to the European Commission, and the International Council for the Exploration of the Seas, as well as to the relevant Danish, Estonian, Polish and Swedish ministries. More than 90% of the BONUS respondents to the final evaluation of the initiative, thought that the initiative was responding effectively to the major environmental and key societal challenges the region faces and will continue to face in the coming years.

The first programme of the European & Developing Countries Clinical Trials Partnership (EDCTP) ran from 2003 to 2015. It launched 65 calls for proposals, received 789 applications and awarded 254 grants with a total budget of €208 million. In addition €169.7 million of cofunding (cash and in-kind) was provided directly to EDCTP projects, bringing the total project value to €377.7 million. More than €154 million (74.2%) of EDCTP grant funding was awarded to African participants and more than 70% of the 254 EDCTP projects were led by African coordinators. More than 700 peer-reviewed publications have resulted from EDCTP1 projects, many of which are in leading journals and are highly cited, indicating high scientific relevance and impact (EDCTP, 2015), including findings that have influenced national and international policies and guidelines. EDCTP funding also triggered the creation or capacity improvement of several clinical trial sites (in Republic of Guinea, Guinea Bissau, Mozambique, Namibia, Senegal, Tanzania), as well as the establishment of the first four African clinical trials networks, one in each of the four sub-Saharan regions (Western, Eastern, Central, Southern)(Technopolis, 2015).

The socio-economic impact of EDCTP2 is exemplified by the response to the Ebola outbreak. As noted by a stakeholder: "Much of what was accomplished (in response to Ebola) would not have been accomplished without the concerted efforts of EDCTP2."

The Article 185 Meta-evaluation (Meyer-Krahmer, et al. 2017) recognised that Art 185 initiatives managed to mobilise significant investments in important policy areas not only of high European added-value but also of global relevance. EU added-value results from the high quality of R&I projects not realisable at national level; the higher impacts and knowledge gains associated with transnational programmes; the strong network effects, the seeding of communities; and the catalytic effect on national initiatives and activities.

Joint Programming Initiatives

Joint Programming Initiatives (JPIs) aim to pool national research efforts to make better use of Europe's public R&D resources and to tackle common European challenges more effectively in a few key areas. JPIs have been around for less than 10 years. They have attracted wide participation from EU Member States and Associated Countries like Norway, Turkey and Israel. Canada and Switzerland are the most prominent of the participating Third Countries but another 10 have participated in at least one of the Joint Calls of FACCE or Water JPI. Taken together, by Dec 2015 JPIs had committed around €262 million to a total of 32 Joint Calls involving 37 countries. 16 of these calls where implemented though JPI-initiated ERA-NET Cofunds reaching a total call budget of €252 million.

The financial support from the Commission (through CSAs and the ERA-NET instrument) has clearly been vital to the development of the JPIs and this will continue to be the case. The JPIs are now taking full advantage of the Horizon 2020 ERA-NET Cofund instrument and so the scale of aggregated investment could increase rapidly over the coming years. (Hernani, et al. 2016)

As a first indication of the alignment of national/regional strategies in certain areas, all JPIs have developed long-term Strategic Research (and Innovation) Agendas to guide their development and orientation. Although a system for systematic evaluation of impacts is still developing, JPIs have impacts to demonstrate in various areas.

JPIs enabled new capacity-building in areas where previously transnational collaboration amongst Member States was poor or nonexistent, e.g. agricultural research, neuro-degenerative research, cultural heritage, anti-microbial resistance and water research.

Interviews conducted by ERA-LEARN 2020 in 2015 revealed that the networking and collaboration opportunities offered by the JPIs were highly appreciated both by the research community and the JPI partners. They were also quite positive about improved collaboration and coordination across different ministries and between different funding agencies at the international and, even more importantly at the national level, leading to less fragmentation.

JPIs have also enabled reduction of duplication and production of new inter-disciplinary knowledge through new actions like the so-called knowledge hubs. MACSUR was the first knowledge hub created under FACCE-JPI. It is a network that builds on the concept of 'Networks of Excellence'. In essence, it gathers together European researchers who have already secured (national) funding for modeling and assessing how climate variability and change will potentially affect regional farming systems and food production in Europe; and for estimating the associated risks and opportunities for European food security. The MACSUR Knowledge Hub brings together 300 researchers originating from 18 countries.

Certain JPIs, including Climate, AMR, Urban Europe, Cultural Heritage, More Years Better Lives, and FACCE-JPI, have managed to apply a multi-disciplinary approach that involves various types of stakeholder (users, industry, societal organisations, municipalities, etc.), which has in turn instigated a fundamental change in the mind-sets of the relevant research communities.

JPIs have also developed a track record of influencing policies at national, European and international levels. In the case of JPIAMR, 20 participating states have developed national plans for anti-microbial resistance, whereas only two had such plans at the beginning of the initiative. New AMR (antimicrobial resistance) national research programmes were set up with earmarked funding in Norway, Sweden, the Netherlands, and Switzerland, while the development of the JPIAMR strategic research agenda influenced the national agendas of Sweden and Spain. The priorities set out by JPIAMR were taken into consideration in the development of the 'European One Health action plan against AMR'. JPIAMR activities are included in the G7 and G20 AMR declarations, in the WHO AMR Global Action Plan and in the latest UN AMR resolution. (ERA-LEARN 2020, 2015)

The research in FACCE-JPI has helped inform the EU Food2030 Strategy and IPCC's fifth assessment report. The work of JPI Climate's Working Group on Climate Services (CS) was crucial in building a European CS community and framing its research needs. JPI Climate contributes to international processes, including the UNFCCC (UN Framework Convention on Climate Change) and the UN Sustainable Development Goals. JPI Water has contributed to the development of national priorities in water research in Cyprus. JPI Climate and JPI Urban Europe influenced the shaping of Horizon 2020. JPI Oceans provided input to the International Seabed Authority and managed to raise marine research as a strategic area at the European level. It also brought the oceans issue to the attention of G7. JPND helped realise the ambition of G7 in dementia research by highlighting certain activities in this area (ERA-LEARN 2020, 2015).

G20 Health Ministers point out JPIAMR as key initiative to support. In the declaration following their meeting in May 2017, they conclude: "We commit to broaden the voluntary financial support for these initiatives. We call on other countries, philanthropic organizations, academia and the private sector to support these initiatives"

(Berlin Declaration of the G20 Health Ministers, May 20, 2017)

The international dimension of the JPIs is also noteworthy. For instance, JPIAMR enjoys membership beyond Europe as Japan, Argentina and Canada are members. It also engages with international stakeholders including WHO, the US National Institute of Health (NIH) the Transatlantic Taskforce on Antimicrobial Resistance (TAFTAR) organisations, and the Association of Southeast Asian Nations (ASEAN). JPI Water activities include Israel, Norway, the Republic of Moldova, Turkey, as well as Egypt, South Africa, Tunisia, Canada and Taiwan. JPND started as a European initiative but is now global including members from Albania, Israel, Norway and Turkey, as well as Australia, Canada and Switzerland.

JPIs have mobilised the shared use of existing infrastructures and the creation of new ones. As a pilot action of JPI Oceans, the shared use of RV Sonne, the German research vessel, was made possible, with significant effects on shared knowledge production as well as efficiency gains. JPND is developing the JPND Cohort Portal, an interactive directory of neurodegenerative disease-relevant cohort studies. JPI HDHL is particular proud of the European Nutritional

"JPIs can help to provide an underpinning science base to support policy development and implementation".

(JPI Oceans as quoted in Hernani, et al. 2016)

Phenotype Assessment Data Sharing Initiative (ENPADASI). ENPADASI is developing an open access research infrastructure for all nutritional, mechanistic, interventional and epidemiological studies. This will create the most advanced system for integrating nutritional data in Europe and beyond, sharing large and small datasets.

Overall, JPIs have given rise to positive impacts in relation to the commitment of members and the involvement of stakeholders, especially end users. Important beneficial impacts include the development of long-term perspectives, common strategic agendas as well as significant contributions to national and international policy-making. Further, most national stakeholders state that their countries intend to either maintain their current level of participation or moderately increase it. Interestingly, the 'marginal players' expect to increase their participation (Hernani, et al. 2016).

Notwithstanding this, JPI members recognise that the ultimate measure of impact concerns the degree to which they manage to address specific societal challenges. Identifying and providing solutions to the challenges addressed takes time. JPIs kicked off implementation by building their governance structures, developing their SR(I)As and planning or launching joint calls and other joint actions. Yet there are still some concerns about trust building between the members, and about the governance structures needed to enable robust and consensus decision making processes (Hernani, et al. 2016), both of which may ultimately require further increases in the levels of commitment and resources dedicated to JPIs.

"The JPI can be considered as a "game changer". Many achievements could not have happened 2 – 3 years before, without the JPI."

(JPI Urban Europe as quoted in Hernani, et al. 2016)

Untapped potential within a challenging future

Despite their differences in scope, structure and specific objectives, P2Ps are all underpinned by the same drivers i.e. the desire to reduce fragmentation in the European research funding landscape; the imperative to address societal challenges with a larger critical mass; and the need to align strategic research programming at EU and national level (Boekholt, et al. 2017). P2Ps have achieved a great deal in bringing together national efforts in order to deal with research issues and societal challenges of common interest. The level of mobilisation of national resources is significant and the momentum that has been created is not negligible.

The potential of P2Ps to address diverging research and innovation needs in different regions of Europe has also been recognised. The ERA-Net Cofund evaluation recommended better exploiting the potential of Cofund actions to support a pro-active widening strategy that would engage low-performing countries. The JPI evaluation suggests that marginal countries and selective players might explore potential synergies with their Smart Specialisation Strategies in order to enable more strategic participation. The importance of attracting lower R&D-intensive countries and creating synergies with European Structural and Investment Funds was also stressed in the Art 185 Meta-evaluation.

Interestingly, the challenges that the three types of P2Ps (ERA-NETs, Art 185s and JPIs) face bear more similarities than differences. Apart from some specific technical or implementation-related difficulties that certain types of P2P might share, the following generic challenges are common across all P2P types.

Admittedly, there is more to be done in order to tap the full potential of P2Ps in fulfilling their higher-level objectives

A coordinated and coherent P2P strategy across the national and European level

The JPIs evaluation report (Hernani, et. al. 2016) calls for greater collaborative efforts to develop national, transnational and EU policies and priorities if the potential of the Joint Programming process is to be fully tapped. Similarly, the evaluation of the ERA-NET Cofund instrument (Gøtke, et al. 2016) concluded that more efforts need to be devoted to embedding ERA-NETs in coordinated and coherent strategies across thematic areas, and to enhancing synergy with other instruments and initiatives. Cofund actions are not deeply embedded in national policy portfolios and/or national strategies, possibly reflecting Member States' lack of ambition to fully realise the instrument's potential.

The Meta-evaluation of the Art 185 Initiatives (Meyer-Krahmer, et al. 2017) also calls for more strategic cooperation among Article 185 initiatives and other P2Ps. Article 185 initiatives are not particularly prominent within national R&I strategies, and in some cases they are not even included within the national ERA Action Plan (EMPIR is a notable exception).

The deliberations for the next Framework Programme offer the option to design and implement such a multi-level approach to joint programming. This may also assign P2Ps a more strategic role at the national level.

Streamlining the overpopulated landscape of ERA supporting instruments

All relevant evaluation reports point to the need for a more streamlined landscape of ERA instruments which is now overpopulated with a plethora of different schemes and initiatives, whose positioning and complementarity is less than clearly justified.

Discussions at the Annual Joint Programming Conference (Nov. 2016) highlighted the need for the P2P landscape to be streamlined by establishing synergies among P2Ps in similar areas, but also by taking decisions on the life span of P2Ps and possible entry-exit criteria. This would facilitate decision-making about the selection of appropriate P2Ps to join and which new ones could or should be formed (ERA-LEARN 2020, Report of the Annual Joint Programming Conference 2016). The need for a clear exit plan, i.e. how long a partnership is expected to evolve, dissolve, or continue without the EU support, was echoed during the Informal meeting of Research Ministers in Tallinn (Estonia) on 24-25 July 2017, who also noted the lack of a systematic process for identifying, implementing and monitoring partnerships.

Increasing commitment to deliver the envisaged impact

Dealing with the societal challenges addressed needs significant resources and continuity of efforts, i.e. high-levels of commitment.

Although a lot has been achieved in terms of creating critical masses and reducing fragmentation, several partnerships suffer from lack of political and high-level commitment and support. This may be partly explained by lack of alignment between national objectives and measures, and partly by lack of coordination between authorities at the national level (Boekholt, et al. 2017).

The JPI evaluation (Hernani, et al. 2017) notes that the overall level of ambition does not meet initial expectations. While some countries demonstrate high level commitment, there are others that have not made much progress. The report concludes that there is a risk that the joint programming process is not sustainable, without a stronger role for the Commission. The need for increased political commitment in order to capture the full potential of the instrument, applies also to the ERA-NET Cofund and Art 185 instruments.

Reaching out beyond the research community

Notwithstanding some notable exceptions, P2Ps are mostly research driven. All different types of P2Ps note that more needs to be done to engage more actively with user communities, including industry and policy-makers. The innovation dimension is underexploited, although there are several P2Ps targeting high TRL[8] projects in energy, or industrial technologies for instance. The ERA-NET Cofund analysis (Gøtke, et al. 2016) argues that the extent to which ERA-NET actions focus on innovation is more linked to the type of participating organisations and their priorities rather than to any obstacles posed by the instrument itself. Indeed there are several networks with increased innovation orientation that also collaborate closely with Public-Private Partnerships (cPPPs) or European Technology Platforms. ERA-NET Cofund actions could be practical ways of supporting Open Innovation in linking national with European innovation programmes.

8 Technology Readiness Level, a measure to assess the maturity of evolving technologies to be implemented.

The way ahead for a rewarding future

Participants at the Annual Joint Programming Conference last November (2016) agreed that the value of P2Ps is highly appreciated although a lot still needs to be done to fully exploit their potential for structuring the ERA. The strategic continuation of successful P2Ps with strong commitments from MS might be one way forward. Simultaneously, the missions and overall aims of P2Ps need to be revisited in order to manage expectations. The added value of national and European investments in P2Ps needs to be clearly demonstrated. The joint programming process seems to be at a crossroads: progress has been made but now we need to compare achievements with the original goals of openness, excellence and impact.

Experience has shown that the prerequisites for successful joint programming include clear goals stemming from a joint vision; their manifestation in a strategic research and innovation agenda; long-term commitment; and evidence of 'substance', as reflected by the number of countries involved, the range of participating stakeholders, and budget volume. National Action Plans and ERA Road-maps reflect the commitment of Member States and are encouraging in this regard, although readiness to engage in P2Ps varies across different countries. The Mutual Learning Exercise on Alignment and Interoperability was instrumental in making Ministries realise the need to engage with 'sectoral' ministries and beyond DG RTD. (Kolar et al. 2017)

Efforts need to be directed towards further developing and improving P2P instruments and initiatives, especially in terms of openness, coherence and an ability to reap the innovation potential of European R&D (Boekholt, et al. 2017). Before creating new instruments, the use of existing ones needs to be optimised. This also necessitates the transnational alignment of national programmes, and long-term commitment and support that also utilises alternative sources of funds, such as the European Structural and Investment Funds.

A wider P2P partnering approach that is imperative would encourage synergy and coordination with all other existing P2Ps and PPPs, as well as with the Work Programmes of the Framework Programme in the areas they address (Gøtke, et al. 2016). Such an approach would help P2Ps realise their high-level objectives and reflect their importance in the development of national and international R&I capabilities.

A new (policy) narrative needs to be developed for P2Ps that is underpinned by evidence of impacts and which will bring science closer to society and industry. This new narrative can be strengthened by an 'umbrella' branding for P2Ps reflecting their common mission but also encompassing and building on their diversity.

But we also need to move from "defending the interests of our own country" to "working for the greater good"

(Hans-Günther Schwarz, Austrian Ministry of Transport, Innovation and Technology, Annual Joint Programming Conference, Nov.2016)

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