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How can the EU Framework Programme for Research and Innovation increase the economic and societal impact of RDI funding in Finland - *Key Results*

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1. INTRODUCTION

This '*Key Results'* report is a shortened version of the full evaluation report '*How can the EU Framework Programme for Research and Innovation increase the economic and societal impact of RDI funding in Finland', paying particular emphasis on the key findings, conclusions and recommendations of the study. The full report will cover in more detail the study context, methodology, provide case studies of Finnish organisations participating in the Horizon 2020, as well as describe as cases how some comparison countries have organised their national support for FP participation.*

1.1 Background

One objective of the current government is to improve the quality and effectiveness of research and innovation. This is particularly essential in a situation where there have been budget cuts in research, development, and innovation (RDI) funding to balance government budgets.

Finland has a long history of investing into R&D and education, which is well reflected in our international standing with regard to competitiveness and innovation, among others. There were steady increases in both private and public R&D investments for several decades, until the early 2000s. Accordingly, Finland has ranked among the top innovative countries in input indicators and framework conditions, such as investment in RDI, education levels, general technology readiness[1].

Over the past decade however, the R&D investments have decreased and the Finnish competitiveness has been quickly deteriorating. In 2016 Finland's gross expenditure on R&D decreased by €145 million to 2.8% of GDP, as compared to the peak of 3.8% in 2009. The estimate for the year 2017 is 2.7%. The lack of funds has also been reflected in the decreasing number of researchers.

These decreases have been mainly due to the cuts in the private sector, most of which concern specifically the ICT industry as one of the dominant enterprises underwent a major crisis. Despite the decline, the R&D intensity of Finland remains among the highest in the EU and globally among advanced economies, and outside ICT industry the general trend of private R&D expenses has been on a slight rise. Within the EU, Finland remains as one of the innovation leaders.

However, looking at some of the innovativeness and competitiveness indicators more closely, e.g. the World Economic Forum indicators; while the overall ranking has stayed high, specifically the indicators that relate to innovation have been declining for some time[2]. Also in general, Finland is coming back from a decade-long economic regression and stagnation, that was set off by the financial crisis but has perhaps more importantly been driven also changes in the structure of the economy. When looking at outcomes, in terms of industrial productivity Finland compares to other Northern European advanced economies,

[1] World Economic Forum, 2017

[2] Pajarinen, Rouvinen and Ylhäinen, 2017

and Finnish universities perform mostly averagely as found in The Academy of Finland's science panel[3].

The shortage of private and public R&D funding has strongly increased the competition for domestic funding, particularly among universities and research institutions whose direct government funding has been cut. In this respect, the availability of increasing amounts of EU framework funding should have offered a welcome alternative for national funding. Accordingly, the Research and Innovation Council (RIC) – an advisory body to the Government - set a goal for Finland to increase funding received from Horizon 2020 – The Framework Programme for Research and Innovation 50% compared with that obtained under the 7th Framework Programme for research and Innovation (FP7). According to the latest figures, Finland is on track to meet this objective of being a net recipient of Framework Programme (FP) funding, although competition is intensifying.

Furthermore, during 2017 there has been a clear upturn in the Finnish economy, and this is likely to be reflected in both private and public investments to research and innovation. After nearly a decade of contraction, in 2017 the economy is growing again. In 2017, the year-on-year growth of GDP has been 2.7-3.0% and most growth forecasts have been revised upwards. The Bank of Finland forecasts continuing GDP growth also for the coming years.

Current Government's objectives. Despite the overall R&D budget cuts, the vision of Prime Minister Sipilä's Programme is to improve the quality and effectiveness of research and innovation activity and for education and research to become more international. The Government Programme includes a number of specific 'key projects' linked to these objectives. Key project five states that cooperation between higher education institutions and business life will be strengthened to bring innovations to the market. It also includes a measure, in which "public and private resources will be drawn upon to put in place high-impact strategic projects and promote a national division of duties in RDI efforts by employing the measures outlined in the multiannual process of intensified cooperation between, for example, universities and research institutes as well as the EU's Horizon 2020 research and innovation programme, the European Regional Development Fund (ERDF) and the European Fund for Strategic Investments (ESFI)."

OECD Review on Finnish innovation system. During 2016-2017 OECD carried out a country review of Finnish research and innovation system. The review was released in June 2017. One of the key outcomes and recommendations of the review concerns internationalisation of Finnish business and research. This is not the first time the concern has been raised. In their review, OECD states that "internationalisation of firms and access to global markets is paramount to enhance innovation activity and firm growth". There are few foreign researchers in Finland, as scope for improvement with regard to international research cooperation. The research landscape is fragmented and needs better governance, among others. The government proposal for 2018 budget states that this OECD review sets the guidelines for government R&I policy for the next few years.

Relevance and timing of this exercise. In respect of the OECD Country Review, among others, there is a need to properly analyse the Finnish participation on the Horizon 2020 (and whether it can be increased) to support the internationalisation of Finnish research overall. Although Finnish participation in Horizon 2020 is at a relatively good level, there is an interest to make the best of the available funding, particularly when national RDI budgets have been on a lowering trend. At the same time, the planning of the next FP – its approach, structures and key themes – has already started and Finland needs a clear

[3] Suomen Akatemia, 2016

mission with sufficient facts and evidence. It is increasingly important to ensure that the next funding programme is built so that expertise arising from national funding as well as financial and societal impact can be leveraged effectively. In addition, it is necessary to identify what has been the value added of RDI activity taking place via framework programmes in terms of the Government Programme's strategic RDI issues important for Finland, as well as from the perspective of the OECD evaluation to be completed.

1.2 Scope and objectives of the evaluation

General relevance. The core actors (Ministry of Economic Affairs and, Ministry of Education and Culture, Academy of Finland and Tekes) of the national Horizon 2020 network, coordinated by the Ministry of Employment and the Economy, conducted a survey for the Horizon 2020 programme's Finnish National Contact Points (NCPs) and committee members in autumn 2016, which analysed Finnish success factors and benefits in the framework programmes and particularly in the Horizon 2020 programme now under way. The survey also considered in an indicative way what should be retained from Horizon 2020 for the next framework programme and what should be changed. This has created a foundation for the consideration of Finland's strategic starting points in the preliminary preparatory phase of the next EU Framework Programme for Research and Innovation. The most important benefits highlighted by the survey relate to the following impacts: extensive networking with international excellence, rapid access to international markets, significant increase in funding for small and medium-sized enterprises (SMEs), creation of new pan-European lead markets, and forecasting and identifying global challenges and creating innovative solutions for them in collaboration with the best experts.

Based on the survey and a discussion session arranged in December 2016, it has been perceived necessary to deepen the knowledge base on the benefits and effectiveness obtained by Finns from the framework programmes also with the aid of econometric analysis. In addition, it is timely to review and evaluate the Horizon 2020 programme's revised, instruments, processes and their linkage to national RDI activities, other EU funding instruments and the development of the European Research Area (ERA). The study should also review effectiveness and utility assessments of key comparable countries by linking to the ad hoc effectiveness evaluation group operating under the ERAC (European Research Area Committee) and utilising the different forms of effectiveness defined therein, and also to the "ERA in Action" work of the EU's RDI Liaison Offices. Analysis, assessment and impact information like this is important for building a Finnish position for the proposals of the next framework period.

Besides a general review of the Finnish participation in the Horizon 2020 and its impacts, this evaluation has a specific research perspective to assess the complementarity of EU Framework Programmes to the national RDI funding. This is being addressed with the following research questions:

1. What kinds of benefits have been obtained to date particularly from the Horizon 2020 programme?
2. What parts of the programme and forms of activity are best for a small economy like Finland, also in relation to National priorities?
3. What kind of social, economic or environmental impacts are perceptible/achievable with the programme or with Finnish projects funded from it?
4. What has been the financial performance of businesses that received funding from EU framework programmes?

5. What kind of innovation effects have arisen from projects of research institutes and universities that received funding from EU framework programmes?
6. How should, for example, EU preparatory and co-funding and the role of national funding organisations be further developed?
7. What kind of conclusions relating to effectiveness are available from comparable countries?

2. CONTEXT, FRAMEWORK AND METHODS

2.1 European research and innovation policy and the role of Horizon 2020

European research and innovation policy trends. Horizon 2020 has its roots well-connected to the recent research and innovation policy development of Europe. In 2010 EU adopted its latest strategy framework, the Europe 2020 Strategy, which set the main lines (i.e. Smart Growth, Sustainable Growth and Inclusive Growth) also for research and innovation in Europe. In particular, much higher emphasis was given to strengthening research and innovation both in the Member States, but particularly collaboration at the European level. The major policy shift was the introduction of the European Research Area (ERA) at this juncture. Two years after, in 2012, the reinforced ERA put more emphasis on a number of more specific issues in European research and innovation collaboration, and also introduced the 3% R&D target for EU. The Jobs, Growth and Investment Package in 2014 brought the European Digital Single Market, emphasised Energy Union and a forward-looking climate change policy in Europe.

Introduction of Horizon 2020 in 2014. Horizon 2020 was designed to drive economic growth and create jobs by coupling research and innovation (R&I), with an emphasis on excellent science, industrial leadership and tackling societal challenges. The general objective was to contribute to the EU's overarching jobs and growth strategy by: helping to build a society and an economy based on knowledge and innovation across the Union; by leveraging additional research, development and innovation funding; and by contributing to attaining R&I targets, including the target of 3 % of GDP for R&I across the Union by 2020.

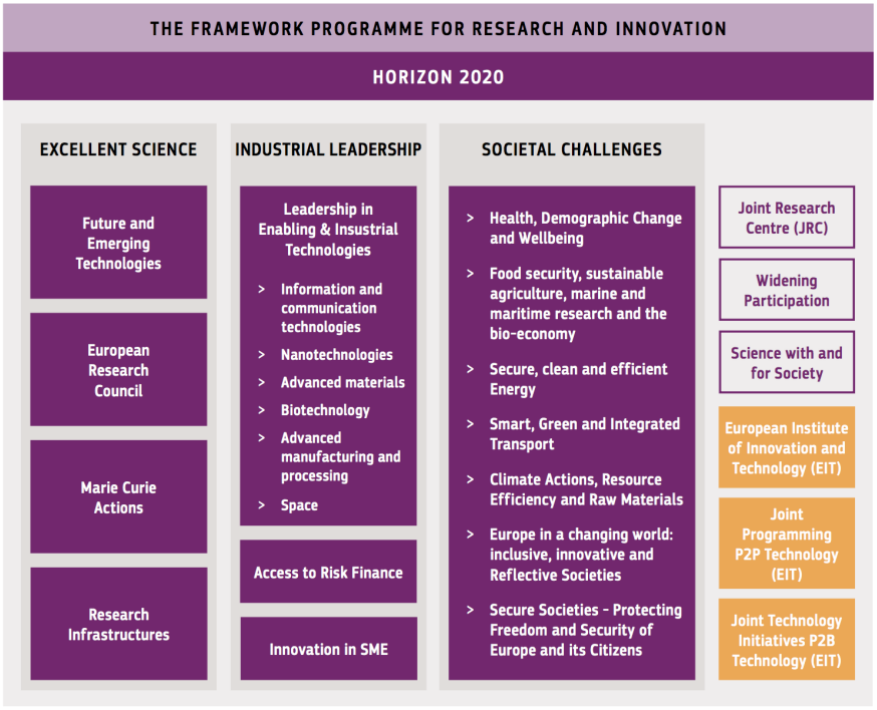
> *Horizon 2020, the EU Framework Programme for Research and Innovation (2014-2020), is unique in the world in terms of its scale, duration and scope. It pursues ambitious objectives, including jobs, growth and better lives for Europe's citizens, through stronger science, technological leadership and the tackling of societal challenges.*[4]

Within the European policy context, the **Europe 2020 strategy** for smart, sustainable and inclusive growth, the **Innovation Union initiative** and the **European Research Area (ERA)** are responses to the recognised challenges including low growth, insufficient innovation, and a diverse set of environmental and social challenges that Europe faces. Science and innovation are considered as key factors leading Europe towards smart, sustainable, inclusive growth, and towards tackling the pressing societal challenges. **Horizon 2020** emerged as a single strategic framework integrating research and innovation (R&I) activities

[4] Interim Evaluation of Horizon 2020, European Commission 2017

and became the largest ever EU R&I programme with almost €80 billion funding available for 2014–2020. It has three strategic objectives; 1) raising and spreading the levels of excellence in the research base, 2) tackling major societal challenges, and 3) maximizing competitiveness impacts of research and innovation. The Horizon 2020 programme is structured around these three priorities and the selection of programme activities and instruments is also driven by these priorities.[5]

Structure of Horizon 2020



Source: Interim evaluation of Horizon 2020, EC 2017.

Activities of Horizon 2020 are focused on three mutually reinforcing **Key Priorities** (also called **Pillars**); 1) Excellent science, 2) Industrial Leadership, 3) Societal Challenges, with two additional priorities 4) Spreading Excellence & Widening Participation, and 5) Science with and for Society. [6] In addition, these are complemented by cross-cutting activities related to social sciences and humanities and innovation pilots, as well as direct non-nuclear actions of JRC and activities within the European Institute of Innovation and Technology. These five work programmes are further divided into specific recognised challenges and measures.[7]

Horizon 2020 is open to everyone, but different **action types** exist defining the expected outcome and for whom specific activities under each work programme are directed;[8]

5 European Commission (2011). Commission staff working paper. Executive summary of the impact assessment. Brussels, 30.11.2011. SEC(2011) 1428 final. Volume 1. http://ec.europa.eu/research/horizon2020/pdf/proposals/horizon_2020_impact_assessment_report_executive_summary.pdf#view=fit&pagemode=none; European Commission (2014). Horizon 2020 in brief – The EU Framework Programme for Research & Innovation. ISBN: 978-92-79-33057-5. http://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/H2020_inBrief_EN_FinalBAT.pdf

6 European Commission (2011) Horizon 2020 – The Framework Programme for Research and Innovation, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2011) 808 final, European Commission 2017 Interim Evaluation of HORIZON 2020, DG-RESEARCH

7 European Commission (2014).

8 European Commission (2014); European Commission. Horizon 2020 sections. https://ec.europa.eu/programmes/horizon2020/en/h2020-sections (visited 20171019)

- **Research and innovation actions** (RIA) aim to tackle clearly defined challenges with a result of new knowledge or a new technology. Funding is directed to consortia of partners from different countries, industry and academia.
- **Innovation actions** (IA) are more focused on closer-to-the-market activities, for example through prototyping, testing, demonstrating, piloting, scaling-up etc. Funding for such activities is directed to consortia of partners from different countries, industry and academia.
- **Coordination and support actions** (CSA) are specifically for the coordination and networking of R&I projects for which the project funding is covered from another source. This type of funding is to single entities or consortia of partners from different countries, industry and academia.
- **Frontier research grants – ERC** are for projects that are assessed on the criterion of scientific excellence in any field of research, carried out by a single national or multinational research team led by a so called principal investigator. ERC funding is meant for excellent young and early-career researcher, already independent researchers and senior research leaders with any nationality and field of research.
- **Support for training and career development – Marie Skłodowska-Curie Actions** (MSCA) are for international research fellowships in the public or private sector, research training and staff exchanges. Funding is directed to both experienced and early stage researchers of any nationality, technical staff, and national/regional research mobility programmes.
- **SME instrument** (SMEI) aims to develop innovative SMEs growth potential and offers lump sums for feasibility studies, grants for an innovation project's main phases, including demonstration, prototyping, testing and application development, and facilitated access to debt and equity financial instruments to support the commercialisation phase of innovation projects. Funding is available only for SMEs both single and consortia of SMEs established in an EU or associated country.[9]
- **Fast track to innovation pilot** (FTI) is a bottom-up measure that was launched in 2015 to promote trans-disciplinary, cross-sectoral and close-to-the-market innovation activities in any area of technology and to any kind of innovation actor to work together and deliver innovations onto the market and/or into society.

In addition**, Public-Private Partnerships (PPP)** are supported through joint undertakings called **Joint Technology Initiatives (JTIs)** that are active in a number of areas of strategic importance for the EU (such as fuel cells and hydrogen, bio-based industries and electronics manufacturing) and through contractual PPPs (such as The Factory of the Future, Green Vehicles, Robotics). **Programme co-fund actions** supplement individual calls or programmes, such as calls for proposals between national research programmes (ERA-NET co-fund), pre-commercial public procurements or public procurement of innovative solutions (PCP-PPI co-fund) and mobility programmes (Marie Skłodowska-Curie co-fund).

An action of the **European Institute of Innovation and Technology** (**EIT)** functions to integrate higher education, research and innovation through the **Knowledge and Innovation Communities (KICs),** which supports long-term vision based partnerships run by a business logic and results-oriented approach with a focus on achieving economic and social impact.[10] The Commission has co-financed the establishment of public procurers' networks through the previous framework programme (FP7) and now co-finances public

[9] As of 1 January 2017, the associated countries are: Iceland, Norway, Albania, Bosnia and Herzegovina, the former Yugoslavian Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland, Faroe Islands, Ukraine, Tunisia, Georgia, Armenia. (European Commission. Associated Countries. http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/3cpart/h2020-hi-list-ac_en.pdf)

[10] European Commission (2014).

procurers from different European countries through Horizon 2020 and CIP to undertake together **PPIs on topics of common interest**.[11] **The Future & Emerging Technologies (FET)** programme functioned already within the FP7. It invests in transformative frontier research and innovation with a high potential impact on technology to benefit the economy and Europe-wide society. Within the Horizon 2020 framework the FET forms a part of the 'Excellent science' Pillar.[12] As a part of the innovation agenda, the Commission has founded the European Innovation Council (EIC) for the last period of Horizon 2020 (2018-2020), to pilot centralized implementation of innovation actions SMEI, FTI, and FET-Open[13].

To enable companies and organisations to gain easier access to risk finance, the **InnovFin – EU Finance for Innovators** offers financing tools and advisory services covering the entire value chain of research and innovation. InnovFin is a joint initiative launched by the European Investment Bank and the European Commission under the Horizon 2020 pillar for 'Industrial Leadership'. **European Investment Bank (EIB)** and the **European Investment Fund (EIF)** have also an important role in implementing financial instruments in partnership with the European Commission by providing loans and guarantees as well as technical assistance and advisory services.[14] To support the knowledge transfer and exchange of information thematic **conferences and events**[15] are organised within the Horizon 2020 framework and **advisory groups** and **independent experts**[16] assist and advice the Commission in connection with the Horizon 2020.

Key changes introduced in Horizon 2020, as compared to FP7[17]

- A single programme for all EU-managed R&I funding, with a single set of participation rules;
- Full integration of innovation in the programme, meaning more support that is closer to market application (e.g. demonstration, support for SMEs, innovation services, venture capital);
- A focus on the major societal challenges facing Europe and the world. This means bringing together different technologies, sectors, scientific disciplines, social sciences and humanities, and innovation actors to find new solutions to these challenges;
- Radically simplified access for participants, including a single web portal for all information and projects, less paperwork to make applications, and fewer controls and audits;
- A more inclusive approach with specific actions to ensure excellent researchers and innovators from all European regions can participate, and reinforced support for partnerships with both the private and public sector to pool resources and build more effective programmes;
- At the same time, successful elements from FP7 are being scaled up, such as the European Research Council (ERC) and transnational collaborative projects.

[11] European Commission (2017). Public Procurement of Innovative Solutions. DG CONECT. 9 May 2017 https://ec.europa.eu/digital-single-market/en/public-procurement-innovative-solutions

[12] European Commission (2017). Future & Emerging Technologies (FET). DG CONNECT. 28 August 2017. https://ec.europa.eu/digital-single-market/en/policies/future-and-emerging-technologies (visited 20171019)

[13] European Commission (2017) European Innovation Council (EIC) pilot DG-RESEARCH https://ec.europa.eu/research/eic/index.cfm

[14] European Commission. Horizon 2020 – Access to risk finance. https://ec.europa.eu/programmes/horizon2020/en/h2020-section/access-risk-finance (visited 20101019)

[15] European Commission. Research & Innovation – conferences and events. http://ec.europa.eu/research/index.cfm?pg=events&period=2017&theme=719491AD-9C69-558D-B05B8AC79345ED08

[16] European Commission. Experts. http://ec.europa.eu/programmes/horizon2020/en/experts (visited 20171019)

[17] Interim Evaluation of Horizon 2020, European Commission 2017

Anticipations towards the next framework programme. Although Horizon 2020 has legacy features from earlier FPs, it has also introduced number of structural, administrative and thematic changes. The Autumn 2016 Survey of National Contact Points (NCPs) and Program Committee members in Finland highlighted the benefits of extensive networking with international excellence, rapid access to international markets, significant increase in funding for SMEs, creation of new pan-European lead markets, and forecasting and identifying global challenges and creating innovative solutions for them in collaboration with the best experts.[18] This has created one foundation for the consideration of Finland's strategic starting points in the preliminary preparatory phase of the next EU FP.

While Horizon 2020 is only half way through, preparations for the next successive FP[19] are starting both in terms of its structure and content in the wake of interim evaluation of Horizon 2020. The newly released Horizon 2020 *Work Programme for 2018-2020*[20] already introduces some of the anticipated changes, such as the grouping of smaller themes into larger missions (low-carbon energy, circular economy, safety, migration, etc.), launching of international flagship projects and supporting open science, and most notably the establishment of the *European Innovation Council* (EIC) *pilot*[21], and the associated *grouping of the innovation instruments,* the SME instrument with Fast Track to Innovation and FET Open, as well as Horizon competitions under one body.

2.2 Previous evaluations European Framework Programmes and Horizon 2020

Typical challenges related to EU Framework Programmes / tradition of Finnish participation and the introduction of Horizon 2020 and the new ambition.

At the time of this evaluation, the Horizon 2020 has been operating approximately four years (2014-2017). At the time of launching of Horizon 2020, there were several concerns about the ability of Finnish research organisations (and industry) to be able to participate at the level of the previous FPs. To some extent this concern has been overcome, with reasonably good participation rate so far. However, Finland has had a slow start to Horizon 2020; after the first year of Horizon 2020 Finnish success rate and share of return were not yet at the current level. Against the latest information, the share of Finnish SMEs has indeed doubled to around 22% of received funding, which is a very promising indication. Subsequently, an SME has made it to the top-10 participants list for the first time, while the rest of the list of leading organisations is largely the same as earlier (VTT, largest universities, main research institutions). VTT and other large operators have traditionally played an instrumental role in planning and coordinating towards other Finnish FP participants, but for the Horizon 2020, also other (and private) intermediary organisations have become more active.

Findings of the EC Interim Evaluation of Horizon 2020 in May 2017. The interim evaluation of the programme presents a wide range of evidence that Horizon 2020 is in many ways already successful[22]. It is well on track to produce the scientific and technological results and outputs and wider societal impacts needed to effectively achieve its objectives.

[18] MEAE, 2016

[19] The current EU Multiannual Financial Framework (MFF) covers years 2014-2020

[20] http://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/stratprog_overarching_version_for_publication.pdf

[21] https://ec.europa.eu/research/eic/index.cfm

[22] European Commission, 2017

It is doing so through actions that are subject to processes and procedures that have been simplified substantially compared to the previous programme and have made the programme much more attractive. More than half of the participants are newcomers, and Horizon 2020 receives 65% more applications per year than FP7 did. Horizon 2020's actions have clear European added value (over 80% of projects would not have gone ahead without its support) and are managed in a highly cost-efficient manner.

SMEs were expected to benefit in particular from administrative simplification and closer knowledge triangle coordination, especially concerning R&I finance. Horizon 2020 also integrates a major simplification and standardisation of funding schemes and implementing modalities across all areas. Its far-reaching integration, simplification and harmonisation were expected to reduce costs for both the European Commission and for applicants.

The interim evaluation found that the programme's original rationale for intervention and its objectives and challenges identified at the programme launch are still highly **relevant** even in light of new political priorities. The EU still spends too little on R&I (the 3 % expenditure target has not been met) and the innovation gap with key competitors still exists, even though performance is improving. Horizon 2020 supports cutting edge research and technological developments. The relevance of the programme is shown by the **sustained interest** in its highly competitive calls: more than 30 000 proposals were submitted each year, compared to 20 000 in FP7. Already now, when half-way through, Horizon 2020 has received more than 100 000 eligible proposals, as compared to the 134 000 of the total FP7 period. Most impressive has been the 131% **increase in the number of applications from the private sector** compared to FP7 (from 20 000 to 47 000 applications per year). The European Commission estimates that Horizon 2020 has been underfunded by approximately € 60 billions.

The externalisation of the most resource-intensive parts of the programme to Executive Agencies has increased **efficiency** compared to FP7. It has helped keep the administrative expenditure below the target of 5 % of the budget. Simplification measures have greatly improved operations (time-to-grant). At the same time, the programme's attractiveness has led to very low success rates (11.6 % compared to 18.5 % in FP7), leaving some parts strongly underfunded: only 1 in 4 proposals evaluated as being of high-quality were retained, and at the same time, Horizon 2020's focus on excellence leads to a high concentration of funding. The negative consequence of increased private sector interest is its lower success rate; from 23.3% in FP7 to 13.0% (-10.3 pps) in Horizon 2020.

With regard to **effectiveness**, evidence suggests that Horizon 2020 is delivering world class excellence in science. Support to innovation and industrial leadership has been effective with some early results on company growth, additional funding leveraged, and innovations brought to the market. However, the programme **falls behind the expenditure target for sustainable development and climate change**, although this expenditure represents a considerable increase compared to FP7.

An important aspect is what kind of benefits and added value does Horizon 2020 bring to national and regional support to R&I in terms of scale, speed and scope. According to the mid-term evaluation, stakeholders state that on average 83 % of projects would not have gone ahead without Horizon 2020 funding.

Status of Horizon 2020 key targets.

Horizon 2020 targets	Realised
35% of EC's financial contribution is climate-related	27.0%

60% of EC's financial contribution is sustainability-related	53.3%
20% of EC's financial contribution is going to SMEs	23.9%
7% of EC's financial contribution is committed through SME instrument	5.6%

Source: European Commission, 2017

Key messages of the High-level Group on maximising the impact of EU R&I programmes. The so called *Lamy Report*[23] on the future of European Research was published 3rd July 2017. The report focuses on the guiding principles for designing a post-2020 EU programme for research and innovation. The main message, and vision, is that investing in research and innovation is increasingly crucial for shaping a better European future in a rapidly globalising world, where success depends ever more on the production and conversion of knowledge into innovation. The report gives EU and national stakeholders the following 11 recommendations for planning the future programmes:

1. Prioritise research and innovation in EU and national budgets
2. Build a true EU innovation policy that creates future markets
3. Educate for the future and invest in people who will make the change
4. Design the EU R&I programme for greater impact
5. Adopt a mission-oriented, impact-focused approach to address global challenges
6. Rationalise the EU funding landscape and achieve synergy with structural funds
7. Simplify further
8. Mobilise and involve citizens
9. Better align EU and national R&I investment
10. Make international R&I cooperation a trademark of EU research and innovation
11. Capture and better communicate impact

It is anticipated that the *Lamy Report* indicates directions towards which the next EU framework programme will be tuned into.

2.3 Previous national evaluations of FPs

This chapter provides a summary meta-analysis of recent evaluations and studies on the impact of the FPs at national level. It looks at six selected European countries which are comparable to Finland in terms of size and overall research capacity: Austria, Denmark, Ireland, the Netherlands, Norway and Sweden. The analysis focusses on available evidence of ex-post impacts at national level, and does not address EU-level impacts or participation statistics or research near-term outputs systematically.

The evaluation record contains a variety of types of analyses including monitoring reports, interim and ex-post evaluations. Outcomes and impacts of complex programmes like the FPs are notoriously difficult to determine. Monitoring reports and interim evaluations that focus on participation statistics and support measures are common but, as can be expected, have less to say about the impacts of the EU Framework Programmes at national level.

Participation analyses

National FP participation is closely scrutinised by national stakeholders and most countries publish regular monitoring reports or interim evaluations with this focus. Austria has been

[23] LAB-FAB-APP, Investing in the European future we want. Report of the independent High-level Group on maximising the impact of EU Research and Innovation Programmes, European Commission 2017. Also known as the 'Lamy Report'.

particularly prolific in this area and publishes annual participation overviews with detailed participation analysis down to the regional level (Bundesländer).[24]

One consideration is the 'return on investment' from the nation contribution to the EU budget. This is not least a concern in Norway which, as a non-member of the EU, pays proportionately large amounts into the programme budget in order to secure access for Norwegian participants. The Norwegian FP6 evaluation outlines a number of measures of 'national participation performance' – such as the funding received by national participants compared to GDP or GERD – and concludes that Norway performs "below its national potential" compared to other European countries[25]. In contrast, an analysis of Swiss participation found that the country had been a net beneficiary of FP6 funding with a financial return of an estimated 152%[26].

More broadly, there is a general assumption in all these studies that increasing the national participation is desirable and should be supported. Nearly all studies use FP programme data (eCORDA) to analyse participation in different programmes, instruments and by types of institutions, as well as the roles played by the national participants, e.g. to what extent they lead projects as coordinators. Some studies also look at motivations and 'drivers' for participation[27], the success rates of national applicants[28] and collaborative patterns between and within countries[29].

Participation analysis as such does not fall within the scope of this chapter but the impact evaluations reviewed below also tend devote considerable space to this type of analysis and the distinction between the two are often not made clearly in practice.

Ex-post impact assessments

Impact evaluations are somewhat infrequent and tend to follow the EU programming cycle. A number of national evaluations of the impact of FP6 were published in 2009-2010 and evaluations of national impact of FP7 are now starting to emerge, although they are still few and far between. Whereas all our six countries have had evaluations conducted of FP6, only Denmark and Ireland have published comprehensive analyses of the national impact of FP7 at the time of writing.

Methodologically, most of the studies rely on secondary data analysis – mostly on eCORDA data – and evidence from participant surveys and interviews for the bulk of the analysis. Many have also used bibliometrics to some extent whereas the use of econometric analysis remains rare. So far, a study from the Danish research and innovation agency is the only example of a fully-fledged econometric analysis, whereas the recent Irish FP7 evaluation found that such an analysis would be too onerous. The following table provides a list of the most recent evaluations and monitoring reports from the six countries included here.

[24] Ehardt-Schmiederer et al., 2014; FFG, 2016, 2017

[25] Langfeldt and Kaloudis, 2009, p. 51

[26] Kern et al., 2014

[27] Åström et al., 2012

[28] Rosemberg, Simmonds, et al., 2016

[29] FFG, 2017

Overview of national ex-post impact evaluations for FP6 and FP7 from selected countries.

Country	Ex-post and impact evaluations	FPs covered	Methods and evidence
AT	Arnold et al. (2010), *Evaluation of Austrian Support Structures for FP 7 & Eureka and Impact Analysis of EU Research Initiatives on the Austrian Research & Innovation System*, Technopolis Group	FP6-7	Interviews Focus groups Participant surveys with control group Secondary analysis (EU) Case studies
DK	Technopolis Group (2010) *Evaluation of Danish Participation in the 6th and 7th Framework Programmes*, Copenhagen: DASTI	FP6-7	Secondary data analysis Participant surveys Interviews
	DASTI (2015), *Effects of participation in EU framework programmes for research and technological development*, Copenhagen: DASTI.	FP6-7	Participant survey with control group Econometric analysis Bibliometric analysis
EI	Technopolis Group (2009). *Evaluation of Framework Programme 6 in Ireland*. Dublin: Forfás.	FP6	Secondary data analysis (EU) Participant surveys (successful, unsuccessful) Interviews
	Rosemberg et al. (2016), *Ex-post evaluation of Ireland's Participation in the 7th EU Framework Programme*, Technopolis Group.	FP7	Participant survey with control group Bibliometric analysis
NL	Boekholt et al. (2009), *Impact Europese Kaderprogramma's in Nederland* [Impact of the European Framework Programme in the Netherlands], Technopolis Group.	FP1-6	Bibliometric analysis Interviews
NO	Langfeldt, L., & Kaloudis, A. (2009). *In Need of a Better Framework for Success: An Evaluation of the Norwegian participation in the EU 6th Framework Programme (2003-2006) and the first part of the EU 7th Framework Programme* (2007-2008). Oslo: NIFU STEP.	FP6	Secondary data analysis (EU, national data) Participant survey Interviews Case studies Bibliometric analysis
SE	Arnold et al. (2008), *Impacts of the Framework Programme in Sweden*, VINNOVA	FP3-6	Secondary data analysis (national) Meta-evaluation Case studies (Institutions and sectors) Bibliometric analysis

2.4 Status of Finnish participation in Horizon 2020

As discussed, the early concerns about Finnish participation have at least partially dissipated. By early 2017, there were altogether 893 Horizon 2020 projects with Finnish participants, 278 out of which were coordinated by Finnish partners. In sum, €579 million funding had been received during this period. These equal to a success rate of 12.8% on average and a reasonable 2.2% share of all granted funding.

A particular concern during the FPs has been the sustained low involvement of small and medium-sized enterprises (SMEs) and a serious attempt was made for Horizon 2020 to address this better than earlier FPs. Against the latest information, the share of Finnish SMEs has indeed doubled to around 22% of received total funding, which is a very promising indication. It is also now the first time an SME has made it to the top-10 participants, while the rest of the list of leading organisations is largely the same as earlier (VTT, largest universities, main research institutions). VTT and other large operators have traditionally played an instrumental role in planning and coordinating towards other Finnish FP participants, but for the Horizon 2020, also other (and private) intermediary organisations have become more active. This is one aspect worth paying a closer look at the study.

Key facts about Finnish participation in Horizon 2020

	All	Multi-partner	Single applicant*	
			SME Instrument (1&2)*	ERC (Pillar I)*
Number of applications	6,986 (5.4% of total)	4,796 (10.9% of total)	1,137 (3.1% of total)	758 (3.2% of total)
Number of projects	893 (6.0% of total)	711 (13.1% of total)	83 (3.1% of total)	63 (1.9% of total)
Success rate	12.8% (8.7% for coordinators) (16.2% for partners)	15%	7.1%	8.4%
Number of Finnishcoordinations	278 (31% of FI projects)	96 (14% of FI projects)	79 (95% of FI projects)	62 (98% of FI projects)
EC Contribution to Finnish participants	€579 million (2.2 % of total, €450k per participation)	€410 million (2.1% of total, €371k per participation)	€56 million (5.1% of total, €670k per participation	€103 million (2.0% of total, €1.6m per participation)

* Technically SMEI and ERC are not single-partner, but most projects involve a single participant, who is thereby a coordinator

Source: eCORDA, extracted May 2017

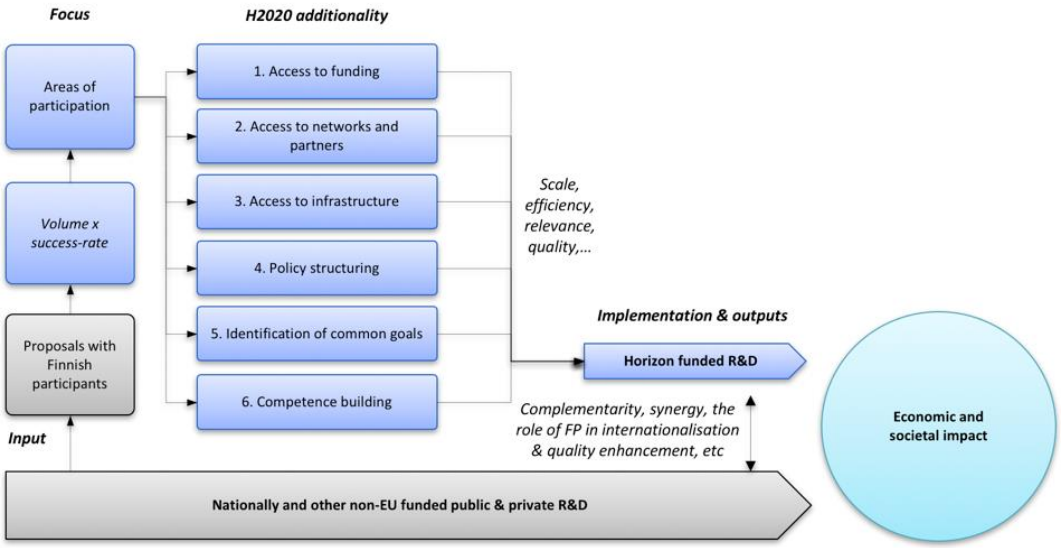
2.5 Framework for evaluating the impact of Horizon 2020 in Finland

Towards a common assessment framework for all countries. In 2017, the ERA Council set up an Ad-Hoc Group of Member State experts to elaborate and propose a common framework for measuring the impact of EU framework programmes,[30] to allow a more systematic assessment of the benefits and impacts of EU funding, as well as to facilitate cross-country comparison and learning. The focus of their analysis is both in the participation itself, as well as its impact to member states. The work of the group is still in progress and official documentation is not yet available, while initial frameworks for assessing the impact have been discussed. The initial dimensions for assessing the impact include *participation structure, structuring impacts, scientific impacts, innovation impacts, economic impacts and societal impacts*.

Specific evaluation framework for this study. For the purpose of this study, we have utilised elements of the ERAC Ad-hoc group, and adapted those to the specific objectives of this study. The analytical framework is presented in the following figure.

[30] ERAC Ad-Hoc Working Group on Measuring the Impacts at National Level of the participation in EU FPs, preliminary draft, May 2017.

Analytical framework for assessing the impact of Horizon 2020 on Finnish RDI funding



In line with the above, our first analytical dimension is the *Finnish participation* – from the general application activity to different areas of proposal successes and participation, as well as motives and anticipations behind that.

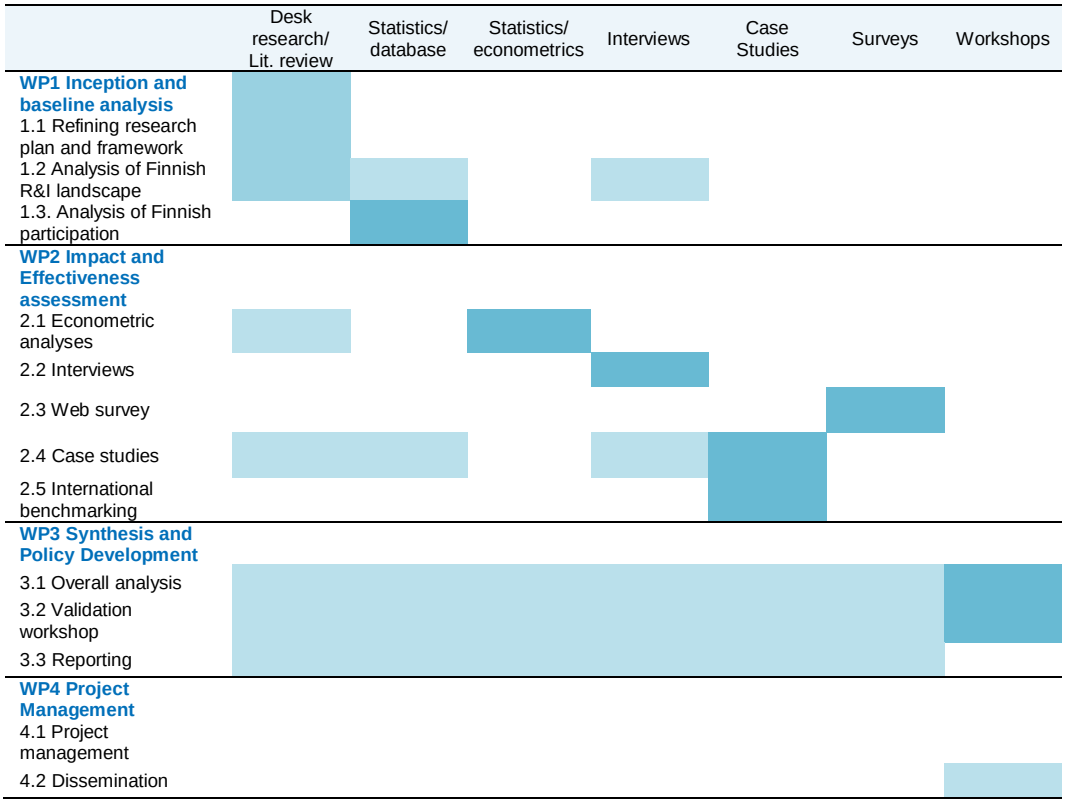
Further to those, the direct *input additionality* of Horizon 2020 is analysed. The additionality is assessed from the perspectives of 1) access to increased funding, 2) access to broader collaboration networks and partnering, 3) access to (international) research and other infrastructures, platforms, etc., 4) Horizon 2020 input to national or local policy structuring (such as complementarity of funding instruments), 5) input to identification of common goals and influence to the direction of research and innovation, as well as 6) input to specific and general competence building among participants. In all these elements, the reflection was done against the option of having conducted (or not conducted) the activities without Horizon 2020 funding and participation, either with or without the help of national RDI funding instruments.

As the Horizon 2020 has been running for four years only, and most of the projects are either at their beginning or at their early phases, it is mostly premature to assess their generated impact. Hence, the impact analysis part of the study focuses on the anticipated economic, scientific, learning and societal impacts of Horizon 2020 participations. Therefore, less weight has been put to the impact assessment part of the study, and subsequently more to the participation structure and the input additionality of Horizon 2020. However, the long-term development of economic impact has been, however assessed from the earlier framework programmes onwards.

2.6 Evaluation methodology

The table below details how the study methods mesh with the tasks within the study framework. As laid out in the plan, some tasks imply the method in itself, while others employ multiple. For example, tasks 'Survey' and 'Econometric analysis' mean exactly that, whereas case studies rely on document analysis, interviews, and other relevant data sources.

Study methodology



Use of various methods within the project

Between the methods, the statistical and econometric analyses provide quantitative information on how effective FP funding is and how well Finnish participants fare in the program. To complement these findings, the surveys, interviews, and workshops provide more qualitative insight in the circumstances on the effects and added value of FP finding, for a fuller overall picture.

The statistical analysis of participation patterns is based on eCORDA databases of proposals and grants covering the entirety of FP7 and the first three years of Horizon 2020 (data extracted May 31st 2017). Besides overall participation statistics in FP7 and Horizon 2020, the analysis covers participation in three focus areas of Health & Wellbeing; Cleantech, Bio-economy and Circular Economy (CBC); and Digitalisation.

The study has used semantic analysis to identify areas of FP7 and Horizon 2020 that are of relevance to the three selected focus areas. The identification and tagging were based on concepts contained within the titles and abstracts of proposals. The aim was to identify and tag all FP7/Horizon 2020 projects and proposals that fall with each the three priority areas, regardless of where these are located within the FP7/Horizon 2020 programme structure.

This sub-set of proposals and projects could then serve as the basis for analysis of Finnish (and comparator country) participation in each of the priority areas.

The econometric impact assessment focuses on examining the enterprise level effects of FP funding. The approach is to use differences in differences estimation to compare outcomes between the treatment group (FP funding recipients) to the recipients of national funding and untreated control group (-s) with a Differences-in-Differences method. The data used in this analysis include enterprise level micro statistics including financials and employment, as well as funding decisions between 2003 and early 2017.

The interviews have been conducted among stakeholders of the programme both in the inception phase and during the case studies. The sampling logic was purposive, as in informants who have expertise on the Horizon 2020 programme and its contribution or practicalities of funding were explicitly sought. The interviews have been conducted face to face or over the phone. The interviews were semi-structured, based on a template with themes without predetermined answer options. The answers were noted down during the interview. Interviews were conducted until saturation of themes was reached. For the general interviews, the answers were later coded back to the themes following content analysis approach for overall analysis.

Workshops have been organised both open for the stakeholders and internally. The first workshop was organised June 8th 2017 after inception analysis to present initial findings and gather feedback and data. The participants were stakeholders with a relationship to Horizon 2020 either as an administrator or user of funding. The second workshop was organised internally September 6th 2017 to review data, develop initial findings and highlight needs for supplementary data collection.

The case studies target innovation (eco-) systems through central organisations within the respective systems. The level of analysis combines organisation in the context of the system. The cases have an exploratory stance, but some propositions as detailed below were developed based on the research questions and inception analysis. The questions and initial hypotheses or propositions for the cases are presented in the following table. The overall objective was to explore how has FP affected formation or development of national innovation networks or ecosystems and interacted with national funding.

3. ASSESSMENT OF FINNISH PARTICIPATION IN EU FRAMEWORK PROGRAMMES

In this section, we first present key findings from the various analyses and then provide a synthesis of common findings in the spirit of methodological triangulation. Further information and details are presented in the Full Report and its Annexes to improve readability of this document.

3.1 Participation analysis

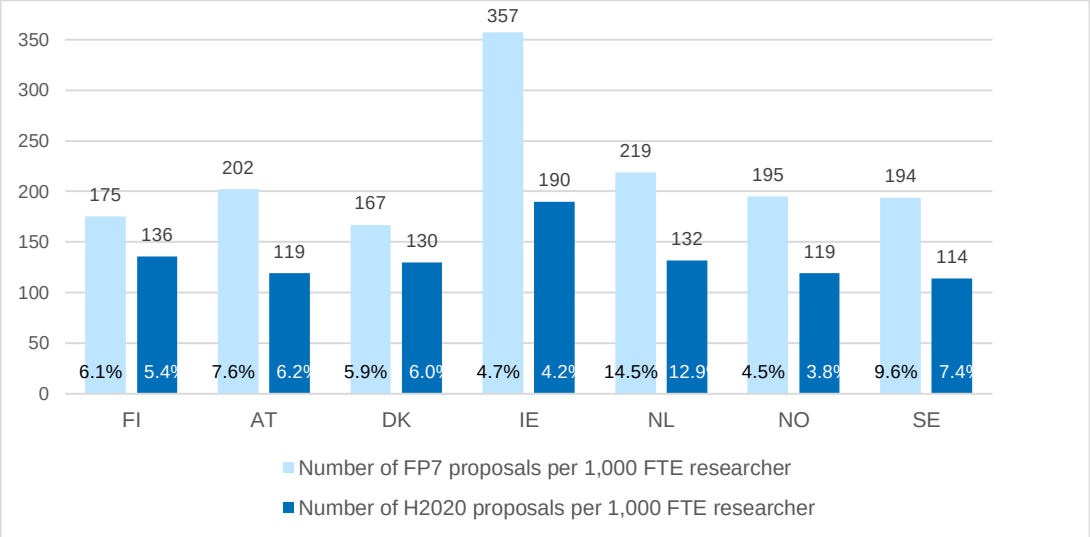
In this participation analysis, we first present the overview and overall statistics. These are based on data extracted from eCORDA and include all funded project from various instruments included therein.[31] After the overall statistics, we discuss participation in national focus areas. Lastly we take a look at the SME instrument specifically. The following section discusses the most pertinent findings, supplementary statistics about participation are enclose below in the appendixes.

3.1.1 Overview to participation and success of Finnish applicants

Participation in proposals

Finnish actors have contributed to the submission of 6,986 *proposals* to Horizon 2020 (as of the end of May 2017). This equates to 5.4% of all proposals submitted to the programme during this period. This is currently slightly lower than the proportion of FP7 proposals involving Finland (6.1%).

Proposals involving each country



Number of proposal per 1000 research staff and percentage of all FP7 / Horizon 2020 proposals

In 46% of Horizon 2020 proposals involving Finland, a Finnish actor has held the role of *coordinator*. This is a higher rate than was seen during FP7, where just 33% of Finnish

[31] Also projects under Joint Technology Initiatives are included in eCORDA, with some exceptions.

proposals were led by a Finnish coordinator. Most comparator countries have seen a similar increase between the two programs, but Finland's rate of proposal coordination in Horizon 2020 is now higher than all comparators. This is a significant improvement on FP7, and as such it is in line with the goal of increasing FP activity in Finland.

Taking account of the relative size of the researcher populations in each country, the number of Horizon 2020 proposal coordinators from Finland is below the rate seen in IE, but above that seen in all other comparators. By comparison, the Finnish rate in FP7 only compared favourably with Denmark.

Many FP proposals (66% in Horizon 2020) involve just one participant, who is therefore by default also the coordinator. This is particularly the case in some areas of the programme (e.g. nearly all of the 19,000 proposals to the European Research Council involve just one participant). These single-participant proposals can therefore give a misleading picture of true proposal coordination rates. If we repeat the above analysis of proposal coordination, but just for *multi-partner proposals* (i.e. excluding proposals with only one partner), the data changes significantly.

Finnish actors have participated in 4,796 multi-partner Horizon 2020 proposals, of which it was the coordinator in 995 (21% of) cases. This is a higher rate than any of the comparator countries, other than Ireland, and slightly higher than was achieved by Finland in FP7. The Finnish rate of multi-partner proposal coordination in Horizon 2020, relative to the FTE researcher population (19 coordinators per 1,000 FTE), is also higher than most comparator countries, other than IE and NL. By both these metrics, proposal activity in Finland has improved relative to most comparator countries between FP7 and Horizon 2020.

On average, Horizon 2020 proposals involving Finland included 1.4 local (i.e. Finnish) actors each. During FP7, a similar number of Finnish actors (1.4) were involved in each Finnish proposal. In both cases (FP7 and Horizon 2020) the average number is below that of NL, but above all other comparators. Excluding single-partner projects increases the average number slightly (e.g. for FI in Horizon 2020, from 1.37 to 1.38 local partners per proposal). However, the overall pattern is similar.

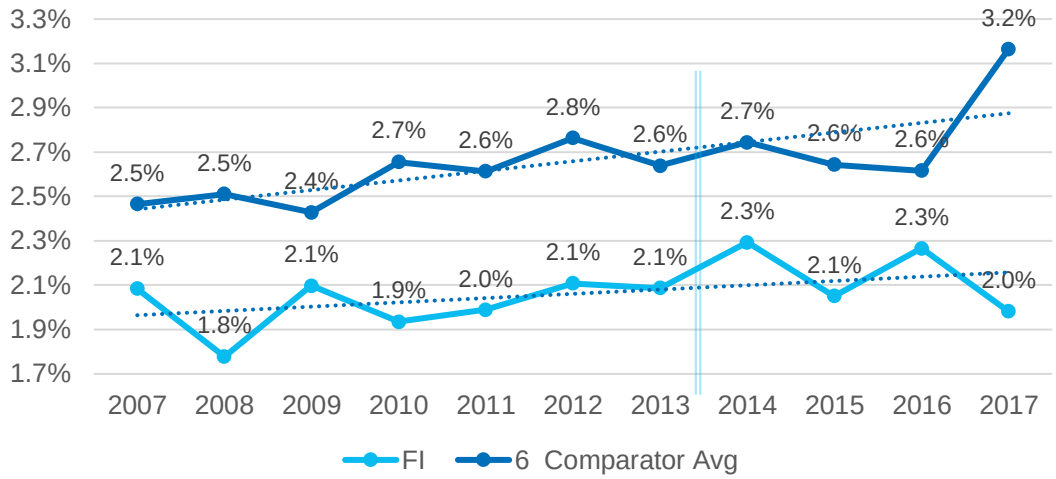
Finnish proposals to Horizon 2020 also included (on average) 10.5 actors from other countries (i.e. beyond Finland). These 48,123 proposal partners came from 133 different countries, but with over half (62%) located in Germany, the UK, Spain, Italy, France, the Netherlands and Belgium. Other countries accounting for an unusually high proportion of partners (for Finland, compared with overall participation patterns) include Sweden, Norway, Estonia, Austria, Poland, Lithuania, Portugal, and Latvia.

Because of multiple Finnish participations in some proposals, the total number of Finnish participations in Horizon 2020 proposals (9,551) is 37% higher than the number of unique proposals in which Finland is involved (6,986). Finland accounts for just 2.2% of all participations in Horizon 2020 proposals, which is lower than NL, SE, AT, and DK, but higher than NO and IE. When taking account of the size of the respective researcher populations, Finland only has a lower number of participations in Horizon 2020 proposals (per 1,000 R&D personnel) than the Netherlands and Ireland, but a higher participation rate (per 1,000 R&D personnel) than Sweden, Norway, Austria, and Denmark.

During FP7 proposals involving Finland accounted for on average 2.0% of all proposals. It was also lower than all the six comparator countries other than Denmark. Nevertheless, because of the longer time-period covered, the participation rate (242 per 1,000 R&D personnel) was higher than that observed in Horizon 2020. Now during H2020 participation

in proposals has grown a few decimals of percentage point. However, looking further at the trend in participation, it seems that Finnish participation is falling slowly behind the comparison. While the figures for 2017 should not be emphasised, it seems that Finnish participation activity is growing, but consistently slower than the comparison. In fact, taking the programme change into account, the trend it is possibly plateauing on the ~2.2% level.

Proportion of participation in proposals



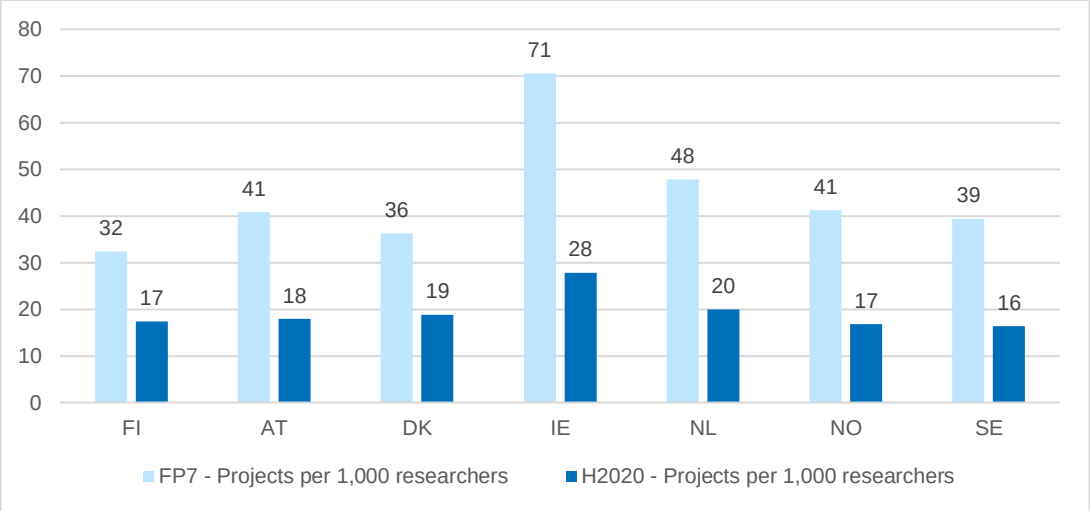
Proportion of Finnish proposals of all compared to average between participants

While distribution of Finnish participations largely reflects the overall pattern, Finns are less active in proposals within the Excellent Science and Science with/for Society programmes, compared with the overall average. Indeed, a smaller proportion of its proposal participations are accounted for by the Excellent Science programme, compared with any of the comparator countries. By comparison, Finland is relatively more active in relation to Industrial Leadership and Euratom programmes, compared with the average. Its proportion of participations accounted for by the Industrial Leadership programme is greater than all comparator countries, while only SE has a greater proportion of participations in the Euratom programme.

3.1.2 Participation in projects and proposal success rate

To May 2017, 893 Horizon 2020 grants had been awarded to projects involving Finland. This represents 6% of all Horizon 2020 projects, which is higher than IE and NO, but lower than the other comparator countries. Finnish actors have been awarded 17 Horizon 2020 projects for every 1,000 R&D personnel in the country, which is higher than Sweden and on par with Norway. This is an improvement on FP7, when Finland's rate of projects per researcher was below that of all the comparator countries.

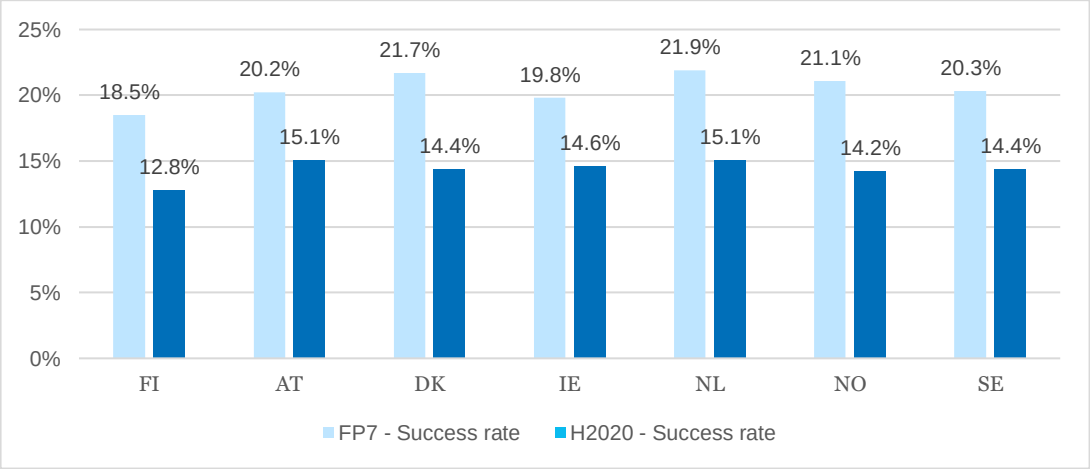
Number of awarded FP projects per 1000 research staff



The 893 projects involving Finland came from 6,986 proposals. This equates to a proposal success rate of 12.8% - which is higher than the overall success rate of Horizon 2020 proposals (11.5%), but below the rates achieved in all the comparator countries.

Finnish success rates in FP7 were much higher (18.5%) than in Horizon 2020, but this partly reflects higher success rates seen in FP7 overall (15.9%). Finland's FP7 success rate was also slightly below that of all the comparator countries.

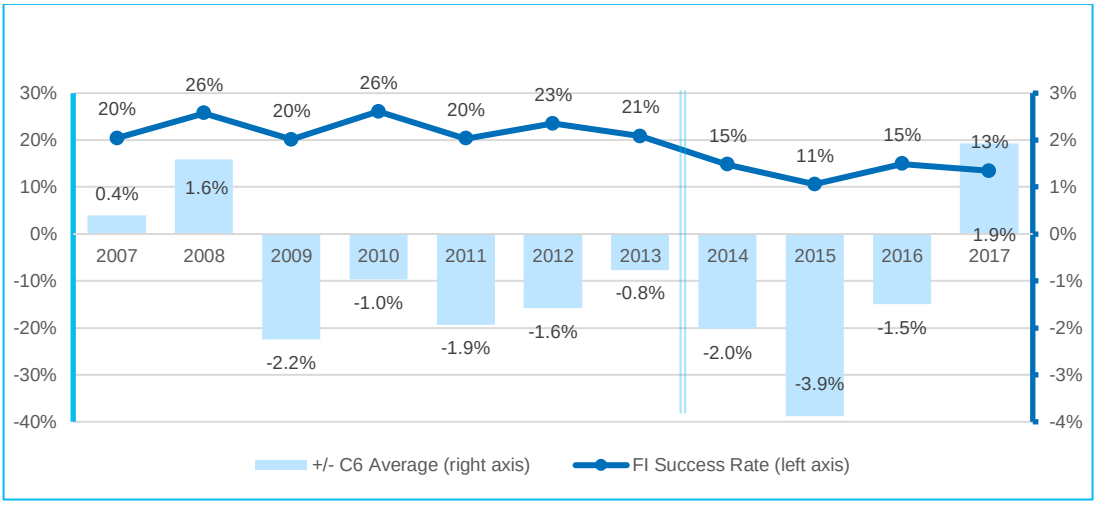
Success rate of proposals



Fraction of approved proposals

Again, looking at broader trends, the success rate of Finnish participations has been stable both during FP7 and Horizon 2020. Spotting trends over the programme periods is not necessarily meaningful, as in general the competition in Horizon 2020 has increased and average success rates have dropped from FP7. However, Finnish success rate is consistently lower than the average of comparator countries most years. Beside the expected level correction between programming periods, Finnish proposal acceptance rate has been stable over time, which is both good and bad as it indicates there is relatively little learning at the system level, but then again there is no catastrophic loss of competitiveness either.

Participation success rate over time



Success rate of proposal with Finnish participants (on the left) by the year and difference to average of comparators (right scale)

Horizon 2020 grants have been awarded to 278 projects with a Finnish coordinator. The role of coordinator is significant, because the coordinator typically has a central role both in defining the project and implementing it, which typically results in a better fit between the project and the coordinators interest and broader benefits from the project. The equates to 5.4 project coordinators for every 1,000 R&D personnel in the country. This rate is higher than Sweden, Austria, and Norway, but lower than the other two comparator countries. Finnish coordinator rates in FP7 were slightly higher (at 6.4 coordinators per 1,000 researchers), but this was below the rates achieved by all comparator countries during this programming period. As such, Finland's performance relative to comparator countries (in terms of coordinator numbers) has tended to improve in the first period of Horizon 2020 compared with the whole of FP7.

The success rate of Finnish-coordinated Horizon 2020 proposals is 8.7% - which is much lower than the rate of success for proposals where Finland is only a partner (16.2%). It is also lower than the overall Horizon 2020 figure (11.5%), and below the rates of coordinator success achieved in all of the comparator countries. In FP7, Finland's success rate for coordinators was similarly below the overall average and the success rates in all comparator countries.

If we look only at those proposals/projects with multiple participants (i.e. excluding those where the coordinator is the only partner), the success rate for Finnish coordinators increases from 8.7% to 9.6% for Horizon 2020, and from 11.0% to 16.1% for FP7. While there is an increase in the success rate overall with this measure, the increase for Finland is more significant than for many of its comparator countries. Nevertheless, the Finnish figures is still lower than in all comparator countries, both for FP7 and Horizon 2020.

The 893 grants awarded to Finland in Horizon 2020 involve 1,288 individual Finnish participations. This represents 2.1% of all Horizon 2020 participations, which is slightly higher than Denmark, Ireland and Norway, but lower than Austria, Netherlands, and Sweden (each of which accounts for between 2% and 7% of all participations). Finland has 25.1 project participations in Horizon 2020 for every 1,000 R&D personnel in the country, which is higher than DK, NO and SE, but below AT, IE, and NL. This is a slight improvement on Finland's relative position in FP7.

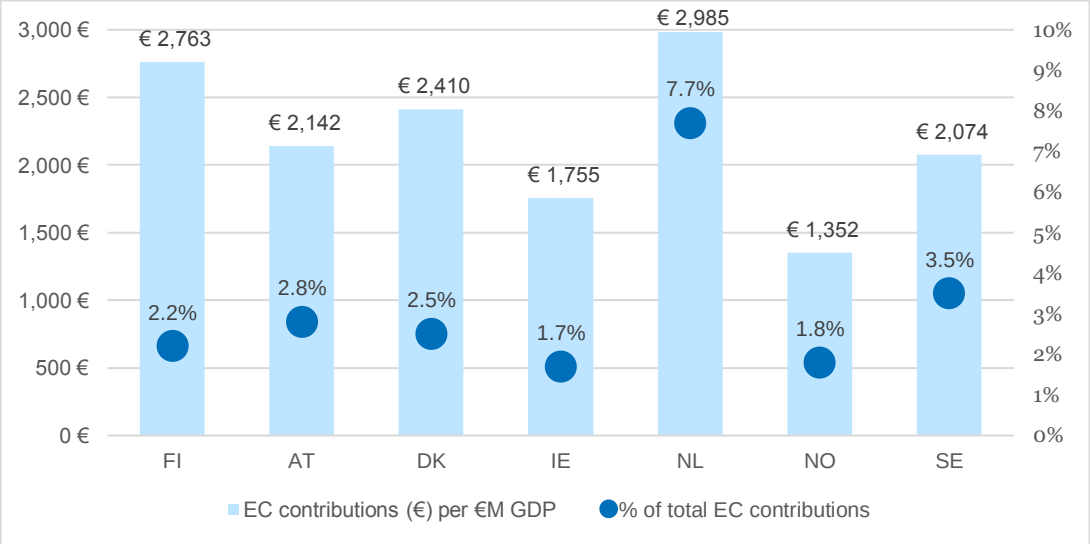
The 1,288 Finnish participations in successful projects, from 9,551 participations in proposals, represents a participation success rate of 13.5% in Horizon 2020 so far. This is

below the overall rate of success for all participations in proposals (14.3%), and below that for all comparator countries. During FP7, the Finnish participation success rate was slightly above average and above the rate in Ireland, but still lower than in the other comparator countries.

Comparing across different organisation types, Horizon 2020 success rates were highest amongst Finnish participations from public bodies (PUB) (25.1%). However, rates here were lower than the overall average (26.5%) and most of the comparator countries. Finnish success rates for private for-profit corporations (excluding education, henceforth PRC) were also high (24%). This rate of success is greater than the overall average and above the rate of all comparator countries except Denmark. However specifically for SME-PRC participations the success rate is 10.9%, which is slightly below the Horizon 2020 average, as well as lower than all the comparator countries. Elsewhere in higher or secondary education (HES, 10.8%), public bodies (PUB, 25.1%), and research organisations (REC, 12.5%), Finnish participations achieved success rates lower than the overall average, and below the levels of success seen across most comparator countries.

EC contributions to Finnish participations in Horizon 2020 projects totalled €579 million, which equates to 2.2% of all funding to project participations to date. This is below the proportion realised by most of the other comparator countries, but higher than that received by Ireland and Norway. If we 'normalise' contributions by using national GDP figures, then Finland compares favourably with its comparator countries, only being below Netherlands in this measure. The average contribution to each Finnish participation (at €450 thousand) is also relatively high, with only Netherlands and Norway having a higher rate.

Proportional contribution from FP



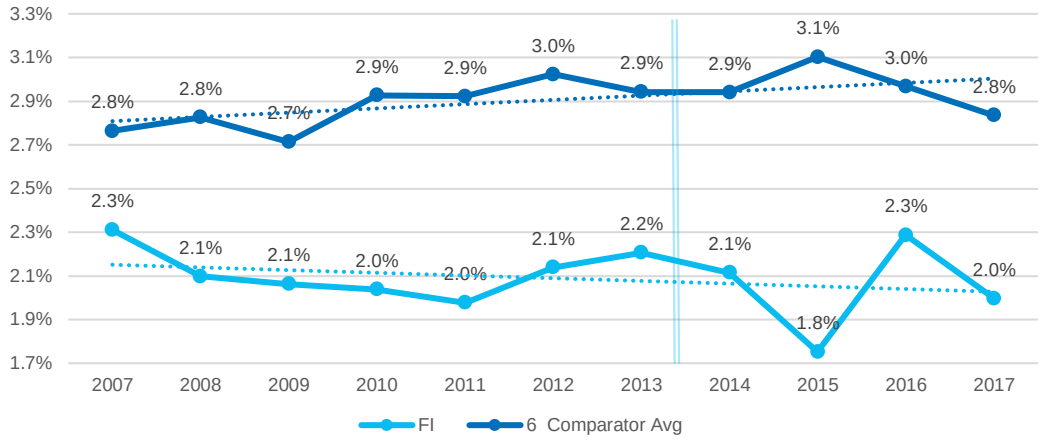
EC contribution per million €of GDP (bars, left axis) and as a fraction of Horizon 2020 programme volume (dots, right axis)

As an overall finding, Finland fares quite well in the light of funding drawdown in absolute numbers and especially in relative contribution per active research staff. **The clear weakness in Finland is application success that consistently trails behind.**

If we unpack the overall figures, we can see another divergent trend. The average participation rate of the comparators has a very slightly rising trend, whereas Finnish rate of participation has an equal and opposite trend that is consistent both with the diverging trends in applications and stable success rates. While again the trend might be slightly

deceiving since the programme change has affected success rates, **the divergence may signal that Finnish participation has plateaued, while others are gaining ground still**.

Proportion of all participations over time



Participations of all projects per year

3.1.3 Analysis of national focus areas

Three specific focus areas were selected based on the longer standing national foci. The list of specific focus areas investigated herein were chosen as a basis for coordinating and developing messages for Horizon 2020 Work Programmes 2016 onwards, based on perceived societal needs and strengths of Finnish innovation system. These are Digitalisation, Health & Wellbeing (H&W), and Cleantech, Bioeconomy and Circular Economy (CBC).

However, it needs to be noted that the foci were selected in 2016 and the data for this analysis were extracted shortly thereafter in 2017, which means that any and all national coordination activities have not much bearing on these findings. As such these data or analyses provide a historical baseline for the national focus areas. Moreover, these areas are chosen as broader policy foci and RDI funding and the FP is only one type of action or instrument implemented to develop these areas.

The individual projects belonging to each focus area were identified through an innovative approach using semantic analysis of project abstracts that enabled populating a list of concepts that were used in searching eCORDA to identify projects that belong conceptually to each of the focus areas (list of keywords in Appendix 1). The keywords were chosen by the researchers through an explorative strategy, and thus the keywords do not reflect the specifics of the Finnish policy foci exactly 1:1 (as discussed also in Section 3). The foci, especially digitalisation and circular or bio-economy are horizontal areas of innovation and technology, which makes narrowing them down and defining them challenging. Therefore, the following results are an indicative comparison between past success in the FPs, not a forecast of future performance.

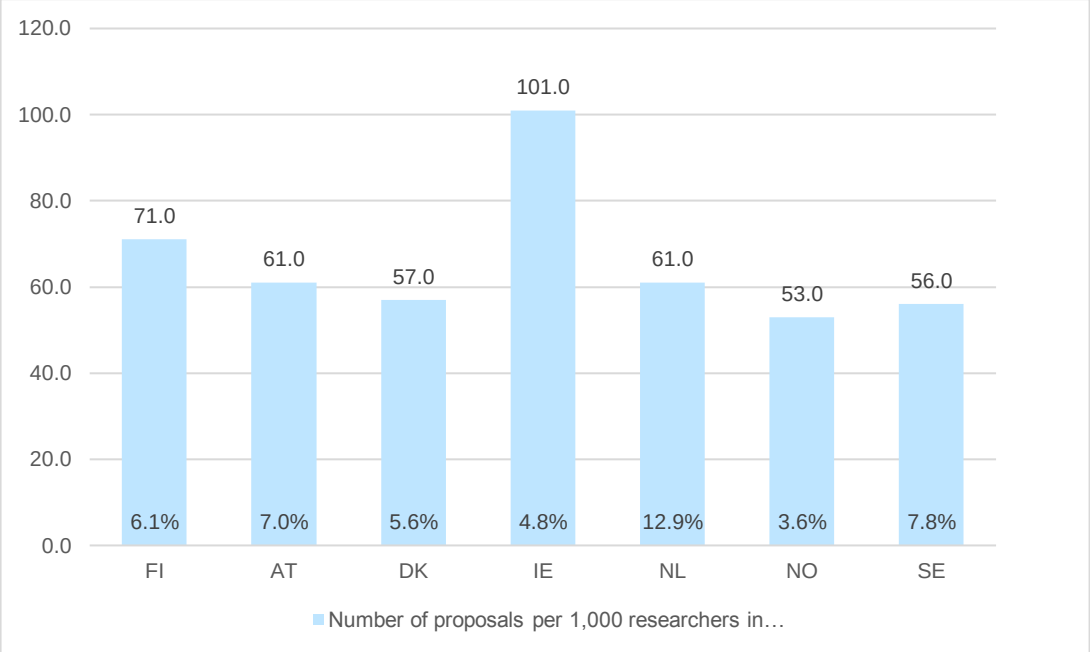
Digitalisation

Finnish actors have contributed to the submission of 3,647 Digitalisation proposals in Horizon 2020 (as of May 2017). This equates to 6.1% of all such proposals submitted to the

programme during this period. This is only slightly lower than the proportion of Digitalisation proposals involving Finland in FP7 (6.8%).

Half of the comparator countries (AT, NL, and SE) have participated in a greater number and proportion of Digitalisation proposals than Finland, in both FP7 and Horizon 2020. However, when taking into account the relative number of R&D personnel in each country, the number of proposals involving Finland in Horizon 2020 is higher than all comparator countries except Ireland. This is an improvement on FP7, where the Finnish rate of involvement was below that of most comparators.

Participation in proposals in digitalisation area



Number of proposal involving country per 1000 researchers and percentage of all proposals

In 43% of Horizon 2020 Digitalisation proposals involving Finland, a Finnish actor held the role of *coordinator*. This is much higher than in FP7, where 30% of Finnish Digitalisation proposals were led by a Finnish coordinator. All comparator countries had a lower rate of coordination than Finland in Horizon 2020, but not in FP7 where IE, NL and SE had a higher rate.

If we consider the relative size of the researcher base in each country, the number of Digitalisation proposal coordinators from Finland (31) in Horizon 2020 is above the rate for all comparator countries except IE. In FP7, the Finnish rate (25 coordinators per 1,000 personnel) was below most of the comparators.

Finnish actors have participated in 2,614 multi-partner Horizon 2020 Digitalisation proposals, of which it has served as the coordinator in 545 (21%). This is a higher rate than all comparator countries except Ireland (22%). The Finnish rate of Digitalisation proposal coordination in Horizon 2020 relative to the FTE researcher population (10.6), is again higher than all comparator countries expect Ireland. This is a higher rate of activity than in FP7, where Finland had a lower rate of MP coordinators per researcher than nearly all comparators.

Because of multiple participations in some proposals, the total number of Finnish participations in Horizon 2020 Digitalisation proposals (5,126) is higher than the number of

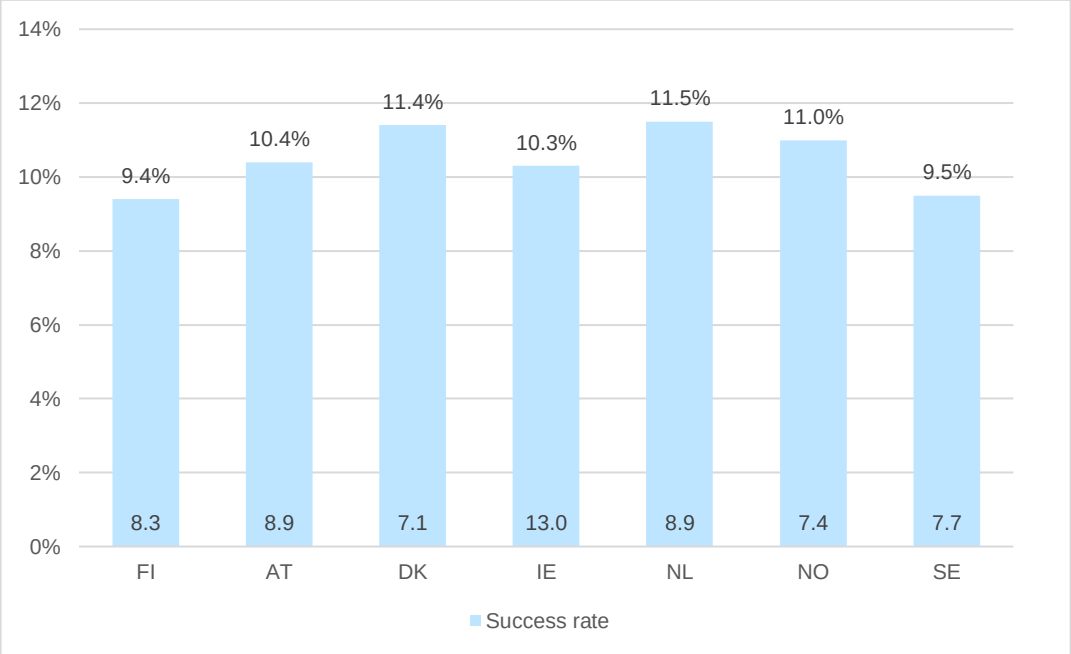
unique Digitalisation proposals in which Finland is involved (3,647). These Finnish participations represent just 2.3% of all participations in Horizon 2020 Digitalisation proposals, which is a lower proportion than AT, NL, and SE. However, when taking account of the size of the respective researcher populations, Finland has a higher number of participations in Horizon 2020 Digitalisation proposals (100 per 1,000 R&D personnel) than all of the comparator countries except Ireland.

Finland accounted for a similar proportion (2.1%) of all participations in Digitalisation proposals in FP7. However, because of the longer time period covered, its participation rate (131 per 1,000 R&D personnel) was higher than in Horizon 2020.

To May 2017, altogether 427 Horizon 2020 grants had been awarded to Digitalisation projects involving Finland. This represents 6.5% of all Horizon 2020 Digitalisation projects, which is lower than AT, NL and SE. When one adjusts for the size of the research base in each country, Finland (with 8.3 Horizon 2020 Digitalisation projects for every 1,000 R&D personnel) sits in the middle of the comparator countries.

The 427 Horizon 2020 Digitalisation projects involving Finland came from 4,533 proposals. This equates to a **proposal success rate** of 9.4% - which is lower than the overall success rate of Horizon 2020 Digitalisation proposals (9.9%), as well as below the rate achieved in all comparator countries. Finnish success rates in FP7 Digitalisation proposals were even higher (18.1%) than in Horizon 2020, but this partly reflects higher success rates seen in FP7 overall. Proposal success rates were still below all comparator countries.

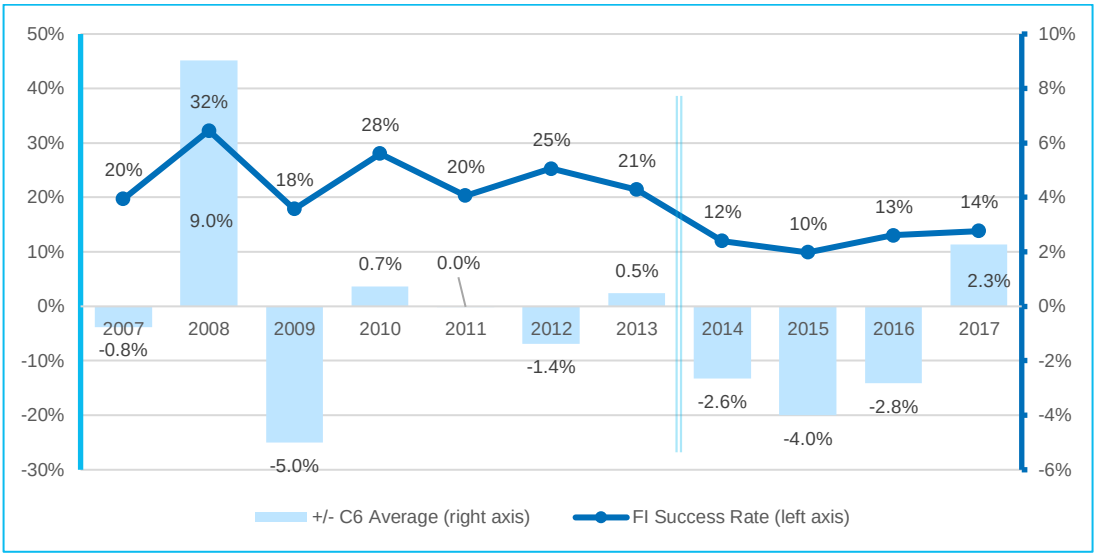
Success rate in Digitalisation area



Success rate of projects and number of projects per 1000 research staff

There is a clear break between the programmes which makes spotting a meaningful trend hard. The general level has dropped almost 10 percentage points on average, but from 2014 forward the trend is slightly positive.

Success rate in Digitalisation area over time



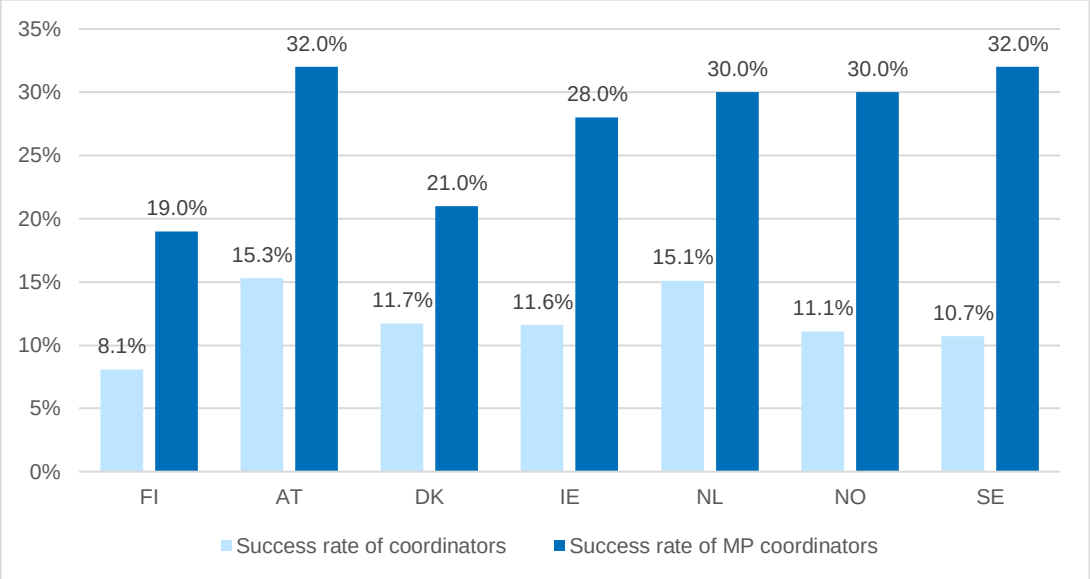
Success rate of Finnish applications per year (left axis), and difference to average of comparison countries (right axis)

Horizon 2020 grants have been awarded to 128 Digitalisation projects with a Finnish coordinator. The equates to 2.5 projects for every 1,000 R&D personnel in the country. This rate is below that of all comparator countries apart from Norway and Sweden. The rate (2.7 coordinators per 1,000 personnel) for Finland in FP7 was lower than all comparators except Denmark.

The success rate of Finnish-coordinated Digitalisation proposals in Horizon 2020 is 8.1%. This rate is both lower than the overall Horizon 2020 figure (10.9%), and lower than the rates of coordinator success achieved in all comparator countries. In FP7, Finland's success rate for coordinators (16.6%), was above average and greater than in half of the comparator countries.

If we look only at those Horizon 2020 Digitalisation proposals/projects with multiple participants (i.e. excluding those where the coordinator is the only partner), the success rate for FI coordinators increases from 14.5% to 19%. However, this is still lower than in all of the comparator countries.

Success rate of coordinators in Digitalisation area



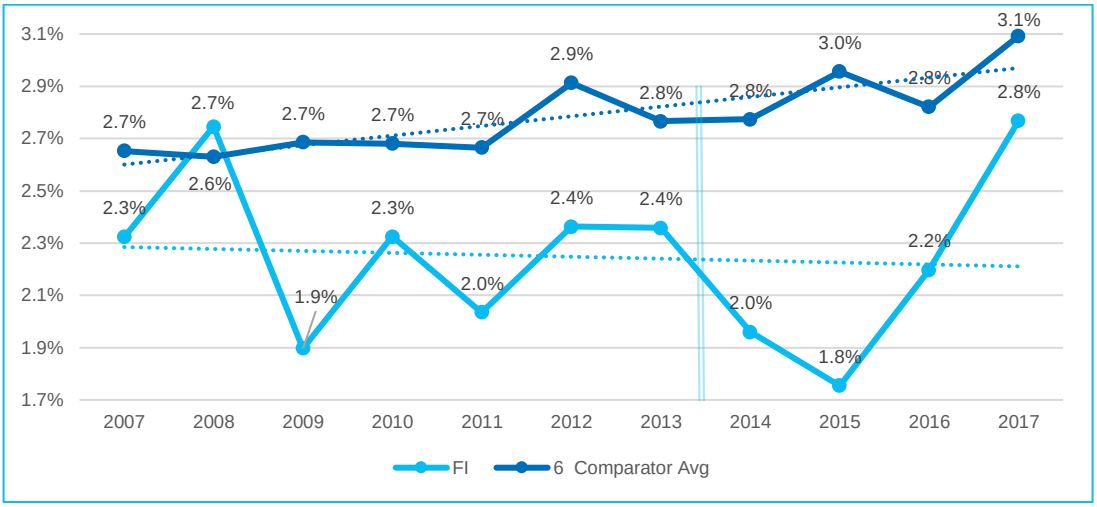
The 427 Digitalisation grants awarded to Finland in Horizon 2020 involve 607 individual Finnish participations. This represents 2% of all participations in Horizon 2020 Digitalisation projects. When taking account of the size of the researcher base, Finland sits in the middle of the comparator countries. The 11.8 Digitalisation participations per 1,000 R&D personnel in Finland is below that achieved in FI, AT or NL, but above that of DK, NO and SE. A similar pattern can be seen in FP7.

The 607 Finnish participations in successful Horizon 2020 Digitalisation projects, from an original 5,126 participations in proposals, represents a **participation success rate** of 11.8% in Horizon 2020 so far. This is below the overall rate of success for all participations in Digitalisation proposals (13.3%), and below that achieved in all of the comparator countries. The Finnish success rate in FP7 compared more favourably.

Comparing across different organisation types, Finnish success rates for Digitalisation participations were highest amongst PUB and PRC organisations (both 18%). The PRC success rate was above average and above most comparator countries. Success rates for HES and REC were below average and below all comparators.

EC contributions to Finnish participations in Horizon 2020 Digitalisation projects totalled €294 million, which equates to 2.3% of all funding to Digitalisation participations to date. The trend follows the pattern of divergence between Finnish participation and comparison. This is below the proportion realised by Austria, the Netherlands, and Sweden. The average contribution to each Finnish Digitalisation participation (at €484 thousand) is however above that achieved by all comparator countries apart from the Netherlands.

Participations in Digitalisation projects over time



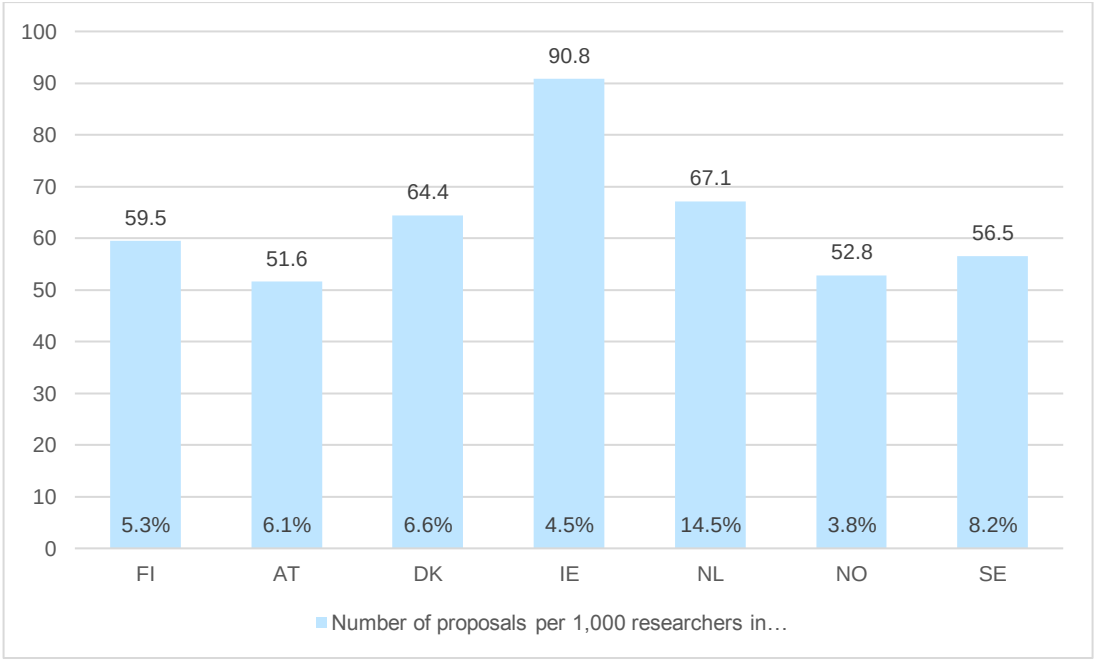
Proportion of all participation per year

Health & Wellbeing (H&W)

Finnish actors have contributed to the submission of 3,051 Health & Wellbeing proposals in Horizon 2020 (as of May 2017). This equates to 5.3% of all such proposals submitted to the programme during this period. It is only slightly lower than the proportion of FP7 Health & Wellbeing proposals involving Finland (5.8%).

As is shown below, Denmark, Ireland and The Netherlands have all participated in a greater number and proportion of Health & Wellbeing proposals than Finland, in both FP7 and Horizon 2020. When taking into account the relative number of R&D personnel in each country, the number of proposals involving Finland compares unfavourably with all comparator countries in FP7 and with half of these countries in Horizon 2020.

Number of H&W proposals involving country



Number of proposals per 1000 research staff and proportion of all participations

In 45% of Horizon 2020 Health & Wellbeing proposals involving Finland, a Finnish actor held the role of coordinator. This is higher than in FP7, where just 36% of Finnish Health & Wellbeing proposals were led by a Finnish coordinator. Most comparator countries have seen a similar increase in coordination rates from FP7 to Horizon 2020, although only IE has achieved a higher rate than FI in Horizon 2020.

If we take account of the relative size of the researcher base in each country, the number of Health & Wellbeing proposal coordinators from Finland in Horizon 2020 (27 per 1,000 researchers) is below the rate seen in half of the comparator countries. This is a slight improvement on FP7 in Finland's relative position.

Finnish actors have participated in 2,114 multi-partner Horizon 2020 Health & Wellbeing proposals, of which it has served as the coordinator in 426 (20.2%). This is a higher rate than in AT, DK, NO or SE, but below that in IE or NL. It is also higher than Finland achieved in FP7 (16.8%). The Finnish rate of Health & Wellbeing proposal coordination in Horizon 2020, relative to the FTE researcher population is lower than most comparator countries, but its relative position has improved slightly from FP7.

Because of multiple Finnish participations in some proposals, the total number of Finnish participations in Horizon 2020 Health & Wellbeing proposals (4,102) is double than the number of unique Health & Wellbeing proposals in which Finland is involved (2,114). These Finnish participations represent 2.1% of all participations in Horizon 2020 Health & Wellbeing proposals, which is lower than AT, DK, NL and SE, but higher than IE and NO. When taking account of the size of the respective researcher populations, Finland's number of participations in Horizon 2020 Health & Wellbeing proposals (80 per 1,000 R&D personnel) puts it in the middle of the group of comparator countries.

Finland accounted for a similar proportion (2.0%) of all FP7 participations in Health & Wellbeing proposals. However, because of the longer time-period covered, its participation rate (106.9 per 1,000 R&D personnel) was higher than observed in Horizon 2020. Despite this, Finland's participation rate in FP7 was lower than all comparator countries.

In Finland, two organisation types (HES and PRC) account for the majority (79%) of participations in Health & Wellbeing proposals, with REC accounting for a further 17%. Further, the proportion of SMEs in PRCs is 90%, which is higher than the overall average, and higher than all of the comparators. The distribution of Finnish participations is similar to the overall average, although a slightly above average proportion is accounted for by HES organisations, while a slightly below average proportion is accounted for by PRC and REC organisations.

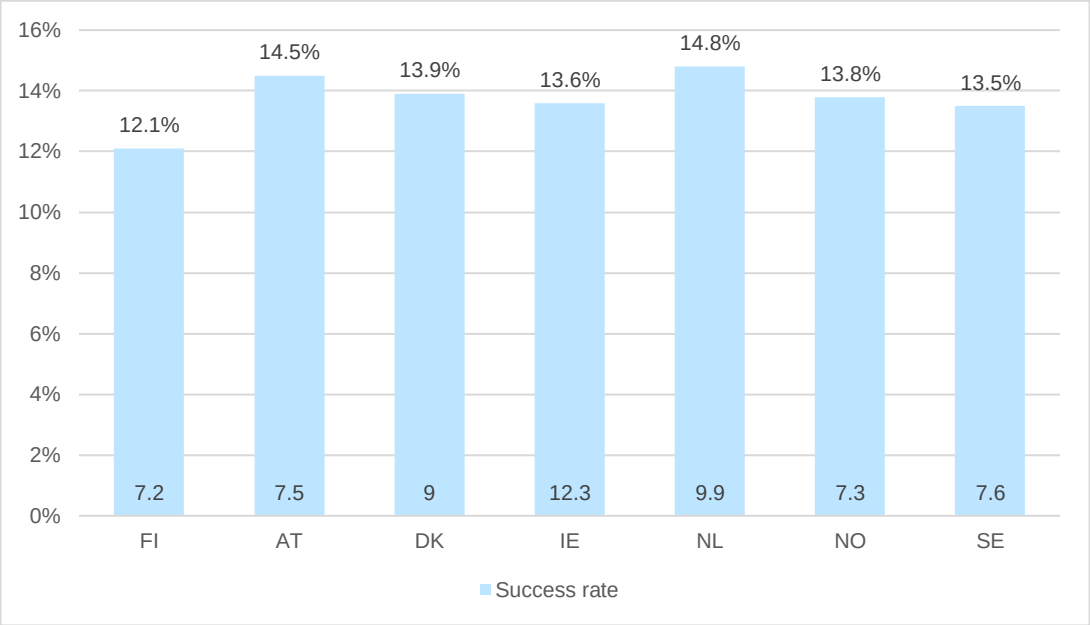
The average EC funding request per Finnish participation in Horizon 2020 Health & Wellbeing proposals was around €725 thousand. This is slightly higher than in most of the comparator countries (except Sweden).

To May 2017, 370 Horizon 2020 grants had been awarded to Health & Wellbeing projects involving Finland. This represents 5.4% of all Horizon 2020 projects, which is lower than all the comparator countries other than Ireland and Norway. Finland compares even less favourably when one adjusts for the size of the research base in each country. Finland has been awarded 7.2 Horizon 2020 Health & Wellbeing projects for every 1,000 R&D personnel in the country, which is lower than any of the comparator countries.

The 370 Horizon 2020 Health & Wellbeing projects involving Finland came from 3,051 proposals. This equates to a proposal success rate of 12.1% - which is slightly above the

overall success rate of Horizon 2020 Health & Wellbeing proposals (11.7%), but below that of all comparator countries. Finnish success rates in FP7 Health & Wellbeing proposals were higher (19.3%) than in Horizon 2020, but this partly reflects higher success rates seen in FP7 overall (16.2%). The Finnish rate in FP7 was still below all comparator countries, except Norway.

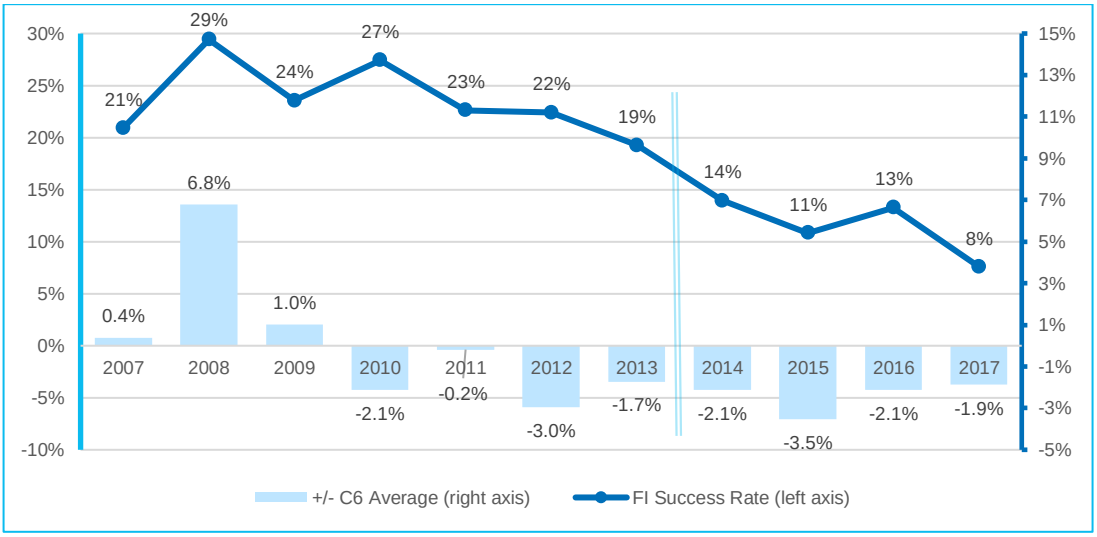
Success rate of H&W proposals



Success rate of projects and number of projects per 1000 research staff

In other parts of the analysis the trend in success rate and participation is slightly muddled by the general level change between the programs, but here the trend is relatively clear and the break came after 2012 after which the success rate of Finnish applications in this has been worse than the previous almost every year except 2016. Further, before 2012 the success rate has been roughly on par with, and after that steadily below the comparison.

Success rate in H&W over time



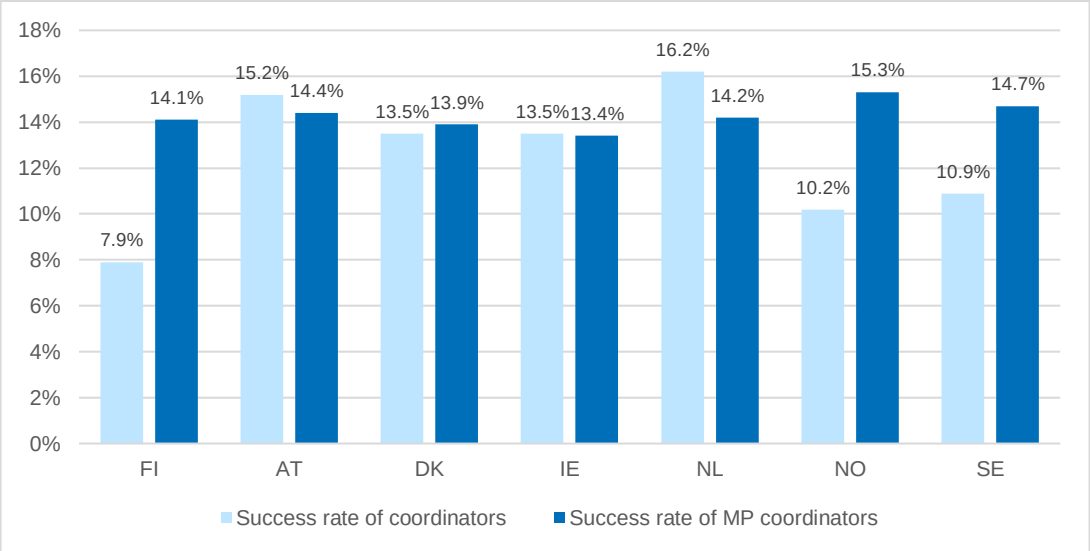
Success rate of Finnish applications per year (left axis), and difference to average of comparison countries (right axis)

Horizon 2020 grants have been awarded to 107 Health & Wellbeing projects with a Finnish coordinator. The equates to 2.1 projects for every 1,000 R&D personnel in the country. This rate is below that of all comparator countries. The rate (coordinators per 1,000 personnel) for Finland in FP7 compared slightly better, but still below that of all comparator countries.

The success rate of Finnish-coordinated Health & Wellbeing Horizon 2020 proposals is 7.9% - which is significantly lower than the overall Horizon 2020 figure (11.7%), and below the rates of coordinator success achieved in all the comparator countries. In FP7, Finland's success rate for coordinators (19.4%) was above average (16.2%), but still below that achieved in most comparator countries (apart from Norway).

If we look only at Horizon 2020 Health & Wellbeing proposals/projects with multiple participants (i.e. excluding those where the coordinator is the only partner), the success rate for FI coordinators increases from 12.1% to 14.1%. This is higher than the overall Horizon 2020 figure (11.1%) but below that of four of the comparator countries (AT, NL, NO, & SE).

Coordinator success rate in H&W area



The 299 Health & Wellbeing grants awarded to Finland in Horizon 2020 involve 506 individual Finnish participations. This represents 2.0% of all participations in Horizon 2020 projects, which is lower than most of the comparator countries (each of which accounts for between 2% and 8% of all participations). Even taking account of the size of the researcher base, Finland does not compare favourably with these countries. The 9.9 Health & Wellbeing participations per 1,000 R&D personnel in Finland is below the 10-16 level achieved by most comparators. A similar pattern emerges for FP7.

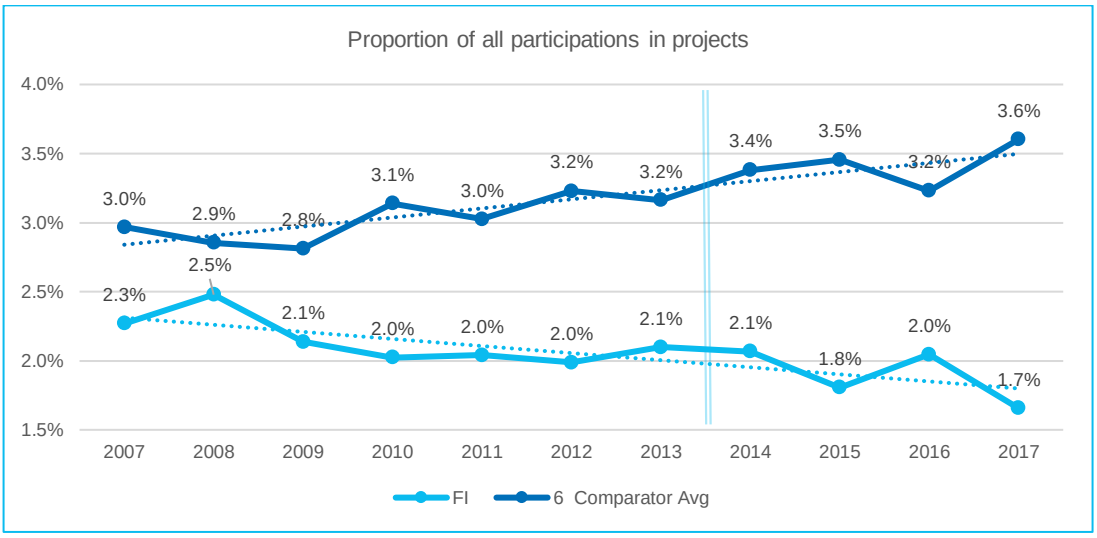
The 506 Finnish participations in successful Horizon 2020 Health & Wellbeing projects, from an original 4,102 participations in proposals, represents a participation success rate of 12.3% in Horizon 2020 so far. This is below the overall rate of success for all participations in Health & Wellbeing proposals, and also below that achieved in all of the comparator countries. Finland's FP7 participation success rate was also below the overall average, and the rates in all comparator countries.

Comparing across different organisation types, success rates for Health & Wellbeing participations were highest amongst Finnish public bodies (27%). Rates here were higher

than the overall average (23%), but lower than most of the comparator countries (apart from DK). Finnish participations from PRC organisations performed well against most comparator countries, being higher than all apart from Ireland and the Netherlands. Elsewhere (HES, REC), Finnish participations achieved success rates that were slightly below the overall average, as well as below that achieved in all comparator countries.

EC contributions to Finnish participations in Horizon 2020 Health & Wellbeing projects totalled €234 million, which equates to 2% of all funding to Health & Wellbeing participations to date. This is below the proportion realised by most of the other comparator countries, but above that received by Ireland and Norway. The average contribution to each Finnish Health & Wellbeing participation (at €462 thousand) is slightly higher than the overall Horizon 2020 Health & Wellbeing average, but below that realised by all-but-one of the comparator countries (AT).

Participations in H&W projects over time



Proportion of all participation per year

Cleantech, Bioeconomy and Circular Economy (CBC)

Finnish actors have contributed to the submission of 3,798 CBC proposals in Horizon 2020 (as of May 2017). This equates to 5.6% of all such proposals submitted to the programme during this period. This is slightly lower than the proportion of FP7 CBC proposals involving Finland (6.1%).

As is shown in the table below, all but two of the comparator countries (IE and NO) have participated in a greater proportion of CBC proposals than Finland, in both FP7 and Horizon 2020. Even when taking into account the relative number of R&D personnel in each country, the number of proposals involving Finland is lower than all comparator countries in FP7 and lower than three comparators in Horizon 2020.

In 42% of Horizon 2020 CBC proposals involving Finland, a Finnish actor held the role of coordinator. This is high than in FP7, where 34% of Finnish CBC proposals were led by a Finnish coordinator. Most comparator countries had a lower or similar rate of coordination in Horizon 2020, while two countries had a slightly higher rate of coordination in FP7 (IE & NL).

If we take account of the relative size of the researcher base in each country, the number of CBC proposal coordinators from Finland (31.2) in Horizon 2020 is below the rate for all

comparator countries except DK & IE. In FP7, the Finnish rate (31.4 coordinators per 1,000 personnel) was below that of all comparators.

Finnish actors have participated in 2,732 multi-partner Horizon 2020 CBC proposals, of which it has served as the coordinator in 532 (19%). This puts it in the middle of the comparator countries. The Finnish rate of CBC proposal coordination in Horizon 2020, relative to the FTE researcher population, is lower than all the comparator countries except Norway and Sweden.

Because of multiple Finnish participations in some proposals, the total number of Finnish participations in Horizon 2020 CBC proposals (5,290) is higher than the number of unique CBC proposals in which Finland is involved (3,798). These Finnish participations represent just 2.2% of all participations in Horizon 2020 CBC proposals, which is lower than for each of the comparator countries, except Norway. When taking account of the size of the respective researcher populations, Finland performs comparably better with a higher number of participations in Horizon 2020 CBC proposals (103 per 1,000 R&D personnel) than all other comparators except Ireland and the Netherlands.

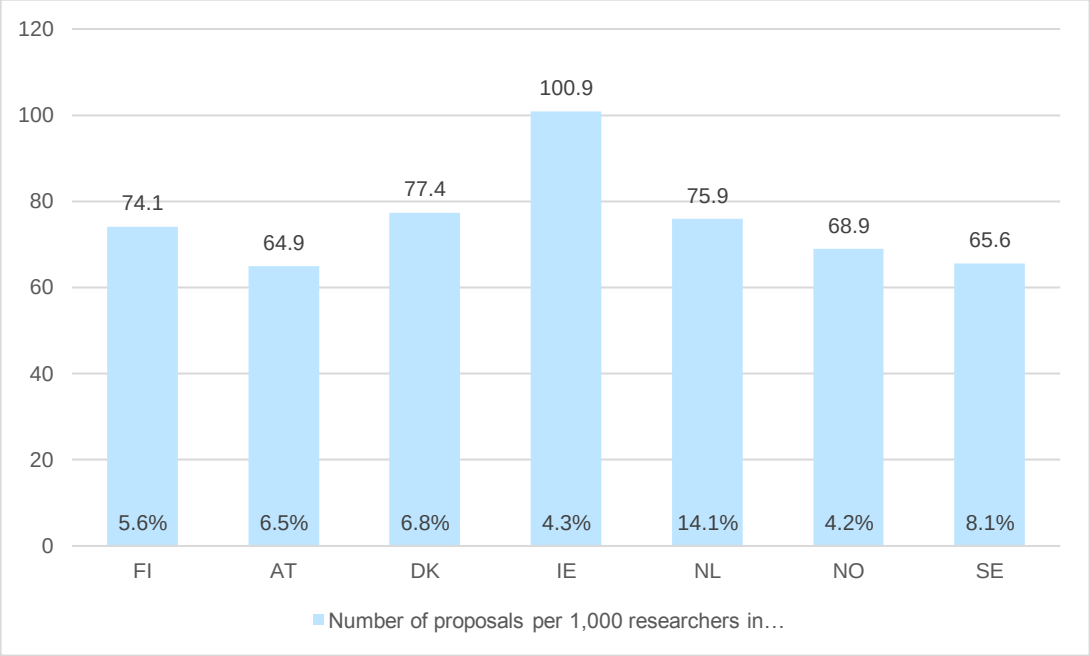
Finland accounted for a similar proportion (2.0%) of all FP7 participations in CBC proposals. However, because of the longer time period covered, its participation rate (128 per 1,000 R&D personnel) was higher than in Horizon 2020. However, this was lower than all comparator countries except Denmark.

The table below shows the distribution of Horizon 2020 CBC proposal participations between different types of actor (categorisations as used in eCORDA). For Finland, it shows that two organisation types (HES and PRC combined) accounts for the majority (76%) of participations in CBC proposals, with REC organisations accounting for a further 19%.

The table also shows the proportion of PRC participations that are SMEs. For Finland, the rate is 86%, which is higher than the overall average, and also higher than all of the comparator countries.

The average EC funding request per Finnish applicant in Horizon 2020 CBC proposals was around €672 thousand, which is higher than in most of the comparator countries, but slightly lower than the overall average.

Participation in CBC proposals

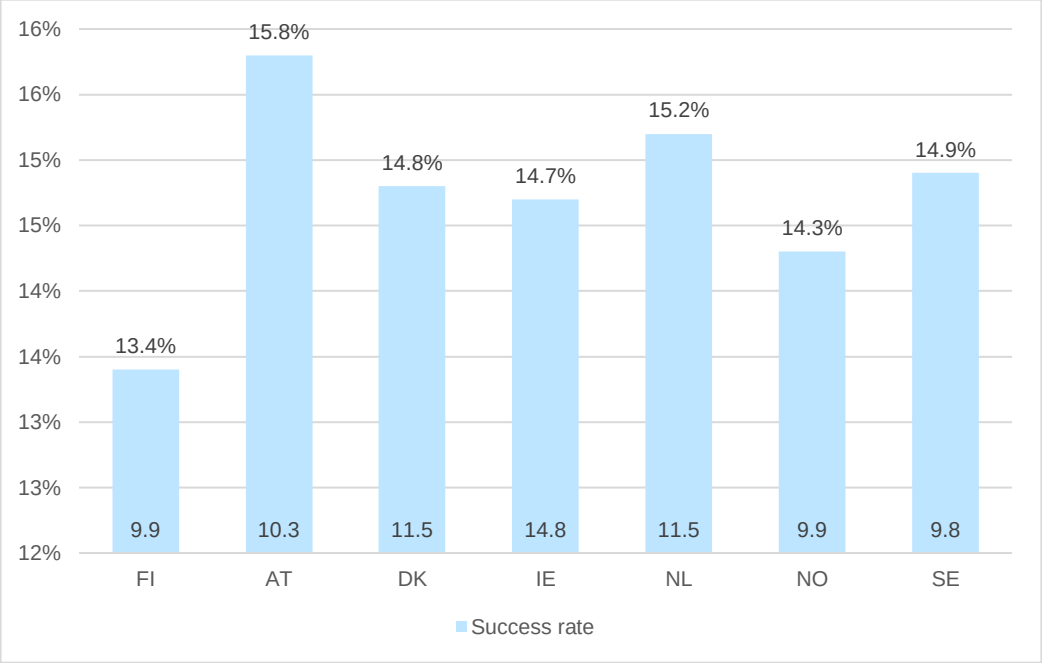


Number of proposal involving country per 1000 researchers and percentage of all proposals

To May 2017, 508 Horizon 2020 grants had been awarded to CBC projects involving Finland. This represents 6.5% of all Horizon 2020 CBC projects, which is lower than all of the comparator countries except Ireland and Norway. Finland compares little better when one adjusts for the size of the research base in each country. Finland has been awarded 9.9 Horizon 2020 CBC projects for every 1,000 R&D personnel in the country, which is lower than all of the comparator countries except Norway and Sweden. This is an improvement on FP7, where the Finnish rate (18 per 1,000) was lower than all comparators.

The 508 Horizon 2020 CBC projects involving Finland came from 3,798 proposals. This equates to a proposal success rate of 13.4% - which is above the overall success rate of Horizon 2020 CBC proposals (11.6%), but below the rate achieved in all of the comparator countries. Finnish success rates in FP7 CBC proposals were higher (19.8%) than in Horizon 2020, but this partly reflects higher success rates seen in FP7 overall (16.3%), and as a result the Finnish success rate was also lower than all comparators in this programme.

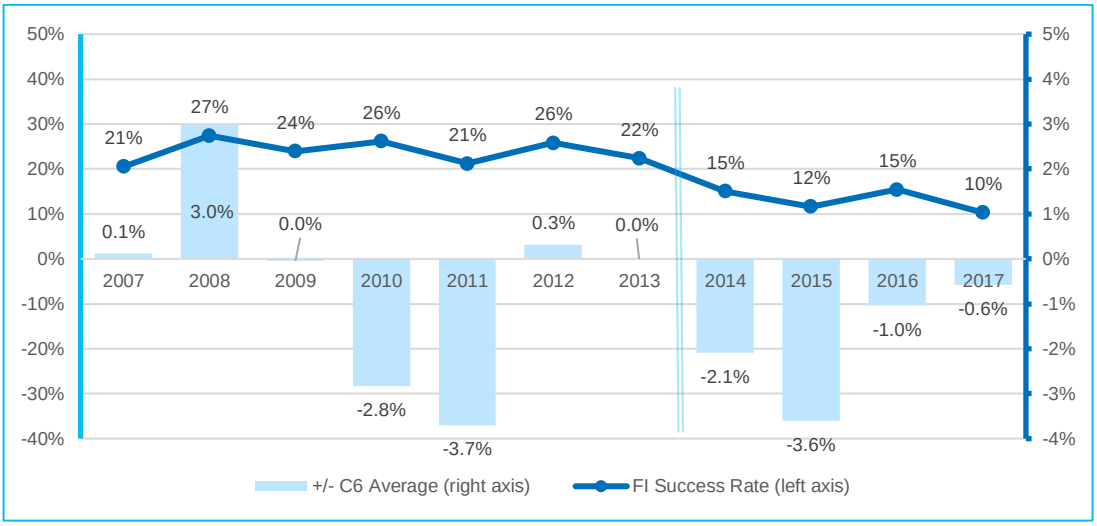
Success rate in CBC area



Success rate of projects and number of projects per 1000 research staff

Looking at the Finnish success rate in CBC, it has been stable through FP and during Horizon 2020 as well, although the trend is again slightly downward. The major difference is that pre-2014 the average has been more in par with the comparison.

Success rate in CBC area over time



Success rate of Finnish applications per year (left axis), and difference to average of comparison countries (right axis)

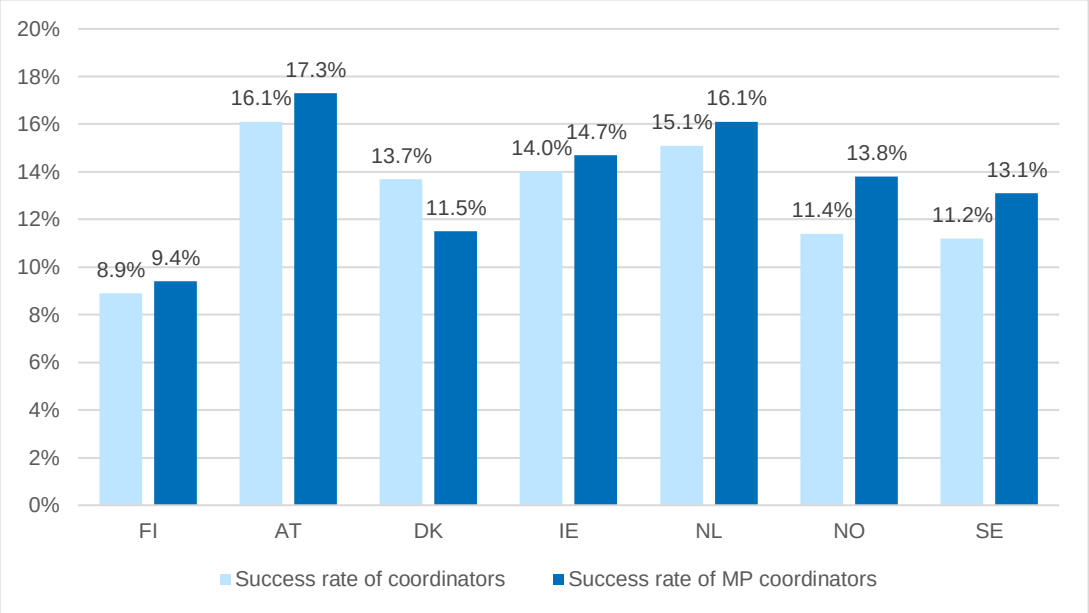
Horizon 2020 grants have been awarded to 143 CBC projects with a Finnish coordinator. This equates to 2.8 projects for every 1,000 R&D personnel in the country. This rate is below that of all comparator countries except SE. The rate (3.3 coordinators per 1,000 personnel) for Finland in FP7 also compared poorly with all comparators.

The success rate of Finnish-coordinated CBC proposals is 8.9% in Horizon 2020 - which is lower than the overall average (11.6%), and below the rates of coordinator success

achieved in all comparator countries. In FP7, Finland's success rate for coordinators was slightly better (10.5%), but this was still lower than all comparator countries.

If we look only at those Horizon 2020 CBC proposals/projects with multiple participants (i.e. excluding those where the coordinator is the only partner), the success rate for FI coordinators increases from 8.9% to 9.4%. However, this still compares unfavourably with the overall average and with all comparator countries.

Success rate of coordinators in CBC area



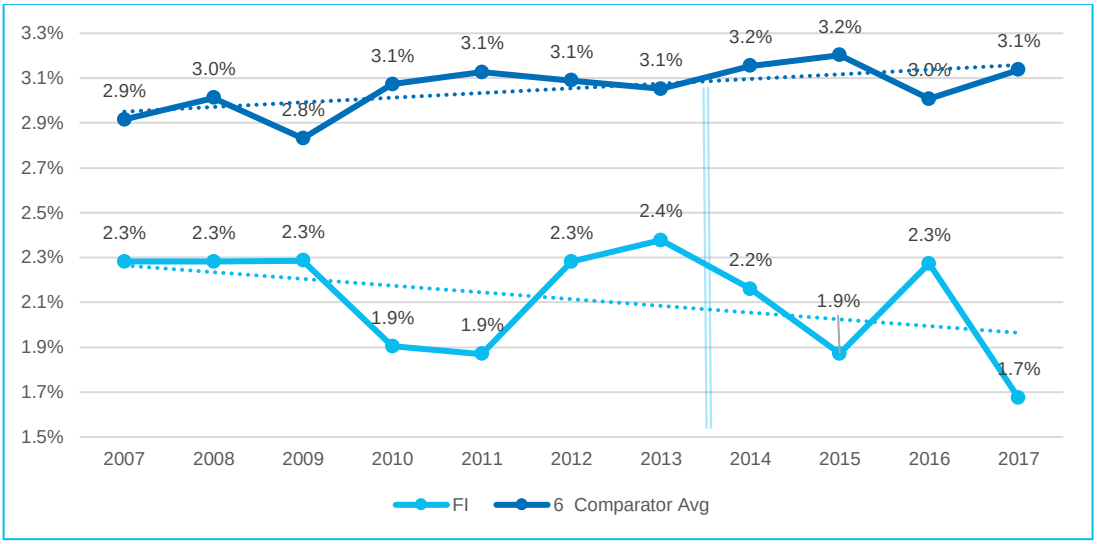
The 508 CBC grants awarded to Finland in Horizon 2020 involve 729 individual Finnish participations. This represents 2.1% of all participations in Horizon 2020 projects, which is lower than any of the comparator countries, except Ireland and Norway. Even taking account of the size of the researcher base, Finland does not compare favourably with these countries. The 14.2 CBC participations per 1,000 R&D personnel in Finland is below that achieved elsewhere expect in Norway and Sweden.

Comparing across different organisation types, Finnish success rates for CBC participations were highest amongst public bodies (29%). Rates here were higher than the overall average (26%), but lower than most comparator countries. The success rates of Finnish participations from other organisation types also tend not to compare well with other countries.

The table also shows the success rate of SME-PRC participations in CBC proposals. For Finland, the rate is 12%, which is below the Horizon 2020 average (13%), as well as below that achieved in all comparator countries except Norway.

EC contributions to Finnish participations in Horizon 2020 CBC projects totalled €335 million, which equates to 2.3% of all funding to CBC participations to date. This is below the proportion realised by each of the other comparator countries except Ireland and Norway. The average contribution to each Finnish CBC participation (at €460 thousand) is also below that achieved by all comparator countries, although slightly above the all country average.

Participations in CBC projects over time



Proportion of all participation per year

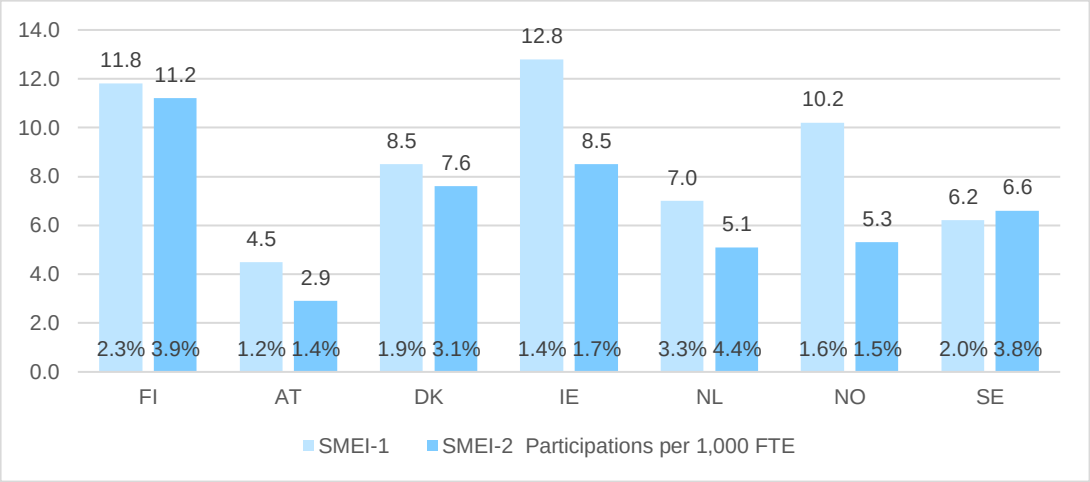
Participation in the SME instrument

Another specific point of interest was participation in the SME instrument (SMEI). The SMEI is a two-phase funding instrument for SMEs with certain conditions, who can propose a small project (maximum grant sum €50 thousand in SMEI-1) for investigation of a feasibility of a business idea and/or a larger one for demonstration (max. grant sum €2.5 million SMEI-2).

Finnish actors level of involvement in SME instrument proposals compares favourably against nearly all comparator countries, for both phases of the instrument. Finns have participated in 604 SME Instrument Phase 1 (SMEI-1) proposals, or 2.3% of all 26,447 participations so far. This is more than all comparator countries except for NL (3.3%). Weighting proposal activity by taking account of the size of researcher populations, Finland's rate of participations in SMEI-1 proposals (11.8 per 1,000 R&D personnel) is above all comparators except IE.

Finland has also participated in 573 SMEI-2 proposals, meaning it is relatively more active here (3.9% of 14,575 participations) than in Phase 1. However, it still ranks slightly below NL in terms of absolute levels of involvement. Compared with the size of the researcher population, however, Finland's rate of participations in SMEI-2 proposals (11.2 per 1,000 personnel) is above all comparator countries.

3.1.4 Participation in SME instrument



Participation in SMEI-1 and SME-2 as percentages of all participations and as number of project proposals per 1000 research staff

In total, €1.2 billion of EC funding has been requested through SMEI-1 proposals. Finland accounts for 2.4% (€28 million) of this total– a higher amount than any of the comparator countries except for NL. On average, Finnish applicants requested €46 thousand each. This is above the Horizon 2020 average (€45 thousand) and places Finland in the middle of the comparators (below SE, DK and SE, but above AT, NL and NO).

The size of phase 2 grants can be much bigger (up to €2.5 million) than phase 1 (€50 thousand). As such, EC funding requests to SMEI-2 total €19.3 billion. Finland accounts for 5.0% (€957 million) of this total – a higher proportion than any of the comparators except for NL. On average, Finnish participations in SMEI-2 proposals requested €1.7 million in funding each. This is above the Horizon 2020 average (€1.3 million), as well as higher than the average in all of the comparator countries.

Finland's relatively high rate of SMEI proposal activity has not fed through entirely into levels of project activity, particularly for Phase 1. Of the nearly 2,200 Horizon 2020 SMEI-1 grants awarded so far, just 51 have been to Finland. This 2.3% share of participations places Finland in the middle of the comparator countries (below DK, NL and SE, but above AT, IE and NO). Its rate of participations in SMEI-1 projects (1.0 per 1,000 R&D personnel) is also below four of the comparator countries (DK, IE, NO and SE).

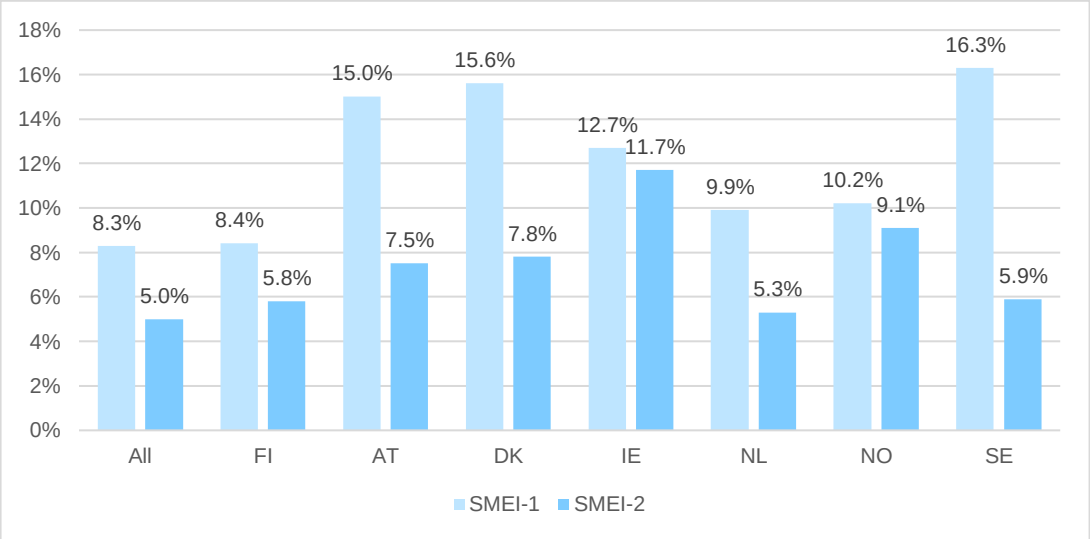
The country has fared a little better with SMEI-2. Of the 724 grants awarded so far, 33 (or 4.6%) have been awarded to Finnish participants. This is fewer than in DK or NL, but more than in the other comparator countries. Compared with the size of the researcher population Finland's rate of participations in SMEI-2 projects (0.6 per 1,000 personnel) compares even more favourably, being higher than all comparator countries except for IE (SE also has the same rate as FI).

Based on the data presented above, on participations and funding in proposals / projects, we can calculate success rates within the SME Instrument so far. Finland compares unfavourably with most/all comparators, both in terms of participation success rates and the proportion of requested funding that has been awarded. This explains why the relatively high levels of proposal activity have not fed through into similar levels of SMEI project activity.

For SMEI-1, just 8.4% of Finnish participations in proposals have been successful. While this is slightly above the overall average, it is lower than for all of the comparator countries. AT (15.0%), DK (15.6%) and SE (16.3%) in particular achieved success rates that were around double those seen in Finland. The proportion of requested that was awarded follows a similar pattern, although the Finnish rate (8.2%) is also slightly below the overall average.

For SMEI-2, Finland has only performed marginally better. Its participation success rate (5.8%) is above average and higher than in NL, but still below all other comparators (particularly IE, which achieved a success rate of 11.7%). Finland's funding success rate (5.6%) is also slightly below average and slightly above the NL rate, but below all other comparator countries (again IE stands out among this group with a 13.3% return).

Participation success rate in SME instrument



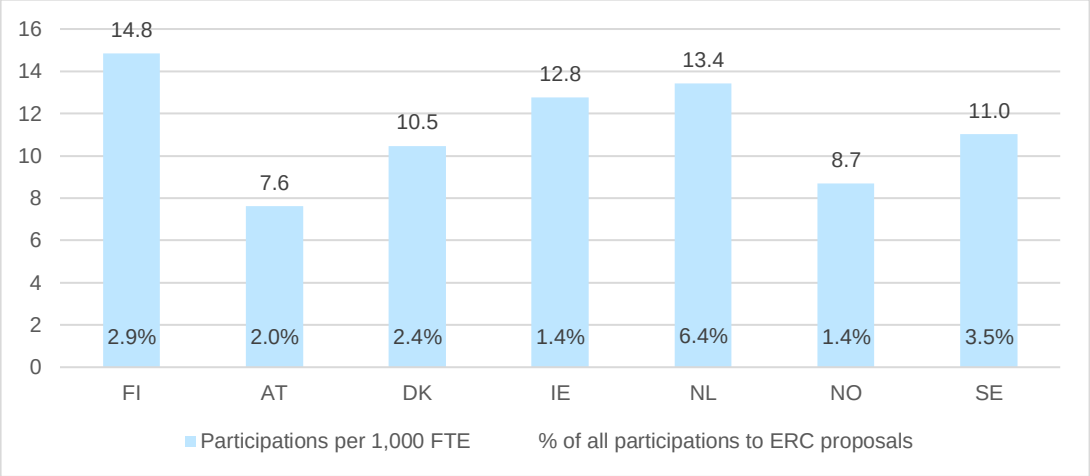
Success rate of applications

3.1.5 Participation in ERC

Another specific point of interest was participation in the European Research Council (ERC). Located within the Excellent Science pillar of H2020, ERC provides funding to enable talented and creative individual researchers and their teams to pursue the most promising avenues at the frontiers of science. A total budget of €13,095 million is available under H2020 for the implementation of the different ERC funding schemes, with between €150 thousand (for proof of concept) and €10 million (for synergy grants) available for individual grants. In nearly all cases, ERC grants are awarded to one researcher at one institution for a single project, with the single selection criteria being scientific excellence.

Finnish actors level of involvement in ERC proposals compares favourably against nearly all comparator countries. Finnish actors have participated 760 times in ERC proposals, or 2.9% of all 26,407 participations so far. This is more than all comparator countries except for NL (6.4%) and SE (3.5%). Weighting proposal activity by taking account of the size of researcher populations, Finland's rate of participations in ERC proposals (14.8 per 1,000 R&D personnel) is above all comparators.

Participation in ERC proposals



Participation in ERC proposals, as percentages of all participations and as number of proposal participations per 1000 research staff in country

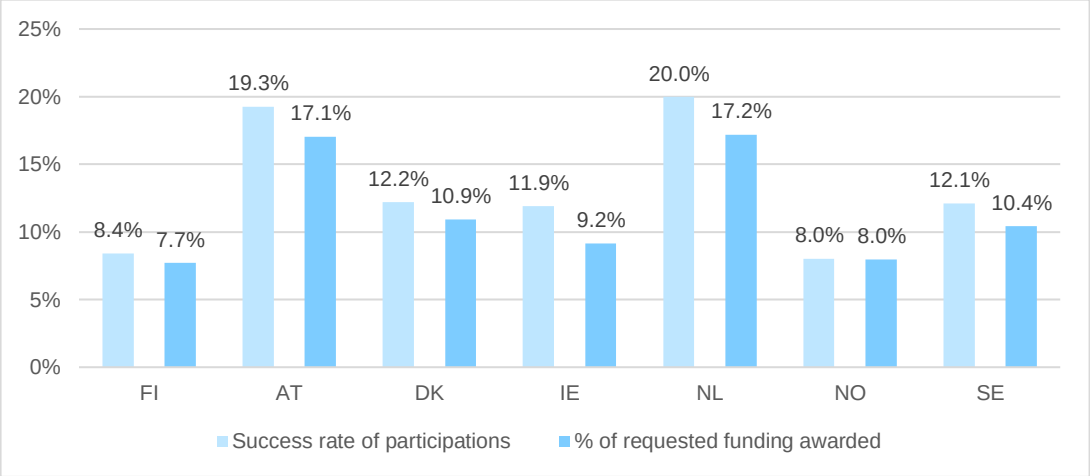
In total, €42 billion of EC funding has been requested through ERC proposals. Finland accounts for 3.2% (€1.3 billion) of this total– a higher amount than most of the comparator countries (except for NL and SE). On average, Finnish applicants requested €1.8 million each. This is above the Horizon 2020 average (€1.6 million) and places Finland above all the comparators except for NO.

Finnish actors relatively high rate of ERC proposal activity has not fed through entirely into levels of project activity. Of the nearly 3,700 Horizon 2020 ERC grants awarded so far, just 64 have been to Finland. This 1.7% share of participations places Finland below most comparator countries (only above IE and NO). The rate of participations in ERC projects (1.2 per 1,000 R&D personnel) is also below all-but-one (NO) of the comparator countries.

Based on the data presented above, on participations and funding in proposals / projects, we can calculate success rates within ERC so far. Finland compares unfavourably with all comparators, both in terms of participation success rates and the proportion of requested funding that has been awarded. This explains why the relatively high levels of proposal activity have not fed through into similar levels of ERC project activity.

Just 8.4% of Finnish participations in proposals have been successful. This is below the overall average (14%), as well as below that of all countries except NO. The proportion of requested funding that was awarded follows a similar pattern, although the Finnish rate (7.7%) is below that achieved by all of the comparator countries.

Success rate of ERC applications



Success rate of applications to ERC and proportion of requested funding awarded

3.2 Econometric impact assessment

3.2.1 Overview

This chapter presents the econometric analysis of the performance of firms that have received funding from past and present EU framework programmes. As part of a wider evaluation this simple exercise is predominantly prepared to conclude whether the impact of EU funding on chosen outcome variables on the firm level is similar to that of other R&D subsidies. Impact evaluation of R&D subsidies is a difficult and laborious task and developing a more nuanced picture would require a more thorough approach for example into externalities. If this is the case, we can draw conclusions regarding the firm level impact from other studies and focus on other aspects of the EU-wide funding programme, as done in other parts of this evaluation.

In the analysis, the impact of funding from framework programmes was analysed from the perspective of firm productivity, turnover, profits, employment, R&D investments, other investments and exports. The analysis is limited to the firm level. In similar studies with Finnish data no effect on labour productivity has been detected and, on the other hand, even negative productivity growth has been evidenced[32]. Also, further evidence from Finnish and international studies shows that the impact of R&D subsidies on firm performance is unclear, even though the impact on R&D activity seems to be positive[33].

The impact of R&D subsidies is a challenging task to study. At the firm level, the impact could take place with a long time-lag, and the outcome is uncertain and its probability distribution highly skewed. Moreover, the impact does not remain within the company that has received the subsidy. In fact, to get a more comprehensive picture of the impact of R&D subsidies, the spill over effects of R&D should also be studied[34]. Therefore, it would be more fruitful to study the effects of R&D subsidies on overall productivity in the economy.

There are also some methodological limitations when studying the effect of R&D subsides on the firms. Causality of the impact, for example, is a question that needs due attention; to

[32] Viljamaa *et al.*, 2014; Karhunen and Huovari, 2015

[33] Zúñiga-Vicente *et al.*, 2014; Ylhäinen, Rouvinen and Kuusi, 2016

[34] for exemple as in Takalo, Tanayama and Toivanen, 2013

control for the problem of selection bias, the firms that have received subsidies are matched with otherwise similar non-receivers based on some background characteristics to form a comparison group. The selection bias arises if there are some unobservable characteristics that influence the programme participation. The participants and non-participants are likely to differ even in the absence of treatment.

When evaluating the performance of any programme, it is crucial/vital/important to construct a suitable counterfactual that represents the outcome in the absence of the programme. This is complicated since firms self-select to the programme based on the outcome variable that the programme is supposed to affect instead of being exogenously assigned to it[35].

In addition, the survival bias relates to the fact that attention is only paid to firms that survive, although there are firms that might cease to exist in either treatment or control group during the observation period. The survival bias may lead to overly optimistic evaluations of the impact of a subsidy if the subsidised firms, for example, are more likely to survive due to the subsidy. Regardless, due to pragmatic reasons survival bias is not taken into account in this study.

3.2.2 Methodology

The motivation for an impact evaluation is to get evidence if the programme works or not. There is a limited budget for subsidies and we should know whether the programmes work as intended. Based on evidence, we get information on how to modify and design programmes and policies to work better in future.

To assess the impact, we would need to know what would have happened without the programme: whether the programme had been beneficial or harmful, or if it did not have any impact at all. Additionally, we should be able to determine what the outcome was as a result of the programme.

A widely used method for programme evaluation is the difference in differences method (DID from this on). It estimates the effect of treatment, in this case programme funding, comparing differences in outcomes between the treatment group and the comparison group.

The DID requires observation of an outcome variable before and after the treatment. The DID assumes that the outcome variable has a same underlying trend in the treatment and control groups. A difference from that trend after the treatment is considered as caused by the treatment. The major challenge in the DID approach is to find a suitable control group.

In this study, our main control group is firms that have received national RDI funding, in practice Tekes funding, during the same period. In addition, we formed two other control groups: innovative firms based on the innovation survey and R&D active firms based on R&D survey.

In addition to selecting specific control groups, we used matching to improve comparability. Treatment group firms were matched to similar firms in control group. We used exact matching to industry classification and nearest neighbourhood matching to firm size.

Matching element was included to correct for the selection bias discussed in the introduction. Matching combats the problem related to the confounding variables, or less technically, the variables that affect both independent and dependent variables. Additionally,

[35] Heckman and Smith, 1999

combining the DID approach to the matching, the unobserved time invariant effects can be controlled for. This is how the comparison group and the treatment group are such that inference can be dubbed causal.

3.2.3 Data

To assess the impact of EU RDI funding on Finnish firms, we have combined EU funding data obtained from Tekes with firm level financial and other data from Statistics Finland. Funded firms that we have studied are from three EU framework programmes, FP6, FP7 and Horizon 2020. The data cover funding decisions from 2003 to early 2017. The majority of the funded firms could be matched with firm level data, and we had in total 855 EU-funded firms with at least partial data.

There were many more funding decisions since a large part of firms had received funding from several EU programmes within the time period, in total 1389. As some of those funding starts took place during a single year in firms with several funding decisions, we had 1146 individual funding start years in firms to begin with.

Description of data

Programme	Firms	Fundings	Start years
FP6	218	324	272
FP7	384	728	589
Horizon 2020	253	331	285
Total	855	1383	1146

Number of firms, funding decisions and years when one or more funding starts took place in a firm.

Unfortunately, the number of observations we could actually use was lower. To estimate the impact five years after the funding started, we needed data from one year before a funding start to five years after a funding decision took place. So, we could use data only up to the start year 2011 from firms with sufficient years with data before and after a funding start. Another problem was other sources of funding both from the EU and the national funding from Tekes. If firms have several R&D funding sources within the assessment period, it is difficult to identify the impact of particular funding. Taking together all restrictions, we were left only with 100 observations.

As firm level data contain all sorts of sources of error and randomness, even the original number of 1146 observations would have been rather low. With only 100 observations it is difficult to draw any conclusions. This is evident also from large standard errors of coefficients in the analysis. In the end, we analysed those 100 observations with a clean impact period as well as those observations with other funding sources within the impact period.

The impact of funding was studied on several firm level indicators:

- Personnel
- Turnover
- Value added

- Labour productivity
- Profits
- Internal R&D expenditures
- Fixed investments on structures, machinery and equipment.
- Exports of goods

There are three different control groups that are used in the study. Each of the control groups were selected so that the firms in them have either received innovation funding from other sources but not from the EU (namely Tekes funding) or reported innovation or R&D activity. The control groups are 1) firms that have received Tekes funding but not EU funding, 2) innovative firms based on the innovation survey that have not received either Tekes or EU funding and 3) firms that have reported R&D activity in the Statistics Finland R&D survey but have not received either Tekes or EU funding. Control groups:

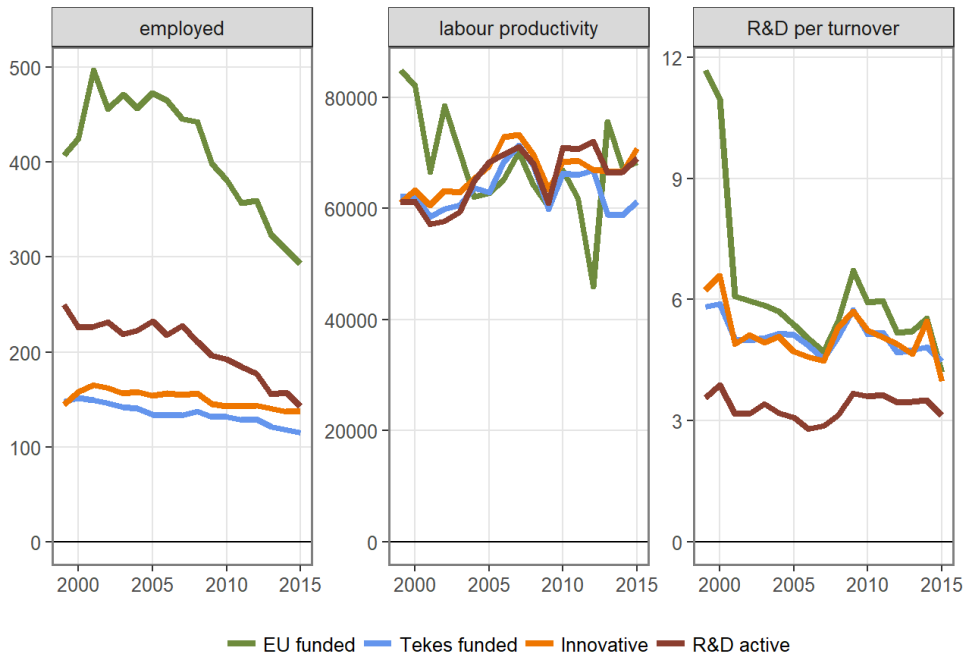
- Tekes funded (not in EU funding)
- Innovative firms based on innovation survey (not in EU or Tekes funding)
- R&D active firms based on R&D survey (not in EU or Tekes funding)

3.2.4 Modelling results

The firms that have received EU funding from framework programmes are on average considerably larger than the firms that were a basis for the control groups. This is a result from the fact that the number of EU-funded firms is a lot lower and includes larger share of the biggest manufacturing firms. The median of firm size in groups is more equal, but even with that measure EU-funded firms are clearly larger than the nationally Tekes-funded firms.

Set aside the size, firms in other groups are rather similar to EU-funded firms. However, the EU-funded firms are compared to similar firms in control groups. Within those selected groups, firms are matched based on industry classification and firm size.

Description of study groups



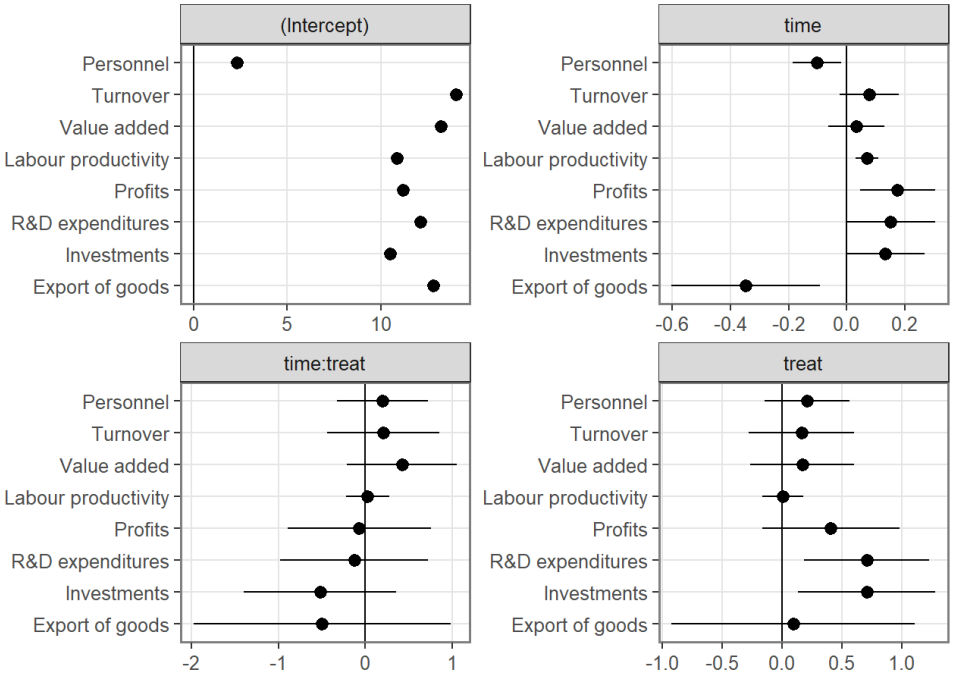
Number of employees, labour productivity (€, value added / employed), and R&D per turnover (%) in firms studied years 1999–2015 in firms with more than 5 employees. Source: Statistics Finland.

FP funding compared to national funding

First, we compared EU-funded firms with Tekes-funded firms, without matching based on firms' characteristics. EU-funded firms were matched with Tekes-funded firms that had a funding start in the same year. We tried to see whether EU funding differs from national funding on its impact on firms. We did a DID estimation where indicator was regressed with a time dummy-variable, before and (five years) after funding, a treatment dummy-variable, EU funding or Tekes funding, and their interaction (impact), which tells us the impact of EU funding compared to the impact of Tekes funding.

Estimated coefficients for the impact variable give us the estimated difference of EU and Tekes funding. The following figure collects results from estimations for all variables. The point estimates for personnel, turnover and value added gives more positive impact for EU funding, the impact is nearly the same for labour productivity, profits and R&D expenditures and more negative for investments and exports. However, none of the coefficients is statistically significant as confidence intervals for coefficients are rather large and includes also zero, which means that there is no difference in impact compared to Tekes funding. Based on the result we cannot say that there were any significant differences in impact on firm level between EU and Tekes funding.

Estimation results for FP funding compared to Tekes funding



Difference in differences estimation coefficients on clean EU funding compared to clean Tekes funding. Point estimates and confidence intervals (95%).

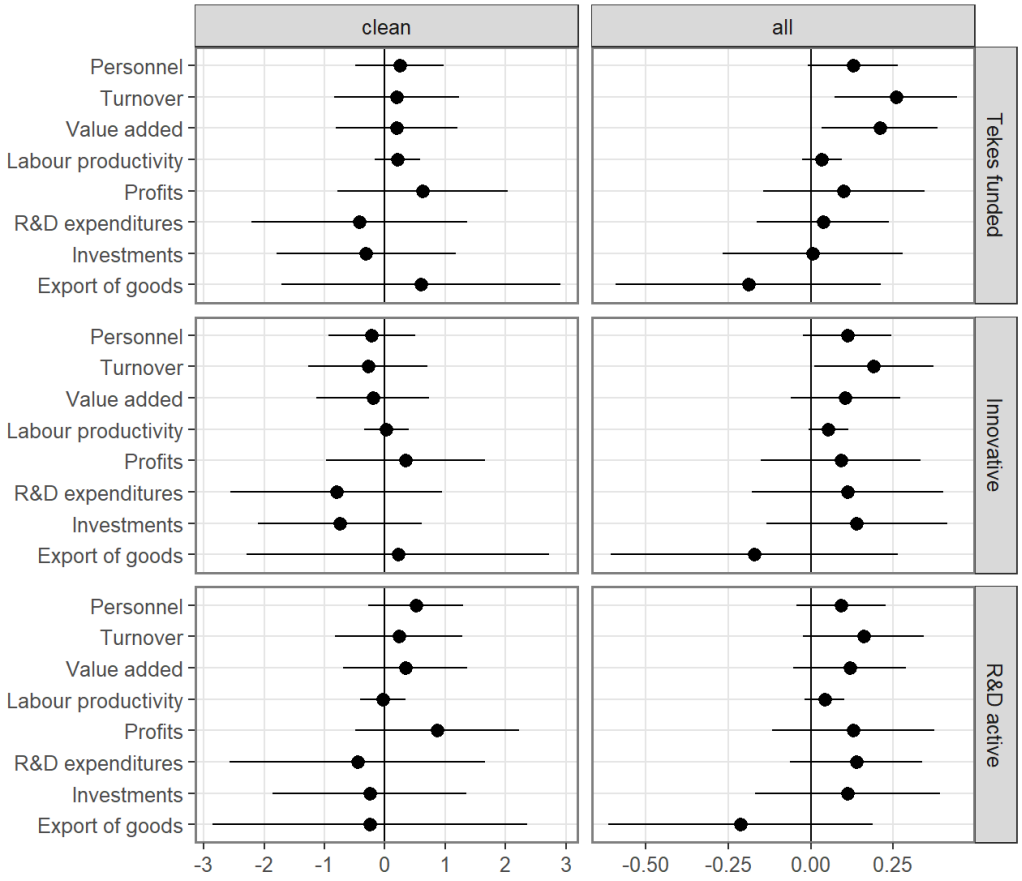
Robustness check

Next, we matched firms based on firm size (personnel) and industry, and compared EU-funded also to other control groups: innovative firms based on innovation survey and R&D active firms based on R&D survey. We did a comparison for clean EU FP funding (no other EU or Tekes funding) and all programmes. We used also all programmes because there were so few observations for clean programmes. However, it should be remembered that based on all programmes we cannot draw conclusion on the impact itself.

The results show that none of the coefficients of impact variables is statistically different from zero for clean programmes. It should be noted that confidence intervals are rather large due to low number of observations and large variation in indicators.

Using all EU programme funding, we find that all point estimates of impact are positive, except for exports of goods, and there are even some statistically significant coefficients. Turnover has grown more in EU-funded firms than in Tekes-funded or innovative firms, and also the value added compared to Tekes-funded firms.

Alternative model intercept terms



Estimation results of the coefficients of the impact after five years for six models. Compared to control groups of Tekes-funded, innovative and R&D active firms. Clean and all EU funding. Point estimates and confidence intervals (95%).

3.2.5 Findings

Impact analysis of research and innovation funding is a challenging task. The particular difficulty when analysing EU funding is that the number of receiving firms is rather low, which is reflected in the larger confidences intervals and margin of error. In addition, participating firms in EU funding are larger than average firms and likely have a broader portfolio of activities. A large part of EU-funded firms have received also several other subsidies, from EU or from Tekes during their history. Thus, isolating the impact of an individual funding source is difficult.

With that said, when isolating the funding sources as best as possible, **the main result is that the impact of EU RDI funding seems at least as good as that of national Tekes funding**. Comparing the impact five years afterwards on EU and Tekes-funded firms that have not received other funding in that period reveals no statistically significant differences. Comparing EU-funded firms with no other funding to other control groups and matching firms to similar control firms does not reveal any statistically significant differences either, largely due to small sample size.

Comparing all EU-funded firms (that is firms with also other compounded funding) to control groups shows that EU-funded firms seem to have grown faster on average.

Growth of turnover is statistically significantly higher compared to Tekes-funded firms and innovative firms. Compared to Tekes-funded firms, value added has grown faster as well. Compared to all three control groups, most of the indicators have had more positive outcomes in the EU-funded firms, even if the difference is not statistically significant in other cases. However, this difference is a product of all the compounded funding, not 'clean' FP funding.

Additionally, the effect of RDI subsidies tends to percolate to commercial gains over a long period of time, for example it has been previously observed in the Finnish context that the productivity gains are reaped more than five years after the intervention[36]. Another aspect is that some of the benefits of RDI subsidies can dissipate as externalities or spill-overs for various reasons to other enterprises, which means that the net impact in the beneficiary enterprises looks lower while the whole economy benefits. Also, it is not clear whether al FP participants pursue e.g. the added European market knowledge after the FP project. This is to say the modelling possibly underestimates the overall impact of FP at the level of the firm and/or economy. The focus of this analysis is at the national level, but it is likewise possible that the total effect across the EU may be larger than any one national assessment would estimate.

3.3 Stakeholder views

To complement the data, a number of stakeholders were interviewed face-to-face, and further surveys were sent to the stakeholders and programme participants. The purpose for interviewing stakeholders/experts and direct participants was to gather a broader view to the significance and contribution of Horizon 2020 and previous FPs in Finnish society beside the economic effect.

Stakeholders were selected purposively, including Programme Committee members, National Contact Points, and other civil servants familiar with the FPs, as well as research administrators and representatives of associations and the industry. The participant survey was sent to the contact person/coordinator of each Horizon 2020 and FP7 project that have ended within 5 years.

3.3.1 Stakeholder interviews

Starting from the general benefits, the FPs are seen as an opportunity to raise the profile and visibility of Finnish research and industry, and for creating new networks. Also from the pragmatic viewpoint the FPs are gaining importance and interest as national applied research funding has declined. However, the voices from the industry are in somewhat contrast with the public sector view regarding usefulness of FP funding in relation to national RDI funding, likely due to the pragmatic realities of participation bureaucracy and acceptance rates in the FPs in comparison to national RDI programs.

For the specific contribution of the FPs, building institutional and personal-professional networks is one of the main benefits. The networks are tied to benefits in terms of RDI substance, but also the ability to influence the direction of the field and associated standards, tying business contacts and other concrete business benefits. Already the application process has the benefit of forcing forward thinking on the consortium Additionally, receiving EU and particularly ERC grants is a major career achievement for

[36] Viljamaa *et al.*, 2013

individual researchers, but also their host institutions and that enables building larger and more competent, internationally attractive, and competitive research groups.

As for the negative effects, not many negative externalities were identified. The interviewees answers were mostly related to the tricky parts of the application procedure in the pre-award phase. The most serious suggested negative outcome or externality was that at least in individual cases the standard setting power of FP consortia can act towards sustaining incumbent business models, current dominant designs and other entrenched interests. Another more general theme was the familiar tug-rope between (basic) research and innovation, where the main concerns were pitting research and innovation against each other and that heavily focusing on relatively short-term impact of grants and current issues can direct attention away from solving large complex issues.

When asked about the impact mechanism, judging from the answers, overwhelmingly **the most important impact pathway is network formation that is associated with both enriching the RDI substance and formation of new business relationships and access to new value chains and markets. A parallel pathway is pooling of actors and resources in a way that would not happen or would be difficult, which paves the way for better impact.**

In reference to relationship with between national funding instruments and the FP, the overall picture is that there is very little harmful overlap of gap. However, some indicated that this apparent coordination between national and EU instruments is more incidental than a result of considered planning and programming. The clearest end deliberate continuum is in the area of Pillar I where national institutions try to identify potential EU applicants early on among their clientele, and nudge and coach them towards the FP. The largest outstanding questions is whether national RDI funding has displaced or crowded-out EU funding, especially during times of plenty. It is difficult to measure, but for example multiple interviewees expressed the view that previously excellent national funding has lessened the pressure to reach towards international cooperation and to some extent taken the incentive to apply for EU funding, and some also expressed doubts if ‘the best applicants’ in their field were applying for EU funding because they could satisfy their needs with national grants. Particularly SHOK funding was mentioned as an instrument that grabbed the attention of national actors and turned them away from the FP. **This question is also related to personnel incentives, both in private and public organisations; it seems incentives are not generally aligned well towards applying FP projects.**

The relationship between FP and ERDF/ESF funding was something the interviewees did not bring up much. One factor is that **in Finland ERDF/ESF funding is negligible in regions where the largest actors reside. Further, ERDF/ESF funding process and reporting requirements are viewed unfavourable by industry and academia compared to other funding instruments. However, Interviewees from regions with better availability of Cohesion Funds viewed them as important instruments for anchoring innovation to the regions.**

Regarding development needs for following FPs, the overwhelmingly most important is further streamlining and simplifying the application, administration and technical reporting, and speeding up the funding process from application to project kick-off. Another related matter is Work Programme content and award criteria, and their relationship to the stated goals of the programme and participation. And third related aspect is evaluation of the applications, some interviewees were concerned about possible different interpretations and

vagueness of award criteria and called for more specific criteria and openness in the process.

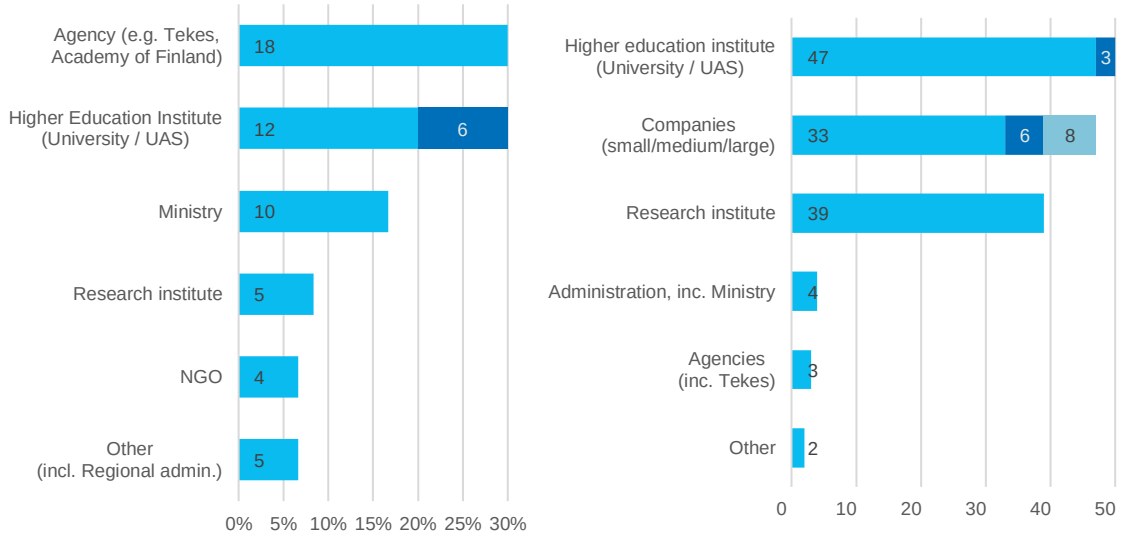
Lastly, in relation to national pre-award support measures, the NCP activities and their development were advocated nearly unanimously. **Overall the views towards NCP and Tekes EUTI office activities were very positive,** the main criticism being that individual NCPs and EUTI have relatively little resources to commit to the activities and thus service availability tends to suffer. In contrast, the interviewees saw pre-award funding for application preparation inefficient and possibly giving altogether wrong incentives, and the present Tekes instruments as sufficient. Multiple research organisations had tried funding application preparation, and were not satisfied with the results. Further critical views were expressed again almost unanimously towards lack of common national strategy and coordination within the national innovation system in general. The present state of the national innovation system was viewed as lacking clear direction, trust between the actors, and mutual understanding of the goals and means of achieving them. In the context of the FP this was seen as an impediment in proactive positioning towards EU RDI policy and programming. **What was called for is a joint broad-based strategy process based on recognition of strengths of the system.**

3.3.2 Surveys for experts and participants

In this section, we will review some of the key findings from the surveys to two stakeholder groups, experts and participants. The list of experts is expanded from those who were included in the interviews reported above, including again NCPs, representatives of administrations and agencies in the field of RDI policy, research organisations, and industry associations. The participant group includes contract persons registered for each FP funded project from Horizon 2020 and all FP7 projects ended within the last five years. The full reports are enclosed as an Appendix to this report.

To begin with, the survey was opened in June 2017. The expert survey received 60 answers and the participant survey 146. In the expert survey, roughly 47% of respondents were from Ministries and agencies, and further 39% were from HEIs and research organisations. In the participant surveys a full 60% were from HEIs and research organisations, and 31 from enterprises where particularly SMEs were represented. In that, research organisations are somewhat overrepresented compared to historical proportion of participations.

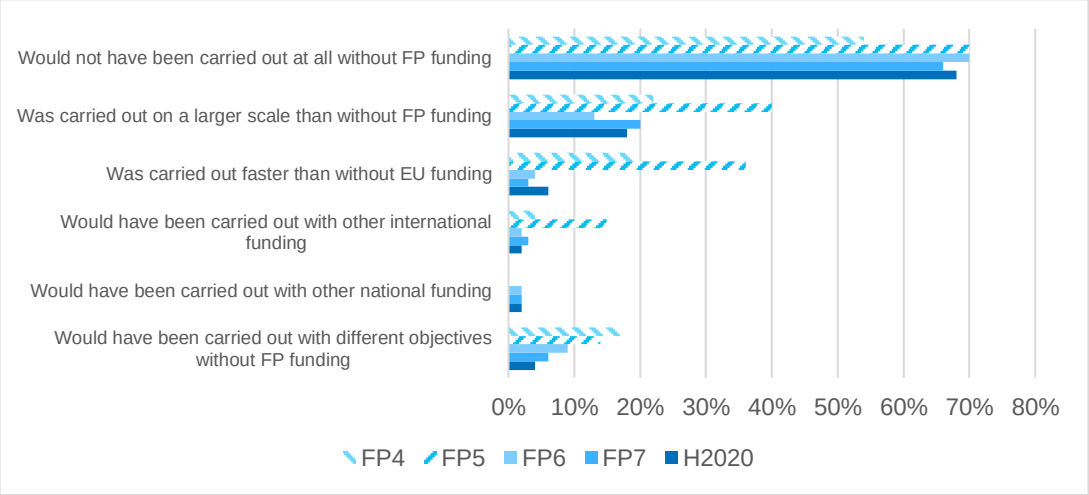
Survey respondent distribution



Distribution of survey respondents, n=58 and 148 respectively. Under 'Academia' universities (lighter hue) and colleges/polytechnics (darker hue) are distinguished, in 'Private companies' large, medium, and small are similarly distinguished following EC guidelines.

As the first finding concerning additionality, a stable portion of 70% of respondent agree that the funded project would not have been carried out without the FP funding. Largest differences to historical figures are in that in the recent FPs the effect on the scale and timing of the work has been smaller (fewer respondents agree that the project was carried out in larger scale or faster with FP funding). Also, significantly fewer agree that the project would have been carried out with other funding or with different objectives. This suggests that in recent times the projects have been more tailored towards the FP and also possibly that the FP and the inherent policy objectives have an increasing effect in steering the direction of RDI activities. In comparison, the Interim Evaluation of Horizon 2020 found that across the Programme 83% of projects would not have been possible without the FP funding. There are two alternative explanations for the difference, one that relates to relatively strong national RDI base and the primacy of national RDI funding, another is that a portion of the pro-jects could have been nationally funded by the participants estimate, but the partners chose to aim for EU funding because of some perceived benefit e.g. from international collaboration.

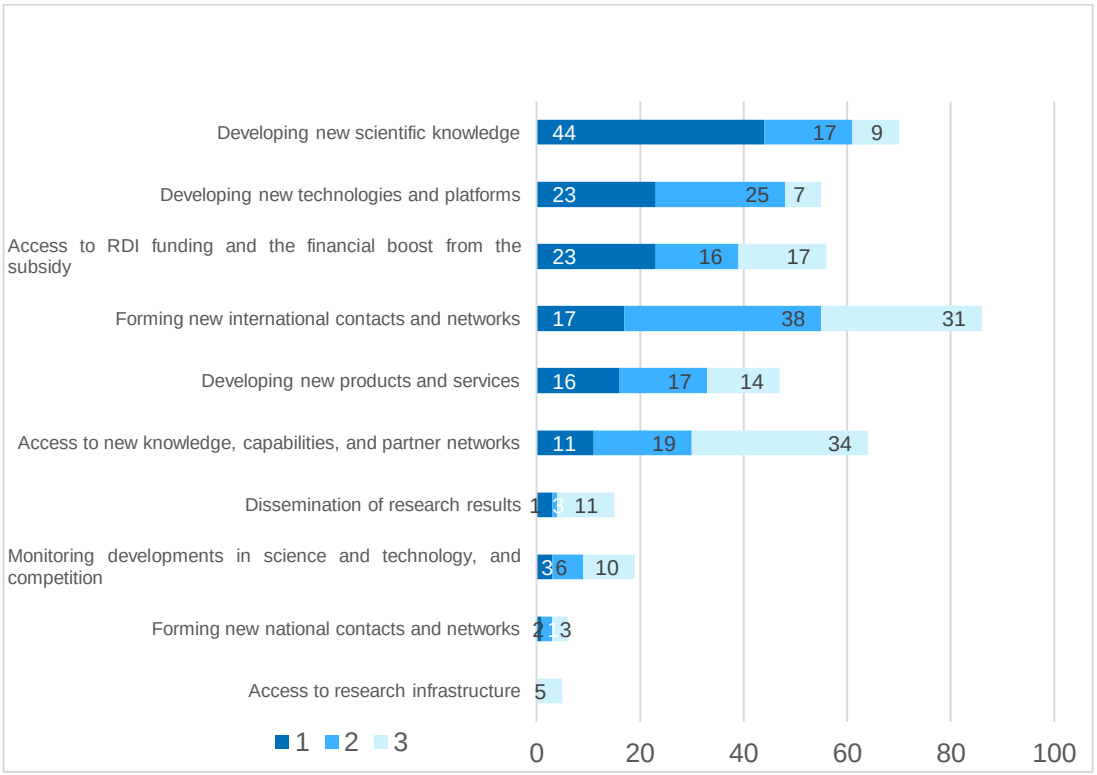
Additionality of FP funding



Source: Findings for FP5 and FP4 for scale, from 'Finnish Participation in the EU Fifth Framework Programme and Beyond', 2004, VTT&TEKES, FP6-own survey data

Related question is why do Finnish organisations participate in the FPs. The following figure gives the three most important reasons for participation. The three most prevalent #1 answers are developing new knowledge, new technologies, and the financial leverage afforded by the funding. The most popular #2 is forming new international networks, which also features as a popular #3. Then the most popular #3 has been access to (existing) networks, capabilities and knowledge. This suggests that Finnish participants who have successfully applied for funding have been focused on the substance first and forming networks and gaining access to existing resources second and third.

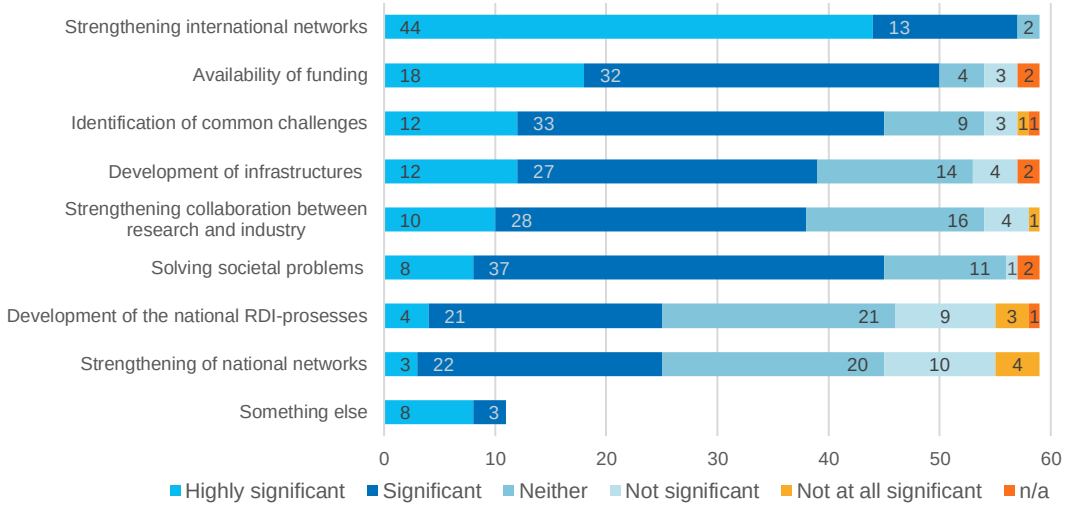
Top 3 reasons for participating in the FPs



The three most important goals 1-3, numbers of responses per item, scale indicates percentage.

This finding is closely mirrored in the experts view on the additionality of the FPs. Building international network is seen as by far and away most significant additionality, followed by access to funding. More interestingly, most of the experts view that the FP has had a significant contribution to identification of common challenges and solving societal problems.

Added value of EU FPs according to experts

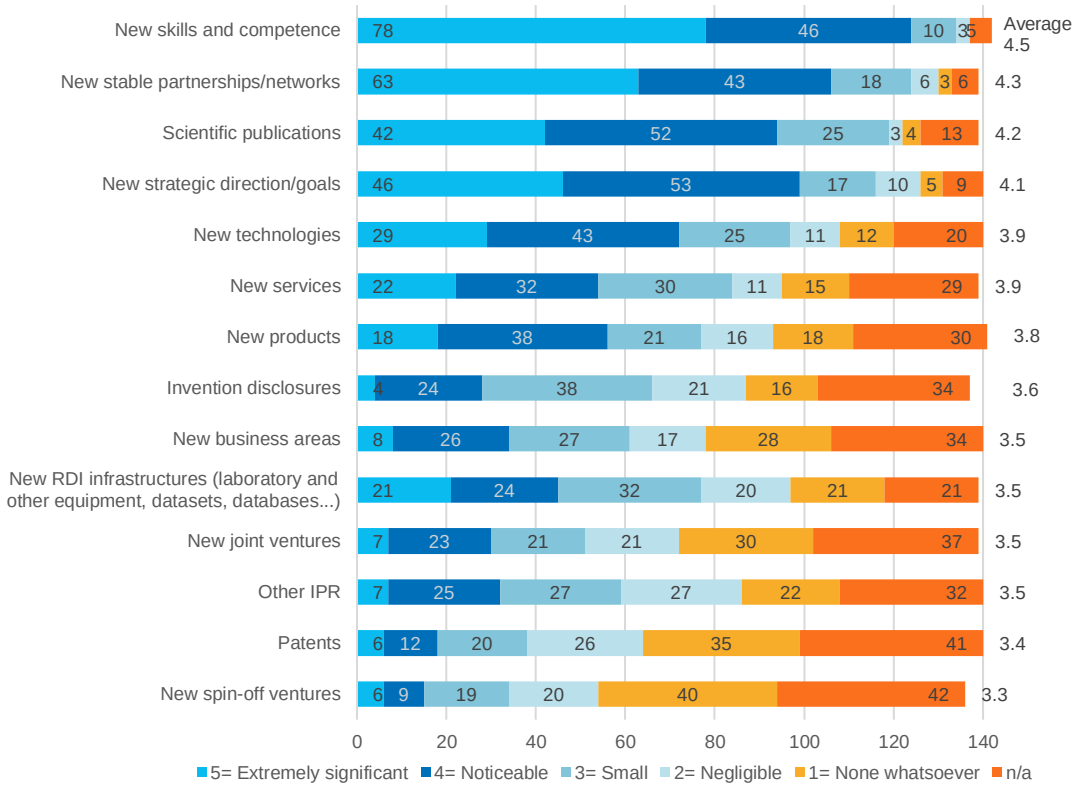


Numbers of respondents and fractions per answer for the items

Again, in a similar fashion, the participants view new partnerships as a major outcome, superseded only by new knowledge. The difference to the preceding figure may be purely due to the difference in point of view between project coordinators and other contact persons and the more of a bird's eye view of the expert group. What is notable though is the fourth outcome, new strategic directions. Another finding is that despite the recent shift in

the goals of the FP from research towards innovation, the outcomes are strongest in pre-commercial end of the spectrum. The most significant contribution is still towards generating new knowledge and competences, networks, and technologies, and to a lesser degree towards new products and services. Regarding direct commercial ventures and registered intellectual property (IPR, including patents, invention disclosures and other IPR), there is a lot of uncertainty and approximately a third of the projects had a no or negligible effect in their own view. These and the following views on outcomes and impacts are surprisingly consistent between respondent groups as well. While researchers are strongly represented in the respondents, the views on outcomes and impacts are surprisingly consistent between respondent groups as well. The largest differences in outcomes are between research institutes and the others in terms of new business areas, spin-offs and joint ventures, where research institutes were the most pessimistic and other groups fit within half a point.

Outcomes of FPs according to all participants

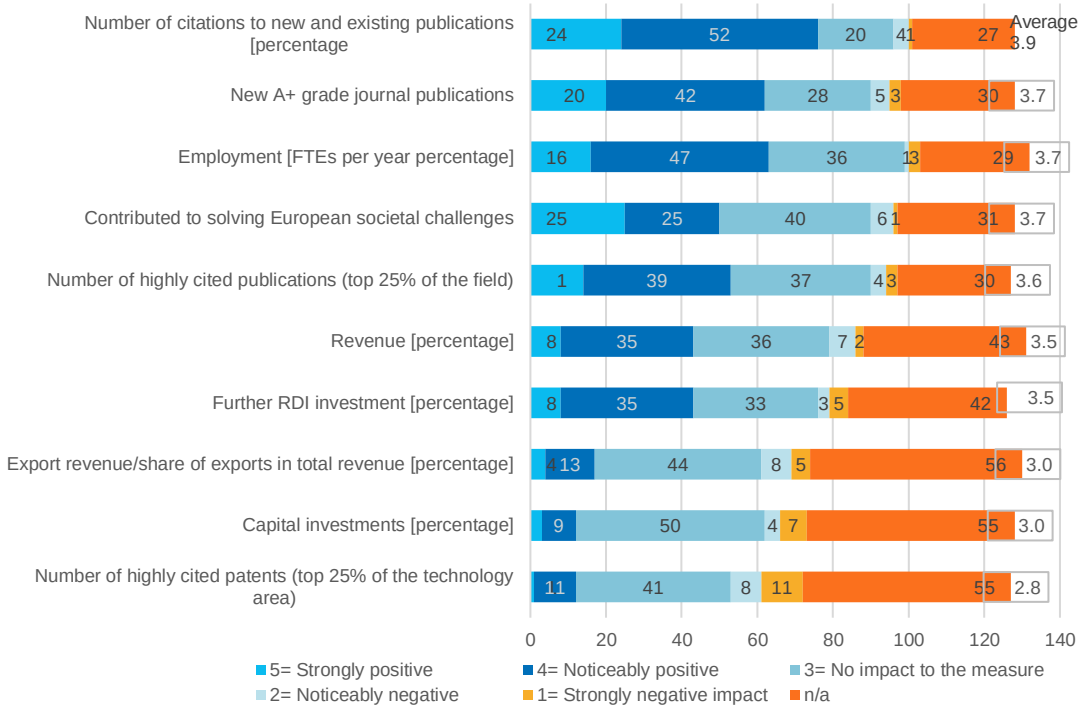


Numbers of respondents per item and average answer

We discussed above that it is possible that Horizon 2020 has had more impact in directions of RDI than before, and this is a relatively direct indication that the policy agendas embedded in the FPs have a direct influence in national RDI at least within the portion funded from the FP.

Going further from the outcome towards impact, the participants are again considerably clearer on the academic impact and noticeable impact it most clear in measures related to academic publishing. However, equally clear is the contribution towards solving societal challenges and employment. In the commercial impact measures uncertainty rises and under a third of the projects has had a noticeable impact in further RDI impact and revenue, in terms of high-quality patents, investments, and exports only around 10% of all projects has had a positive impact.

Impact of FPs according to all participants



Numbers of respondents per item and average answer

All in all, it can be said that the FPs contribute to Finnish RDI, but to a large degree the contribution has been focused in pre-commercial capacity building that will hopefully turn into innovation in further development. As such this may not be what has been hoped for in the light of FPs moving from research more towards innovation and solving societal challenges, but taking into account the distribution of participation, and respondents, up to two-thirds of Finnish participants are research organisations whose horizon is naturally more in the pre-commercial research and development end of the spectrum. That said, the answers are relatively consistent between the respondent groups, within half a point of each other for most questions, as is evident in the comparison between respondents.

However, it is also reasonably clear that the FPs have had a contribution towards solving societal challenges, which is a new feature and in line with the explicit goals of Horizon 2020. Another and previously unrecorded finding is that the FPs increasingly have role in steering RDI substances also in Finland.

3.3.3 Support measures for Horizon 2020 participation

Overview of FP support mechanisms

Most Member States offer a diverse range of financial, non-financial and structural support measures to help potential and current applicants to engage with the FP. It is possible to group the types of support offered into a broad typology presented below. It is possible to further extend this typology across a horizontal axis, too, examining supports in terms of their intended audience. Support measures are offered in the main for researchers within higher education institutions and public research organisations, as well as for private sector

businesses, though eligibility criteria vary. Few supports other than the National Contact Points appear to be aimed at supporting the participation of government actors in the FPs.

A typology of FP participation support instruments

Support category	Actions included
Funding for proactive actions to influence calls	Influencing EU groups or research agendas / calls via membership of specific groups or committees
	Support to, or coordination of, JPI/co-fund engagement
	Alignment of national research funding programmes to EU / FP priorities
Funding to find calls and partners	General awareness of FP nationally or in specific groups
	Support for international networking
Funding to produce proposals	Payment of salary costs for authors
	Travel costs for partnership meetings / conferences / events
	Payment of consultancy costs
	Training / capacity-building
Co-funding for FP participants	Top-up or match funding
	'Buy out' or replacement funding for academics
	'Second chance' funding, to conduct or further develop non-funded projects

The following sub-sections set out a brief synthesis of the FP support measures observed in the sub-set of Member States selected for this review, per each heading of the typology and highlighting pertinent examples throughout.

Advice and guidance

Central to Member States' support to FP participation are their networks of National Contact Points (NCPs). Though NCP services are generally designed to the standards and guiding principles of the European Commission,[37] and cover all sub-programmes of Horizon 2020, networks of NCPs are organised differently in different Member States. A review of regional FP support measures found that there are several typologies of NCP network organisation, reflecting their national innovation systems. The review also found that NCP networks may be augmented regionally (e.g. Belgium,[38] Poland,[39] UK – Northern Ireland[40]). Poland offers one example of an NCP network that is augmented by regional contact points: The NCP network focuses on specialist issues, while the regional contact points offer more generic support as the first contact for applicants, and refers requests for specific expertise to relevant experts within the NCP network.[41]

1) Inner-ministry NCP system

2) NCP system coordinated by a Ministry, but decentralised operations

[37] See: http://ec.europa.eu/research/participants/data/support/20131125_NCP%20Minimum%20standards.pdf

[38] See: http://www.ncpwallonie.be/, https://www.ncpbrussels.be/

[39] Dall, Nyiri and Schuch, "Capacity Building and institutional strengthening of Science and Research in BiH International benchmarking of the NCP systems in Europe", 2010

[40] See : http://h2020ni.com/supportcontacts/

[41] Gulda, Walendowski, Markianidou, Otte, "Peer review of the Polish research and innovation system - Background report", 2017. Available at: https://rio.jrc.ec.europa.eu/sites/default/files/report/Peer%20review%20of%20the%20Polish%20research%20and%20innovation%20system%20-%20Background%20report.pdf

3) Public agency based NCP-system

4) Project-based contracted NCP system with a public organisation

5) Project-based contracted NCP system with a private non-profit organisation

6) Federal multi-level NCP-system

Across the support systems reviewed, the visibility of NCPs, and their 'connectedness' with other parts of the support system and target constituents is often stressed as important. For example, the Greek NCP network is well-regarded for its expertise and visibility, as well as its knowledge in managing EU projects and close links with the national public research infrastructure. However, it has been acknowledged that its lack of national co-funding and frequent changes in key staff are limiting factors. The network has also been assessed as having few links to the private sector (and especially with SMEs), and little involvement of regional players.[42]

A number of Member States have specifically prioritised visibility and connectedness. In preparation for Horizon 2020, France formalised the role of its NCPs via the introduction of national standards.[43] An intensive promotion campaign was also launched, through which all NCPs were encouraged to establish mutually-supportive relationships with support services acting at regional and local level. The Irish NCP network contains two dedicated NCPs for SMEs that work primarily to raise awareness, build relationships and then provide hands-on support. In addition, Ireland has introduced a special 'industry team' for Horizon 2020. The team is made up of relevant NCPs and National Delegates, and has been introduced to ensure that the relevant expertise can be brought to multi-sectoral and multi-disciplinary projects. In consultation with a member of Ireland's team, the study team was informed of the team's ability to bring in thematic expertise such as ICT – a key area of success for Ireland in the FPs.

Under FP7, the Austrian Research Promotion Agency (FFG)[44] ran a programme of 'Strategy Talks', targeting leading Austrian firms, universities and research organisations to explore their participation in the FPs, addressing organisations rather than individual researchers. The 2010 evaluation of the support services for FP participation support in Austria found that the 'Strategy Talks' had been very well received.[45] The 'Strategy Talks' have since been developed into comprehensive consulting services. The FFG Academy now offers in-depth training to applicants to Horizon 2020, including, for example, how to write a competitive ERC bid. The training covers basic principles, tips, how evaluation panel members view and review proposals, and the opportunity to share the experiences of an ERC grant holder. [46]

Several Member States have launched specific support measures that provide help with proposal writing, finding partners and building partnerships, or organising networking events through their NCP system. In some cases, these kinds of functions are fulfilled for businesses through close alignment with the Enterprise Europe Network (EEN).

There are other examples of best practice in advisory support that do not relate specifically NCP networks. Germany's European Liaison Office of the German Research Organisations

[42] Sakellariou, "The structure of the NCP System in Greece, strengths and weaknesses, evaluation and potential steps for improvement", presentation, 2009

[43] See: http://www.horizon2020.gouv.fr

[44] FFG is the lead national agency for H2020, and oversees both the national strategy to increase participation and the NCP network

[45] Arnold, Boekholt, Good, Radauer, Stroyan, Tiefenthaler, Vermeulen, "Evaluation of Austrian Support Structures for FP 7 & Eureka and Impact Analysis of EU Research Initiatives on the Austrian Research & Innovation System", 2010

[46] See https://www.ffg.at/europa/veranstaltungen/ffg-akademie_2016-07-07

(KoWi) is a comprehensive service platform for German research organisations, self-organised by its scientific members and co-funded by the federal government.[47] It offers services across a range of research funding streams and project lifecycle stages, from advice and coaching to specific training on EU proposal writing and project management.[48] Similarly, the Netherlands Enterprise Agency provides services through its IRIS team (International research and innovation collaboration) such as information days aimed at specific calls, training (for instance on legal and financial terms), international and technological missions, partner search, and liaison between the Netherlands and Brussels.

In some Member States, the national organisation that oversees the NCP network also coordinates the country's representation in the European Technology Platforms (ETPs) and Joint Technology Initiatives (JTIs). This approach is taken by the Portuguese Office for the Promotion of the R&TD Framework Programme (Gabinete de Promoção do Programa Quadro de I&DT, GPPQ), whose mission is to bridge the gap between researchers and Portuguese companies, and the activities of Horizon 2020.[49] Adopting this type of mutual coordination was discussed as a possible avenue to increase the influence of Ireland in the ETPs and JTIs within the interim evaluation of Ireland's participation in Horizon 2020.[50]

Funding for proactive actions to influence calls

To achieve maximum synergy, most Member States have drafted their research and innovation strategies and action plans in line with the European research priorities (e.g. France Europe 2020,[51] the Netherlands' 'Top Sectors' policy[52]) In addition, a select few have conducted specific national exercises to align national and European research priorities: Ireland's 'National Research Prioritisation Exercise',[53] for example, sought to ensure that Horizon 2020 participation is aligned with the country's leading economic and research sectors. The priority areas were subsequently refined in its national strategy for research and development, science and technology, Innovation 2020.[54]

The majority of Member States invest in some form of support to influence the Horizon 2020 Work Programmes and calls. These are mostly made up of directly-funded activities rather than grant schemes, though grants are also offered for hosting events in Brussels (e.g. Science Foundation Ireland's Brussels Conference Programme), as well as ways to promote national research strengths, and to provide inputs to national representatives in the Horizon 2020 Programme Committees and Advisory Groups.

Commonly, there is a Brussels presence or office for the Member State, which provides intelligence between the national or regional researchers and the European Commission. A powerful example of this is the Netherlands House for Education and Research (Neth-ER), a collaborative approach between Dutch universities, regional education centres, and national research organisations to develop the positioning of Dutch research within European research and innovation policy. Neth-ER is part-funded by the Dutch Ministry of Education, Culture and Science.[55]

[47] See: http://www.kowi.de/en/kowi/about-kowi/about-kowi.aspx

[48] See: http://www.kowi.de/en/kowi/services/services.aspx

[49] See: https://rio.jrc.ec.europa.eu/en/organisations/office-support-participation-horizon-2020

[50] Rosemberg Montes, Simmonds, Wain and Nielsen, "Interim evaluation of Ireland's Participation in Horizon 2020", 2016

[51] See: http://www.agence-nationale-recherche.fr/PA2018&usg=ALkJrhjZuJ0OzF_cpnTHH7iftZk-YA28Mw

[52] The Ministry of Economic Affairs and Ministry of Education, Culture and Science, "Global challenges, Dutch solutions", 2014

[53] Research Prioritisation Action Group, "National Research Prioritisation Exercise: First Progress Report June 2014", 2014

[54] See: https://dbei.gov.ie/en/Publications/Innovation-2020.html

[55] See: https://www.neth-er.eu/en/about-neth-er

France has sought to increase participation in Advisory Groups and evaluation panels[56] as part of the broader drive to address falling participation in prior FPs, and to increase the French research community's influence in the European Research Area's decision-making. To do so the country reorganised its representatives.[57]

In some cases, special groups made up of senior officials are put in place to drive the strategic approach to influence calls. For example, Denmark established Strategic Reference Groups in priority programme areas, consisting of National Delegates and core participant organisations within each Horizon 2020 sub-programme, to provide up-to-date information on research developments, strengths and Danish positions to the Programme Committee members.[58] France, meanwhile, operates a national 'Mirror Group' to support the French representatives in the Joint Programing Initiative (JPI) Governing Boards.[59] In order to drive the identification and pursuit of opportunities in Horizon 2020, Ireland has established a single High-Level Group for Horizon 2020, chaired by the Chief Scientific Advisor to the Irish Prime Minister, and backed by the Minister for Skills, Research and Innovation.[60]

Funding to find calls and partners

Most Member States offer some form of grant to support international networking, partner meetings and attendance at relevant events, such as conferences. The grants are usually small (in the order of €100-600 per day), and cover out-of-pocket expenses such as travel, accommodation and subsistence, as well as certain fees, such as registration for conferences. Schemes are mostly targeted at researchers, but may also be available to businesses dependent upon eligibility and strategic orientation.

Some Member States include travel and accommodation funding within their financial support measures for proposal preparation. For example, in Germany, the current support for proposal preparation focuses on collaboration with partners in key strategic geographies, and funding covers travel and accommodation for German and foreign researchers and experts.

Funding to produce proposals

Funding to support applicants to produce proposals is the most common form of support offered among the Member States examined, and usually offers a larger amount of funding than the other categories of support. Many countries continue to offer financial support to universities and research organisations to prepare proposals, and often, larger amounts are available for those applying to coordinate a Horizon 2020 consortium. Where funding is available to a broader set of organisations, the funding is differentiated depending on recipient (i.e. research organisations or commercial entities). Funding to produce proposals generally the costs of preparatory work, including project-related resources, equipment, and personnel costs.

There is an observable trend among more developed Member States to shift financial support away from generic support and toward areas of specific need, or to address specific structural imbalances. These may include addressing perceived under-

[56] See: http://www.horizon2020.gouv.fr/

[57] Ibid

[58] Kolar, Hunter, Boekholt, and Teichler, "Mutual Learning Exercise: Alignment and Interoperability of National Research Programmes. National Coordination", 2015

[59] Ibid

[60] See: http://www.horizon2020.ie/minister-damien-english-wants-researchers-to-think-big/

performance in Horizon 2020 pillars or sub-programmes, or to increasing the participation of a certain sub-set of organisations.

A rather striking example of this among the Member States examined, Austria ceased provision of direct financial support for Horizon 2020, instead realigning its budgets toward addressing organisations or groups in real need via, for example, advisory support and training. The 2010 evaluation of the Austrian support system suggested that rather than subsidise activities that actors would undertake anyway (or that actors are able to do by themselves), state support should rather aim to create added value and induce learning among applicants.[61]

In France, the programme 'Setting up European or International Scientific Networks' (*Montage de réseaux scientifiques européens ou internationaux, MRSEI*) has been established for Horizon 2020 as part of a suite of measures to address declining participation observed in prior FPs. The programme aims to facilitate access to European research funding through the formation and coordination of transnational networks. Up to €30 thousand is available over 18 months across all disciplines for research networks that specifically intend to prepare and submit a collaborative project in response to a large-scale European or international call for proposals with major technological and scientific impact.[62]

Germany's national funding to produce proposals under Horizon 2020 specifically supports collaborative applications to Horizon 2020 with partners from three strategically-important areas: i) Central and South-Eastern Europe, ii) North and South America, and iii) the Asia-Pacific Research Area. Funding ranges between €60 thousand for 12 months, to €150 thousand for 36 months. The funding variously supports proposals to the three pillars of Societal Challenges, Excellent Science and Industrial Leadership, and is calculated on the type of beneficiary (where commercial entities may be funded for up to 50% of their eligible costs). Germany also offers a grant of up to €25 thousand over nine months to support the fachhochschulen, which have been identified as an area for improvement in terms of FP participation.

Ireland's performance in successive FPs suggests significant development in its capacity and capability to engage with the FPs, and its financial support measures have consequently developed: current national financial support is aimed at coordinators, and at researchers applying to the ERC – including researchers in disciplines that are traditionally less-exposed to the FPs. Grants of up to €12.5 thousand are available to those applying to coordinate a Horizon 2020 project, covering all costs except consultancy, while the remainder of funding in this category is aimed at applicants to the ERC. Funding to ERC applicants includes funding of up to €500 thousand for those who submitted a proposal that was deemed fundable but did not receive funding due to a lack of available programme budget. Two grant schemes are aimed at supporting researchers from the Arts, Humanities and Social Sciences (AHSS) to access the ERC, including a grant of up to €220 thousand to develop interdisciplinary projects with research from the Science, Technology, Engineering and Maths (STEM) subjects.

The Polish Ministry of Science and Higher Education (MNiSW) launched a scheme for Horizon 2020 called 'Grants for grants' ('Granty na granty'). The scheme is part of a suite of supports to address low levels of internationalisation,[63] and provides approximately €7.5

[61] Arnold, Boekholt, Good, Radauer, Stroyan, Tiefenthaler, and Vermeulen, "Evaluation of Austrian Support Structures for FP 7 & Eureka and Impact Analysis of EU Research Initiatives on the Austrian Research & Innovation System", 2010

[62] See: https://uk.ambafrance.org/ANR-Montage-de-reseaux-scientifiques-europeens-ou-internationaux-MRSEI

[63] European Commission Joint Research Centre, "Research & Innovation Observatory Country Report – Poland", 2016. Available at: https://rio.jrc.ec.europa.eu/en/country-analysis/Poland/country-report

thousand for research institutions intending to take a coordinator role in a project consortium.[64] The scheme offers differentiated funding amounts based on beneficiary (research organisations or SMEs, for example).[65] The grants support the preparation of an application (including consultancy) in the writing and reviewing of the application or the organisation of project consortium. The grant process is flexible, and may be requested ex ante (before preparing and submitting the funding application) or ex post (after the funding application has been submitted and evaluated). In the latter case, costs for preparing the application can be reimbursed, however, only if the application has reached a certain scoring threshold in the evaluation process. Prior consultation suggests that uptake has been rather high,[66] and the scheme appears to replace an SME-specific grant in place for FP7, which received little uptake.[67] Poland also launched an incentive scheme to encourage applications from employees of research institutes ('Benefits on the Horizon'). A 'bonus' equivalent to approximately 10% of the EU funding secured, is available to individual staff members if the organisation is successful and takes a coordination role in the project.

Across Member States, there are few schemes that are dedicated solely to industry or SME participation, though these do exist in a small number of cases, such as in the UK Devolved Administrations. The Scottish Funding Council (SFC) launched a new 'Horizon 2020 SME Engagement Scheme'[68] to encourage greater SME participation. SMEs apply for a voucher of between €1,200 - €6,000 to access Scottish higher education expertise and advice for assistance in the Horizon 2020 application process. A similar scheme was launched by Invest Northern Ireland, though uptake was found to be rather low.[69] Invest Northern Ireland also offer Project Definition Funding, a grant of up to €15 thousand for proposal preparation, covering the full range of costs (from travel to legal advice and consultancy) that is available to researchers and businesses that meet Invest Northern Ireland's broader funding eligibility criteria.[70] The Welsh government offers the ScoRE Cymru (Supporting Collaborative Research and Innovation in Europe) scheme, which provides funding to stimulate Wales-based organisations to participate in European collaborative research such as Horizon 2020. ScoRE Cymru can provide up to approximately €13.5 thousand for the bid writing costs of applications, and approximately €1 thousand for travel and meetings.[71] [72] While not strictly a dedicated SME-facing scheme, as of late 2014, 72% of funding awarded through the scheme had been awarded to SMEs.

Co-funding for FP participants

There are several examples of co-funding for FP participants, each of which aim to mitigate the impact of funding shortfalls and support the successful implementation of projects. For example, the Academy of Finland provides match-funding for non-commercial research organisations with projects under the Horizon 2020 Societal Challenges priority, in order to address funding shortfalls and encourage participation in European projects. Similarly, Science Foundation Ireland provides an additional overhead payment to the Irish host institution of ERC award winners, to assist the successful implementation of ERC-funded

[64] See: http://www.granty-na-badania.com/2016/06/granty-na-granty-2016.html

[65] [65] Gulda, Walendowski, Markianidou, Otte, "Peer review of the Polish research and innovation system - Background report", 2017. Available at: https://rio.jrc.ec.europa.eu/sites/default/files/report/Peer%20review%20of%20the%20Polish%20research%20and%20innovation%20system%20-%20Background%20report.pdf

[66] Simmonds, Brown, Wain, Rosemberg Montes, Izsak, Roman, "Review of the support mechanisms provided by the Northern Ireland Executive to support delivery of the Executive's target of participants winning €145m from Horizon 2020", 2016

[67] Gulda, Walendowski, Markianidou, Otte, Op. Cit.

[68] See: http://www.gov.scot/Topics/Business-Industry/support/Horizon2020

[69] Simmonds, Brown, Wain, Rosemberg Montes, Izsak, Roman, Op. Cit.

[70] See: http://h2020ni.com/financial-support/

[71] See: http://gov.wales/funding/eu-funds/horizon2020/?lang=en

[72] See: https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/support-measure/score-cymru

research. Science Foundation Ireland also offers additional funding to support Irish host institutions that have recruited an ERC awardee from abroad.

Finnish Position

Generally Finnish support measures are middle of the pack. The present system of support comprises mainly advisory through National Contact points and two funding instruments. First is Tekes funding for preparation of nationally significant projects, defined as projects where a Finnish applicant has a significant role as a work package leader or coordinator of the project. The funding is granted by application for proposals that have passed the threshold scores in evaluation. Another instrument is overhead cost subsidy granted by Academy of Finland under Strategic Research Council, that is specifically targeted for Pillar III projects. Additionally, it is permitted to use Tekes and Academy funded project time to prepare EU applications that are related to the project topic.

Historically there have been different instruments specifically for funding application preparation both open national funding and internal funding in different research organisations. There are no public evaluations available of those. According to Tekes estimates, the volume has been between €1-2 million per year with the average contribution being approximately €50 thousand, which means 20-40 projects or applications have benefitted from the pre-award grant yearly. In general, both of the main funding organisations have concluded that effectiveness of pre-award funding, i.e. proposal stage funding is not high in terms of improving success rates. This same conclusion has been drawn in other national institutions as well. It may however have an effect on the number of proposals, but other data suggest that the quality rather than number of proposals is the limiting factor in Finland.

The Finnish NCP activities are distributed within Tekes and Academy of Finland, and the coordination point and official FP information office is Tekes EU Research and Innovation Programmes (EUTI) office. As for stakeholder views on advisory services, the NCP activities are viewed very favourably in terms of quality. The perceived bottle neck is the limited resources of NCPs, who have generally only a part of their time committed specifically for NCP activities while a larger part is committed to other tasks in the host organisations.

As for private advisory services, there is a small cadre of EU consultants that operate in Finland, but hard numbers of the volume of activities do not exist in the public sphere. The stakeholder views on private are ambiguous; on the one hand the services are rated well for the most part, but on the other the use of such services is viewed as a necessary evil and there is wide spread principled opposition for using public subsidies on private contractors for application preparation both in the public and private spheres.

Contrasting with the case countries, the difference between the other countries and Finland is not so much quantity of instruments as how they are implemented. Two of the features in common between the well-performing countries are clear goals and strategy for EU participation with monitoring and extensive proactive NCP services.

Overview of FP support measures

	Finland	Sweden	Denmark	Norway	Spain	Netherlands	Ireland
Non-financial advisory services	Yes, similar services in all countries (mainly through NCPs and EEN)						
Funding to influence calls	No	Yes	No	Yes	No	No	Yes
Funding to find calls and partners	No	Yes, travel grants	No	Yes, travel grants	Yes, network building instruments	No	Yes, travel grants
Funding to produce proposals	Yes, for large projects with at least two Finnish participants	Yes, in selected sub-programmes	Yes	Yes, very elaborate and generous. Second-chance funding for well-rated, rejected ERC and SME Instrument phase 1 proposals	Yes, indirect capacity building and networking instruments	No	Yes, for coordinators and ERC proposers. Second-chance funding for well-rated, rejected ERC proposals
National co-funding	Yes, for projects in Societal Challenges	No	No	Yes, mainly for research institutes, but also for other actors in selected sub-programmes	No	Yes, in selected sub-programmes, as well as for R&D providers	Yes, for ERC hosts, and for those recruiting ERC winners from overseas

Source: Case studies, interviews

4. CONCLUSION AND RECOMMENDATIONS

4.1 Conclusions

Determined investment into research and innovation are at the core of EU policies for sustainable growth and competitiveness, and the EU framework programmes for research and innovation are the main delivery mechanisms of those policies. The FP is seen as a tool for the renewal of industry and society, and a booster for economic growth at the European level, which is well aligned with Finnish RDI policy.

Over time, every new FP has brought an increase in the volume of available EU funding and variety of instruments for research and innovation. The latest FP, the Horizon 2020, has taken particularly large steps in this direction. The budget has been increased to nearly €80 billion, and its objectives are more directly linked to EU's societal and industrial challenges. It also made a significant attempt to better address the needs of SMEs (through the SME instrument) and academic research of the highest standard (through ERC).

With its considerably larger budget and new instruments, Horizon 2020 has become increasingly attractive to all kinds of research organisations. When at the same time most European countries have faced a series of cuts in national RDI budgets, the popularity of Horizon 2020 has further increased as an alternative funding source. This has in turn resulted in higher application volumes for Horizon 2020, and consequently lower average success rates than in previous FPs.

Finnish organisations have been active in applying for funding from Horizon 2020. By the end of May 2017, there have been nearly 7,000 proposals with Finnish participants, equal to 5.4% of all proposals submitted to the programme during this period.

Unfortunately, Finnish success rate remains at an average, or even slightly below the average level, when compared to similar types of economies (SE, DK, AT, NO, IE, NL). However, due to relatively large number of applications, Finland's total funding drawdown (€579 million) is still larger than its calculated share of payments towards the FP.

The analysis shows that the FPs have brought a clear added value for Finnish participants, and the participants are generally very satisfied with their experience and results of participation. The projects have contributed towards new knowledge, skills, international networks, and technology development.

The direct economic impact of FP projects to participant companies appears positive, although the margin of error in the analysis is large. FP funding in isolation has a similar economic impact than national RDI funding. According to the survey, for most participants the economic benefits from the projects surpass the invested sums.

The specific conclusions regarding national impact and added value of Horizon 2020 by each specific question posed for the evaluation are as follows:

Q1. What kinds of benefits have been obtained to date particularly from the Horizon 2020 programme?

Participants in the FP have been generally very satisfied with their participation and in most cases the benefit from the participation has exceeded the investment.

The most pronounced benefit from the EU FPs have been:

- generation of new knowledge and capabilities, followed by
- international contacts and networks, that in turn enable
- access to new information, capabilities, and markets.

Especially from the industry perspective, collaborative (Research and) Innovation Actions enable working with potential customers and users to develop solutions that are tailored to the target market and also enable learning about preferences and markets.

European programmes also expose national actors to new level of competition scientifically and commercially and raise the bar for participants. Also in doing so, FP projects offer a showroom window to display Finnish capabilities and earn prestige.

Q2. What parts of the programme and forms of activity are best for a small economy like Finland, also in relation to Finnish RDI policy focus areas?

Finnish strength in applying for FP finding is evenness. There is no specific niche where participation would have been orders of magnitude more successful. The strongest successes have been achieved in those (sub-) programmes where there is a clear concentration of national capability, particularly Energy and ICT. Also, the total drawdown from the SME-instrument is substantial, despite the comparatively low acceptance rate of applications. This in fact illustrates the Finnish paradox, almost across the board Finnish application success rate trails behind comparable countries, but due to relatively high volume of activity, drawdown in per researcher or normalised by GDP for example is roughly on par with the comparison.

The analysis of success in national focus areas (Health & Wellbeing, Digitalisation, and Bio-Circular Economy) shows these areas fare no better or worse. These areas were chosen late 2016 and the participation data end in early 2017, so the current results form a baseline view of success.

In broader view, greater benefits have been reaped through national ecosystems, which spread the knowledge generated and acquired in FP projects within the national framework. The ecosystem cases demonstrate how consistent investment in particular technology areas by different types of actors create new research and business opportunities, and also support renewal of incumbent enterprises.

Q3. What kind of social, economic or environmental impacts are perceptible/achievable with the programme or with Finnish projects funded from it?

According to the participants' perceptions, among the chief benefits are increase in knowledge and development of new technologies. These are followed by new products and services. In terms of social impacts, participants have found a noticeable or strong

contribution towards employment and an even stronger contribution towards solving social challenges.

These perceptions are supported by interviews which propose that, broadly speaking, solving societal challenges in built in the programs in terms of specific goals for developing energy saving, environmentally friendlier, and more accessible technologies, services and other solutions. This notion is also consistent with participants finding that the FPs also contribute to finding new strategic directions and goals.

Q4. What has been the financial performance of businesses that received funding from EU framework programmes?

The econometric analysis assessed the impact of EU funding with a five-year window after funding, with the matching year being the one before. The examined dependent variables were turnover, employment, productivity, investments and exports. The results of analysis were positive, but due to limited sample size not statistically significant. To put the effect into scale, the net economic impact of FP funding in isolation from other instruments is similar to national RDI funding. There is however some uncertainty in making strong conclusion on this point due to limitations in the data.

More significant effect was found for compounded funding, i.e. for those enterprises that have been granted national and various types of EU funding. This finding may be subject to some selection bias, as in applicants of various programmes have more experience in applying for funding by default and they are also a self-selected group that have chosen to apply for subsidies time and again. However, it also suggests that there is synergy between national and EU funding.

Q5. What kind of innovation effects have arisen from projects of research institutes and universities that received funding from EU framework programmes?

The participants report FP projects have contributed towards new technologies, services and products, and to a lesser degree towards new business ventures and IP. These effects arise in many cases through collaborative effort with enterprises.

However, the ecosystem cases, described in the full report, also illustrate another vector through contribution to and even creation of innovative ecosystems. The VTT case and particularly PrintoCent illustrates a development path of an ecosystem based on (partially) EU-funded research and the case of FiCEIP illustrates how basic research also contributes towards creation of innovative spin-offs or start-ups.

Q6. How should, for example, EU preparatory and co-funding and the role of national funding organisations be further developed?

Stakeholders are generally very satisfied with the content and professionalism of Finnish NCP services. The main bottle neck in the support system are dearth of resources committed to the NCP activities. The stakeholder views towards private professional support services for application and use of EU-funding colloquially known as ‘EU advisors/consultants’ are variable.

In terms of international comparison, the portfolio of Finnish FP participation support measures is average among the investigated countries. Contrasting with the best practice cases, the well-performing countries have a clear strategy towards the FP with specific goals and monitoring systems. The NCPs also act proactively through the life-cycle of the

application to identify potential participants and build consortia, to support preparation of the application, assist in contract negotiation and analyse evaluations to identify potential second round applicants and develop services even further.

As for pre-award funding for proposal preparation, the support is equivocal. Both nationally and in the comparison group, the finding has been that grants for proposal preparation tends to increase number of submitted proposals, but does not correlate as strongly with quality of application and thus the relationship to funded projects is tenuous. Based on the cases, the case is for pre-award grants is best supported if there is a dearth of applications. However, the analysis of participation may suggest, the bottle neck in Finland is not lack of activity in submitted proposals inasmuch acceptance rate. Further, this is contraindicated by the observations that qualitatively the commitment of the applicants and their genuine interest in European collaboration plays a large role in successful applications.

For the last aspect of this question that concerns national funding organisations, the stakeholders uniformly across all respondent groups and levels indicate that a clear national and EU RDI strategy would help coordinate efforts and align RDI efforts and investments towards national and EU profiles. This view is also supported by the best practice cases discussed above, and in the best systems the strategy is coupled with yearly monitoring to enable corrective measures. Going deeper into the stakeholder views, perhaps what is needed is a forum for setting and negotiating directions for RDI strategy and policy, rather than a mere paper that expresses some goals. As of now the stakeholders express worry over lack of direction and ownership or leadership in RDI strategy, which perhaps coincides with the lack of a forum for discussing these matters.

Q7. What kind of conclusions relating to effectiveness are available from comparable countries?

The main benefits of FPs in terms of international contacts and networks, visibility and prestige, development of market knowledge and so on are very robust and consistent between comparable countries and over time.

The findings and conclusions of this evaluation discussed immediately above are consistent both with earlier findings on contribution of EU FPs and also with earlier research literature on impact of RDI subsidies.

As such the turn of Horizon 2020 to a Framework Programme for Research & Innovation from the earlier Research and Technology Demonstration has not for the time being had a strong effect on the goals of the participants or the outcome and impact of FP projects; the main goals and outcomes are still in Finland and have been elsewhere quite heavily focused on pre-commercial development and less direct product and service development or other commercial outputs, SME instrument and specific demonstration projects notwithstanding.

4.2 Recommendations

Recommendation 1: Continue to elaborate a clear national RDI strategy towards the EU and FPs

The stakeholders strongly suggested that a clear national EU RDI strategy be elaborated. It is therefore recommended that further work is done to clarify the national focus areas in relation to present and future FPs, and to enable the stakeholders to position themselves towards the national goals. The strategy work should further clarify the vision, priorities and

targets for FP participation for future FPs, including what are the specific goals for the participation in terms of science, industry and society, and what is the ambition level in terms of drawdown and application success. A well-communicated and participatory strategy process would increase the awareness of, and commitment to national priorities amongst various stakeholders, and hence facilitate for more synchronised and effective implementation. Lastly, it is important that the implementation of the strategy is regularly monitored with participation statistics, etc., to ensure its effectiveness.

Recommendation 2: Analyse the root cause of low application success rate

One of the key findings of the evaluation is that the Finnish application success rate is lower than expected, and therefore further work is needed to address the exact cause before design of new instruments or actions. Systematic analysis of evaluation feedback, applications and consortia is needed to form a complete picture what is the general quality level of applications and distribution of scores, and reasons for low and high scores. For example, whether the framework programme is able to attract internationally most competent researchers and research organisations, what are the compositions of typical consortia with Finnish participants, and what is the technical and substance quality of applications, in order to identify the strengths and weaknesses of the Finnish applications.

There are several suggested and conceivable reasons why Finnish application success is lower than expected. These hypotheses include, among others, the lack of skills in application writing, lack of appropriate partners, and lack of substance/competence. One level deeper, lack of potential partners may be, again, because of lack of international orientation, because Finnish actors may not be viewed as potential partners, lack European added value, and so on. Understanding which of these or other factors are significant in affecting evaluation of Finnish applications is a key for finding the right problem to address and subsequently the right instruments when trying to raise application success rate.

Recommendation 3: Strengthen the support measures for FP participation

The present NCP activity is very well-rated; however, the challenge is its lack of resources to fully commit to the work. In some of the comparison countries NCPs engage in finding potential applicants especially in the national focus areas, consortium building and application development, and track down near misses for another round of submission. Which is something that would likely help address the Finnish challenges.

In broader view, the path from national funding instruments to FP needs to be further examined. Based on the evidence, the largest benefits come from projects that relate to existing national RDI activity and programming. In the past, some of the best results have been achieved when national instruments have acted as accelerators towards the FP. However, again national funding should not pose a disincentive for applying EU funding. There is as much evidence that parallel/concurrent national programmes lower the interest in FPs as there is for the finding that sequential national programmes enable attracting FP funding. Thus, it is recommended to examine the synchronicity between content themes and timing of future national programming and ecosystem policy and the FP to enables growing a mass of potential participants.

Another layer is at the level of individual applicant. There are some suggestions that some actors already try to identify potential future applicants early when actors start using national funding. This should be developed further, so that desk officers in Tekes and Academy routinely assess future European potential of their clients and direct them towards relevant information and experts.

However, the support system should not be an end unto itself. Each type of instrument and action have a specific purpose and impact logic. Thus, it is recommended that the reasons why Finnish applications fail are carefully studied. While at the moment the hypothesis is that the Finnish problem is quality of applications, and the instruments should target consortium building and application writing, this may change in the future and there should be a feedback system to systematically gather information about application volume and acceptance rate and monitor the application quality i.e. evaluation feedback of the application to enable proactive redirection of support activities.

Recommendation 4: Leverage best practices in FP application and participation

Participation activity and application success in the framework programmes do not spread evenly across all organisations. It is the largest research organisations, top universities and knowledge-intensive companies that take the major share of all Finnish participations and also demonstrate higher success rates with proposals. These organisations often have a long record of professional research, high overall volumes of research and a history of international research collaboration. More importantly, they have accumulated vast amounts of experience and practice from participating in EU framework programmes – understanding how to identify relevant themes and topics, which kind of partners to look for, how to organise proposal preparation, how to write successful proposal, and how to manage and coordinate projects successfully, etc.

In the interest of increasing the overall level of participation success, this accumulated competence and practices should be leveraged as much as possible. Our largest public research organisations, such as VTT, already act as a major FP application hub and project coordinator for many other organisations. Thus, it is recommended to build on existing strong ecosystems and encourage formation new ones.

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