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Ex-Post Evaluation of the Seventh Framework Programme

COMMISSION STAFF WORKING DOCUMENT
Accompanying the document

Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions

On the Response to the High Level Expert Group on the Ex-Post Evaluation of the Seventh Framework Programme

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1. INTRODUCTION

According to the legal base of the Seventh Framework Programme for Research, Technological Development and Demonstration Activities (FP7), an independent expert group (hereafter referred to as HLEG) should carry out an external evaluation of the rationale for, and implementation and achievements of, FP7 within two years of the end of the Programme, i.e. by the end of 2015.[1] The Commission shall report on the findings of the HLEG report, its recommendations and the Commission's observations in a Communication.

This Staff Working Document of the Commission Services (SWD) accompanies the Commission Communication.[2] The purpose of the ex-post evaluation of FP7 is to inform the European Parliament, the Council, Committee of the Regions, the Economic and Social Committee and Member States, the research community, the general public and other stakeholders about the achievements of FP7. It will also contribute to improving the implementation of Horizon 2020 and the Euratom Research and Training Programme 2014-2018, and provide input into the design of future Framework Programmes.

The evaluations of the SWD cover FP7 and the combined Euratom Framework Programmes 2007-2011 and 2012-2013. JRC direct actions are part of the EC and Euratom FPs, but are evaluated separately from both programmes, as requested by Council and thus not covered by this SWD. It covers the seven years of implementation of FP7 from 2007 to 2013[3]. It takes into account the objectives of FP7 at the time of its adoption as well as the effects of the changing context, which increased the focus on FP7 as a driver of growth with increased emphasis on industrial participation and innovation.

2. BACKGROUND TO THE INITIATIVE

2.1. Context and baseline scenario

The Treaty on the Functioning of the EU (TFEU) stated that EU action on research and technological development has as objectives: strengthening of the scientific and technological basis with the EU, promoting the free circulation of researchers, knowledge and technologies and encouraging competitiveness[4]. These objectives were replaced by the Lisbon Strategy in 2009 with: strengthening the EU's scientific and technological bases by achieving a European Research Area (ERA) in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry. This emphasises a shift in focus toward jobs and growth.[5]

When FP7 was designed, the EU was facing general challenges such as decelerating economic growth, increasingly fierce international competition supported by rapid advances

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1 Decision No 1982/2006/EC of the European Parliament and of the Council of 18 December 2006 concerning the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007-2013). Similar text also in: Council Decision 2012/93/Euratom of 19 December 2011 concerning the Framework Programme of the European Atomic Energy Community for nuclear research and training activities (2012 to 2013).

2 This is in accordance with the new 'Better Regulation' Guidelines adopted in May 2015, according to which SWDs must be prepared for evaluations.

3 In assessing the EC Commitment also calls implemented later have been included.

4 Art 179 (TFEU).

5 Recital 4 of Decision 1982/2006/EC, O.J. 412/1 of 30.12.2006.

of new technologies such as ICT, significant environmental degradation caused by global warming and climate change, as well as three specific challenges in the area of R&D: a low level of investment in R&D (1.97% of GDP in 2005 – both public and private),[6] a "brain drain" effect leading the best researchers to move abroad, and a weak capacity to transform basic research results into marketable innovations.

A continuation of the Sixth Framework Programme (FP6)[7] as baseline scenario would have led to the persistence of specific and systemic weaknesses in the ERA and the attractiveness of the ERA would have continued to decline. It would also have sent a discouraging message to Member States who were committed to increasing their investment in R&D. Finally, it would have become more difficult to achieve cohesion in the area of research and innovation.[8]

2.2. Objectives and intervention logic

The four overarching objectives of FP7 were: (1) to contribute to the EU becoming the world's leading research area[9]; (2) to support progress towards the target of spending 3% of Europe's GDP on R&D by 2010[10] [11]; (3) to support the creation of the ERA; and (4) to contribute to the development of a knowledge-based economy and society in Europe.

The main focus of FP7 was on science, especially the promotion of collaborative research and excellence.

The ex-ante Impact Assessment of FP7 identified the following eight specific policy objectives for FP7: (1) enhancing the competitiveness of European industry through joint technology initiatives; (2) increasing European-wide S&T collaboration and networking for sharing R&D risks and costs; (3) contributing to an increase in the level of research investment[12]; (4) improving the coordination of European, national and regional research policies; (5) strengthening the scientific excellence of basic research in Europe through increasing coordination and competition at European level; (6) promoting the development of European research careers and making Europe more attractive to the best researchers; (7) providing the knowledge-base needed to support key Community policies; and (8) increasing availability, coordination and access in relation to top-level European scientific and technological infrastructure.

6 Notably as compared with the USA (2.59%).

7 See Ex Ante Impact Assessment of FP7; SEC(2005) 430 for the description of the Baseline scenario.

8 Further details about the background including the detailed intervention logic to FP7 and the baseline scenario can be found in Annex 6.

9 Recital 4 of Decision 1982/2006/EC, O.J. 412/1 of 30.12.2006.

10 Two-thirds of it financed by the private sector.

11 Recital 3 of Decision 1982/2006/EC, O.J. 412/1 of 30.12.2006. Target established by the Barcelona European Council in March 2002.

12 Contribute to the realisation of the 3% Barcelona objective by more than doubling Community investment in R&D.

Figure 1 shows that the intervention logic of FP7 was designed to maximize its impacts.

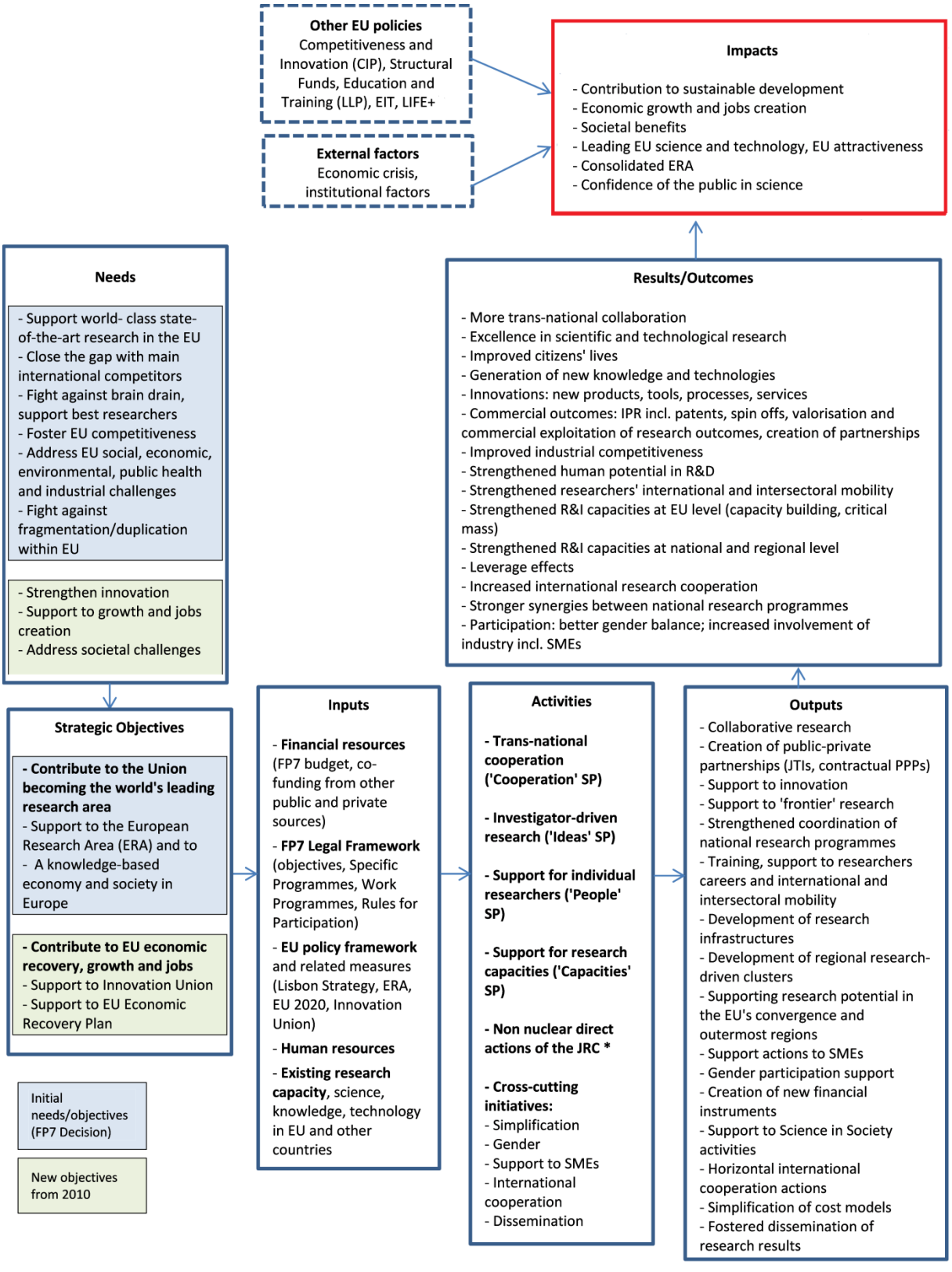

Figure 1: Intervention logic of FP7

3. EVALUATION QUESTIONS

In line with the 'Better Regulation' Guidelines, this SWD addresses the five evaluation questions of effectiveness, efficiency, relevance, coherence and EU added value. The evaluation of effectiveness is organised around the eight specific policy objectives of FP7 used in the ex-ante Impact Assessment of FP7, as outlined in section 2.2.[13]

4. METHODOLOGY

This evaluation has been coordinated by the Evaluation Unit of the Commission's Directorate-General for Research & Innovation[14] with the support of an Inter-Service Group comprising other Commission services[15]. The evaluation is based on a wide range of sources comprising internal assessments by Commission services (based mainly on data from CORDA[16], Eurostat, and other sources such as SciVal, OpenAIRE, Annual Monitoring Reports, ERA and other surveys) as well as external horizontal and thematic evaluation studies[17], including the results of the interim evaluation of FP7 carried out in 2010[18]. It also includes the factual evidence stemming from the HLEG report.[19]

The evaluation presents qualitative and quantitative results using a variety of methods[20]: surveys and interviews with FP participants; social network analysis; patent and bibliometric analysis; and microeconomic and macroeconomic modelling. Finally, the evaluation includes the results of the online stakeholders' consultation.[21]

It deserves emphasis that this evaluation cannot and does not present a complete picture of FP7 results and impacts. The main reason is that this evaluation builds to an important extent on final projects reports and that so far[22] only 12,149 FP7 projects[23] (accounting for about 50% of the total number of FP7 projects) have finished.

In addition, there is the well-known 'time-lag' issue, i.e. the fact that research projects take time to produce societal impacts: it takes years before the new knowledge generated within the scope of a single project or a portfolio of projects is valorised in the form of new products,

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13 More information about how the evaluation questions were identified can be found in Annex 5.

14 The evaluation was carried out from June to September 2015, with additional review in November and December 2015.

15 European Commission Services involved: SEC GEN, DG AGRI, DG CNET, DG EAC, JRC, DG GROW, DG HOME, DG MOVE, DG ENV, DG CLIMA and DG RTD.

16 Corda, the common research data warehouse, is the Framework Programmes' (FP) central repository of data collected and/or derived during the course of FP implementation. See Annex 3.

17 The first evaluation studies feeding into the exercise were launched in 2010 and the last study results will become available in 2017. The list of evaluation studies feeding into this meta-evaluation is presented in Annex 4. It should be noted that all studies were subject to a quality assessment, providing robustness to the overall assessment.

18 Interim Evaluation of the Seventh Framework Programme - Report of the Expert Group, 2010. This did not cover Euratom, which was subject to a separate evaluation: Interim Evaluation of the indirect actions of the FP7 of the European Atomic Energy Community (Euratom) for nuclear research and training activities (2007 to 2011), 2010. Annex 20 provides an overview of the key findings of this interim evaluation and the follow-up given to them.

19 The HLEG identified 10 key achievements of FP7 which can be found in Annex 27.

20 Further details on the methodologies can be found in Annex 3.

21 The results of the consultation which ran from February to May 2015 can be found in Annex 2.

22 As of 1/12-2015

23 CORDA 1/12/2015: 9927 finalised projects with 1,279 ICT projects added from DG Connect and 949 from ERC.

processes, services and economic, social and environmental impacts.[24] FP7 also accounts for a mere 7% of total public budgets and outlays for R&D (GBAORD) in Europe and, apart from FP7, a variety of other factors (economic growth, other policies) influence the uptake of research results[25].

This is a significant point. There are indications that the increased emphasis in the later stages of FP7 on innovation and industry participation in order to respond to the economic-financial crisis is beginning to generate positive micro-economic effects. Participating organisations are reporting innovative product, process and service development, higher Technology Readiness Levels, and increased productivity and competitiveness. However, it is too soon to make a final assessment of the impact of FP7 on EU competitiveness.

It is not easy to compare and benchmark the performance of FP7 with that of other programmes. No comparable (in terms of scale and scope) single research and innovation programme exists anywhere in the world. With the exception of SME participation and gender, no performance indicators or targets were defined at the start of FP7. In addition, and as already mentioned, at the outset, FP7 was considered a programme, with each sub-programme and thematic area developing its approach to evaluation on a bottom-up basis, focussed on direct achievements. This was not fruitful as a basis for measuring impact at the level of the entire Programme.

To overcome these challenges, whenever possible (e.g. in the case of the analysis of participation patterns), FP6 was used as a benchmark. Where FP7 differed from FP6, assessments were based on counterfactual analyses or (partial) comparison with similar programmes elsewhere in the world.

5. IMPLEMENTATION STATE OF PLAY

5.1. FP7 themes and activities

In order to realise the objectives outlined in section 2.2, FP7 supported six types of activities through four Specific Programmes, JRC actions and Euratom actions:

– The **'Cooperation'** Specific Programme supported trans-national cooperation on policy-defined key scientific and technological themes. It included 10 thematic areas[26] and across all these themes, support for trans-national cooperation was implemented through collaborative research; Joint Technology Initiatives (JTIs); coordination of non-Community research programmes; and international cooperation.

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[24] Considering the time needed for the uptake to ensure impacts, most of the impacts of FP7 will happen in the next 15 to 20 years.

[25] EC/Regional Policy (2012), Evaluation of innovation activities. Guidance on methods and practices, Brussels; Thomas E. Vass (2008), The three year time lag between innovation collaboration and new product innovation, The Private Capital Market Working Paper Series No. 2008-02-02; Edwin Mansfield (1991), Academic research and industrial innovation, Research Policy, 20, 1-12; Holger Ernst (2001), Patent applications and subsequent changes of performance: evidence from time-series cross-section analyses on the firm level, Research Policy, 30, 143-157.

[26] The Cooperation thematic areas were: health; food, agriculture and fisheries, and biotechnology; information and communications technologies; nanoscience, nanotechnologies, materials and new production technologies; energy; environment (including climate change); transport (including aeronautics); socio-economic sciences and the humanities; space; and security.

- The **'Ideas'** Specific Programme supported investigator-driven research based on the initiative of the research community, implemented by the European Research Council (ERC), an independent scientific council.
- The **'People'** Specific Programme supported individual researchers' career development, training and mobility through Marie Curie Actions (MCAs) and policy actions.
- The **'Capacities'** Specific Programme supported research capacities through the following programmes: Research Infrastructures including eInfrastructures; Research for the benefit of SMEs; Regions of Knowledge; Research Potential; Science in Society; Coherent Development of Research Policies; and International Cooperation activities.
- The **Joint Research Centre** (JRC) actions provided customer-driven scientific and technical support to the Community policy-making process;[27]
- The **Euratom** programme funded indirect research actions in fusion energy as well as nuclear fission and radiation protection, and JRC direct actions in the field of nuclear waste management, environmental impact, safety and security.

Each of the FP7 Specific Programmes had more detailed objectives[28] and a dedicated Work Programme. The implementation of the Work Programmes involved a more integrated approach compared to previous FPs addressing all aspects, including horizontal priorities such as international cooperation, dissemination, SME activities and cross-cutting issues, with a strong central coordination across themes.

A detailed analysis of which FP7 themes and actions were expected to contribute to the FP7 overarching and specific objectives is included in Annex 26.

5.2. Budget, funding instruments and implementation

It is important to distinguish between the budget for FP7 and the amount committed in open calls, which covers the scope of the FP7 Ex Post Evaluation. FP7 had a voted budget of EUR 55 billion over its seven-year lifespan, almost three times higher than FP6. The FP7 EC contribution committed in open calls amounts to EUR 45 billion. The breakdown per Specific Programme is shown in Table 1. The differences between the budget and the EC contribution committed in open calls is explained by the JRC, ITER, EC administrative cost, and other non-competitive activities, which are not part of the open calls.

[27] See footnote 1.

[28] Annex 24

All Countries, FP7 Signed Grant Agreements: Participation and Contribution by Priority Area (committed funds)			
Specific Programme	**Priority Area**	**Signed grant agreements**	**EU financial contribution to grant agreements (EUR)**
COOPERATION	Health	1008	4.791.666.619
	Food, Agriculture and Fisheries, and Biotechnology	516	1.850.804.919
	Information and Communication Technologies	2328	7.875.038.393
	Nanosciences, Nanotechnologies, Materials and new Production Technologies - NMP	804	3.236.447.326
	Energy	374	1.851.309.964
	Environment (including Climate Change)	494	1.719.305.065
	Transport (including Aeronautics)	701	2.272.243.197
	Socio-economic sciences and Humanities	253	579.553.418
	Space	267	713.287.662
	Security	319	1.331.371.746
	General Activities	26	312.687.984
Subtotal: COOPERATION excluding JTI (59% of total funding)		**7090**	**26.533.716.293**
COOPERATION	JTI-IMI (Innovative Medicines Initiative)	56	930.895.602
	JTI-ARTEMIS (Embedded Computing Systems)	38	142.246.025
	JTI-CLEAN SKY (Aeronautics and Air Transport)	474	198.090.904
	JTI-ENIAC (Nanoelectronics Technologies 2020)	63	468.962.267
	JTI-FCH European Hydrogen and Fuel Cell Technology Platform)	152	443.791.407
Subtotal: COOPERATION JTI (5% of total funding)		**783**	**2.183.986.206**
Total: COOPERATION (63% of total funding)		**7873**	**28.717.702.498**
IDEAS	European Research Council (17% of total funding)	4539	7.710.443.822
PEOPLE	Marie-Curie Actions (11% of total funding)	10705	4.777.221.466
CAPACITIES	Research Infrastructures including eInfrastructures	341	1.528.321.724
	Research for the benefit of SMEs	1029	1.249.585.007
	Regions of Knowledge	84	126.689.334
	Research Potential	206	377.734.056
	Science in Society	183	288.397.372
	Support for the coherent development of research policies	27	28.213.463
	Activities of International Cooperation	157	173.417.040
Total: CAPACITIES (8% of total funding)		**2027**	**3.772.357.995**
EURATOM	Fusion Energy	4	5.248.981
	Nuclear Fission and Radiation Protection	134	352.824.123
Total: EURATOM (1% of total funding)		**138**	**358.073.104**
	Total	**25282**	**45.335.798.885**

Table 1: FP7 EC Contribution allocated in open calls in EUR million
Source: CORDA 26/11/2015.

Commission services implemented the 'Cooperation' and 'Capacities' Programmes whilst Executive Agencies – notably the European Research Council Executive Agency (ERCEA) and the Research Executive Agency (REA) – implemented the 'Ideas' and 'People' Specific Programmes. The implementation of FP7 was monitored on an annual basis.[29] Performance indicators were not included in the legal basis of FP7, but identified within the framework of the Strategic Planning and Programming Cycle (Management Plan).[30] FP7 used different funding instruments including support actions implemented on the basis of calls for proposals and contributions to the joint implementation of national research programmes, such as the Joint Programming Initiative and ERA-NETs.

The Joint Technology Initiatives (JTIs) were novel instruments in FP7 and the first experience in setting up public-private partnerships in research at European level. Projects were funded jointly by the Commission and industry; Members States also joined as funding partners in the case of JTIs in the information and communication technologies sector.

In addition to providing direct financial support, FP7 improved access to the European Investment Bank (EIB) debt finance for participants through the 'Risk-Sharing Finance Facility'.

5.3. Impact of the economic crisis on the FP7 implementation

The context in which FP7 was implemented changed significantly during the lifetime of the programme. In 2008, a global economic-financial crisis started that not only affected the priority given by Member States to R&I but also had an impact on the implementation of the FP. In order to help combat the crisis, the Commission launched in 2008 a 'European Economic Recovery Plan' (EERP) and adopted in 2010 the 'Europe 2020' Strategy for smart, sustainable and inclusive growth. As part of the Europe 2020 strategy, the Innovation Union flagship initiative had a significant impact on FP7.

As part of the EERP, three contractual research Public-Private Partnerships (PPPs)[31] were launched in sectors particularly affected by the crisis and implemented directly under the rules of the FP7[32].

Stronger emphasis was also put on the development of ERA, notably to improve researchers career and mobility, align research agendas, develop research infrastructures including eInfrastructures, and support international cooperation. Finally, more attention was paid in the last years of implementation to innovation aspects, and notably to increasing the participation of Small and Medium-sized Enterprises (SMEs). Accordingly, the EC contribution to SMEs increased from 10% in 2007 to 17% in 2012.

Important developments also influenced the implementation of the Euratom programme, e.g. the signature of the ITER international agreement in November 2006 and the nuclear accident following the great east-Japan earthquake and tsunami (Fukushima accident) in March 2011.

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29 This was requested by the Decision n° 1982/2006, Articles 7(1) and Council Decision 2006/970/Euratom, Art 6(1).

30 The list of indicators is presented in Annex 7.

31 PPPs had similar objectives to the JTIs. Research agendas were identified in cooperation with private partners and managed by the Commission. In the case of JTIs, calls, projects and dissemination of results were managed by the JTIs.

32 Factories of the Future, Energy Efficient Buildings and Green Cars.

To facilitate the award and management of grants, the Commission implemented various measures to reduce the administrative burden for applicants and participants.[33]

5.4. Situation for different stakeholders

During the seven years of FP7, 489 calls were concluded that gave rise to nearly 136,000 proposals involving more than 601,000 applications. More than 25,000 proposals (19% of evaluated proposals) were funded, involving more than 130,000 participations from about 29,000 participants (22% of the participants in evaluated proposals). The participations came from 170 countries, of which 86% were from EU Member States, 8% from Associated Countries and 6% from Third Countries.

All types of stakeholders benefited from **FP7 financial contributions**, as illustrated in Table 2. The HLEG report states that FP7 was an open system that allowed more than 21,000 organisations that had not participated in previous FPs to receive EU funding, which means that about 72% of the participants were new to the programme. At the same time, it notes that concentration effects in the RTD centres of Europe occurred, as is illustrated by the fact that the top 500 organisations in FP7 obtained 60% of the total FP7 financial contribution. **FP7 participation** involved a number of different actors. Universities and research organisations together accounted for more than 60% of participations, and 30% of participations were from the private sector[34], of which more than half were small and medium-sized enterprises (SMEs).

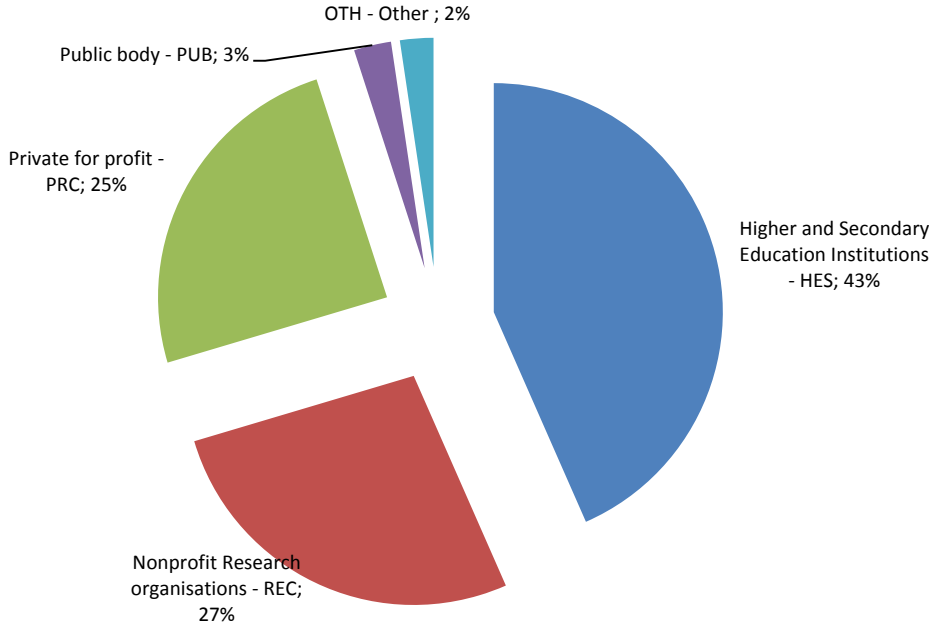
Organisation	Committed EC Contribution in FP7 EUR billion	Number of Participations
Higher and Secondary Education Institutions - HES	19,678	50,239
Non-profit Research organisations - REC	12,235	33,256
Private for profit – PRC	11,162	40,834
Public body - PUB	1,193	6,193
OTH - Other	1,067	4,215
Total	**45,335**	**134,737**

Table 2: Distribution of committed EC Contribution
Source: CORDA 25/11/2015

The highest proportion of funding was allocated to Higher and Secondary Education (HES) institutions and research organisations (REC). The private institutions received a 25% of the funding. The overall funding to SME's in FP7 was EUR 6.4 billion, where EUR 4.8 billion came from the Cooperation programme. Graph 1 illustrates the distribution of EC Contribution by type of organisation. The FP7 financial contribution going to SMEs reached 17% of the total 'Cooperation' Specific Programme (accounting for about EUR 4,898 million), which is above the 15% target adopted by the Commission. The HLEG reports that from FP6 to FP7 the Higher Education Institutions increased 75% in total EC contribution; Research Organisations increased 42% and Private Companies increased 61%. Lastly Public Organisations increased 91%, but from a very low level.

[33] COM(2010) 187, 29.04.2010.

[34] The highest business sector participation in absolute numbers was recorded in the ICT thematic area, where the business sector takes just over one-third of participations and budget.



Graph 1: Distribution of EC Contribution by type of organisation
Source: CORDA 25/11/2015

According to a study on University participation in the Framework Programmes (FPs)[35] the three most important motives for participating for the top 25 European universities were:

i. the positive effects on the quality and quantity of scientific outputs;
ii. the enhancement of institutional reputation and international competitiveness[36]; and
iii. the positive effects on collaboration opportunities.

This result differs significantly from that for other universities in the same study, which highlighted the importance of satisfying funding needs among motives, and ranked the effects on scientific outputs only third. According to a study on Research-performing Organisations (RPOs) in the FPs,[37] the most important objectives of participation relate to economic benefits, networking and reputation. The strategic alignment of both RPOs and national research agendas with the key objectives of FPs is a very important enhancer of RPOs success in participation.

35 An analysis of the role and engagement of universities with regard to participation in the Framework Programmes, to be published in 2016.

36 83% of universities believe that participation in EU programmes had a positive effect on the capacity of the organisations to provide services for the commercialisation of knowledge. This is because the FP7, and in particular the Cooperation and Capacities programmes in particular, facilitated, as it is implicit in their mission, interaction and collaboration with firms.

37 The role and participation of research organisations in the Framework Programmes, Ernst & Young Special Business Services, 2015 forthcoming.

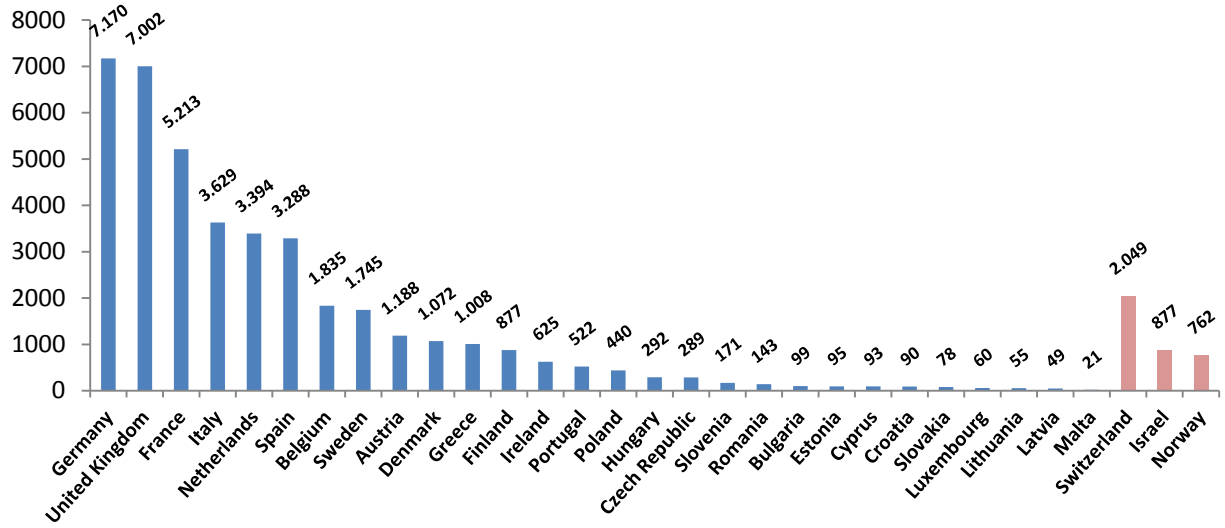
The reactions to the online stakeholder consultation describe the situation from the perspective of different groups of stakeholders[38]. Overall, 68% of respondents[39] were satisfied or very satisfied with FP7, whereas 17% were moderately or very dissatisfied (15% didn't know). Ministries and funding agencies were most often *very satisfied*, whereas individual respondents tended to respond "*Moderately or very dissatisfied*" more often than other groups of respondents.

5.4.1. Country Participation in FP7

On average, each Member State received 3.2% of the FP7 financial contribution. The HLEG reports that:

- 85% of FP7 funding was allocated to organisations located in the EU-15
- 4% to organisations in the EU-13
- 9% to organisations in Associated Countries
- 2% to organisations in other countries outside Europe.

Graph 2 shows the total amount of EC Contribution to Member States and top 3 Associated Countries. The table underlines the findings of the HLEG report, and also shows that the three associated countries are receiving substantial parts of the FP7 funding compared to many Member States.



Graph 2: FP7 EC Contribution, million EUR, Member States and top 3 Associated Countries
Source: CORDA 25/11/2015

The HLEG calculated that the average annual EC contribution per researcher across recipient country in EU-15 was about EUR 3,900 and about EUR 1,300 for the EU-13 specifically.[40] Based on a comparison of the FP7 funding received with the number of inhabitants, the HLEG concluded that the annual FP7 financial contribution per inhabitant is on average EUR 14 across EU-15 countries and less than a quarter of that for EU-13 countries. However, when comparing the FP7 funding received with total annual national RTD expenditures, the HLEG

38 See Annex 2

39 The respondents could identify themselves as: Higher education institutions, public research organisations, individuals, private sector, ministries and agencies, or SMEs.

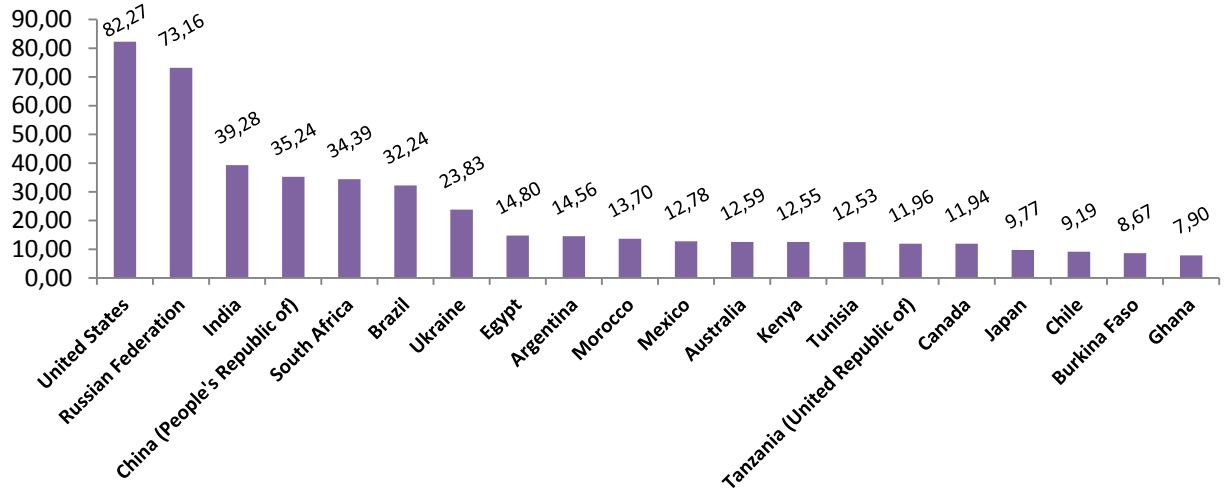
40 For EC Contribution per country across the sub-programmes please see the HLEG report, p. 32.

found that the FP7 financial contribution per million EUR of national RTD expenditures is 30% higher in the EU-13 than in the EU-15. Overall, the HLEG concludes that the low shares of the EU-13 in FP7 is not caused by a bias against the new Member States but rather by a comparably high number of weak proposals submitted by, or with partners from, the EU-13 countries.

Given that the goal of FP7 funding was to achieve scientific excellence, it did not have a geographic objective. At the same time, two actions under the Capacities Specific Programme were aimed at facilitating cohesion: the 'Regions of Knowledge' Programme (RoK) and the 'Regional Potential' Programme (REGPOT).

5.4.2. Participation of third countries

FP7 was open to **international cooperation.** On average, 6 countries (Member State, Associated Countries and Third Countries) participated in each FP7 project. Graph 3 illustrates the 20 countries that received the highest EC Contribution in FP7.



Graph 3: EC Contribution EUR million, top 20 third countries
Source: CORDA 25/11/2015

The FP7 contribution to non-European partners was relatively moderate overall (1.4% of the FP7 financial contribution). It was higher in collaborative projects (4.7% of the FP7 financial contribution), notably in the fields of health, food, climate actions, earth observation and security issues. 20.5% of collaborative projects had at least one partner from third countries. The success rate of proposals that had two or more research partners from third countries was about 25% higher than that of proposals without such partners.[41] Third countries also participated in ERA-NETs: by the end of FP7, thirty non-ERA countries contributed to research funding in 22 ERA-NETs.

Nearly a quarter of the Marie Curie Actions projects have at least one non-European organisation involved. The FP7 Marie Curie Actions supported some 50,000 mobile researchers representing over 140 different nationalities and carrying out their research projects in more than 80 countries worldwide.

41 CORDA: 03/12/2015

The FP7 – Capacities programme on international cooperation (INCO) launched 31 coordinated research calls leading to 90 coordinated or parallel projects with targeted third countries. The FP7 - Capacities - INCO activities supported policy dialogues with third countries and regions and capacity-building, and aimed at raising awareness of FP7 and dissemination. INCO-NET and INCO-LAB projects capitalised on existing collaboration initiatives with third countries and gave them a European dimension, paving the way for continued future collaboration and science diplomacy.

5.4.3. Gender Balance

For FP7, a target of 40% of the under-represented sex was set for evaluators, advisory bodies and other groups. The main gender balance numbers are:

- Overall proportion of women evaluators was slightly higher than the target (40.4%).
- The proportion in the European Research Area Board (ERAB) reached 45.5%.
- The proportion of women in Advisory Groups was 33% overall, while four Advisory Groups reached percentages from 40% to 43%, three from 37 to 39%, and three less than 30% (Space, NMP and ICT).
- The participation of women in Programme Committees increased from 2009 and almost reached the target (38%). [42]

Data[43] on finalised projects shows the amount of women participants in FP7 projects:

- Total Workforce: 38%
- PhD Students: 44%
- Scientific Managers: 30%
- Work Package Leaders: 29%

The HLEG report furthermore found that, the share of women project coordinators in FP7 was 19.2%, showing that while progress has been made, 'glass ceiling effects' persist meaning that the more senior the researcher, the less likely it is a woman. The HLEG reports that the importance of family support measures in the FP7 – MCA programme is demonstrated by the fact that 42% of individual fellows, and 44% of industry-academia partnerships and pathways apply for them.

5.5. Results from finished FP7 projects

This section assesses the results from finished FP7 projects on publications, open access, commercial exploitation and IPRs such as patent applications.

Most publications are produced after the project has ended. In FP7 the Commission only registered publication until the end of the project leaving out many publications. ERC and a number of other programmes used other ways of monitoring FP7 publications. For this reason the best tool for identifying number of publications related to FP7 is using the data mining

[42] Success rates of male and women candidates to Marie Curie individual fellowships are statistically very similar, i.e. there is no discrimination for women applicants. In addition, family friendly measures are set at contractual level and adopted in all Marie Curie projects. In particular, the family situation of the researcher is taken into account for fixing the amount of mobility allowance to which all Marie Curie researchers are entitled. A dedicated panel (Career Restart Panel – CAR) was introduced under the Marie Curie Intra-European Fellowships (IEF) in the 2010 People Work Programme with the aim to better ensure equal opportunities and encourage the return into the career after a break.

[43] CORDA (SESAM, RESPIR) 03/12/2015

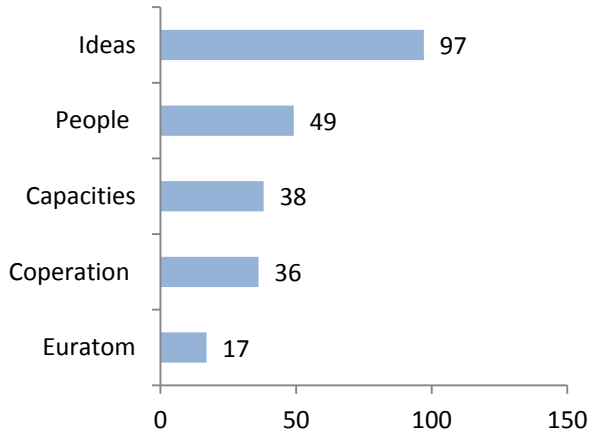
tool (openAIRE) that enabled the identification of a total of 171,258 publications that can be attributed to FP7[44]. This averages 6.8 publications per funded project – a number that is expected to increase as more projects are finalised. In the analysis it was found that[45]:

- 'Cooperation' can be attributed 81,993 publications (47.8% of total)
- 'Ideas' Specific Programmes can be attributed 63,417 publications (34.5%)
- 'People' can be attributed 21,867 publications (10,8% of total)
- 'Capacities' can be attributed 11,598 publications (6.6% of total)
- 'Euratom' can be attributed 631 (0.3% of total)

To be able to compare them across the programmes an analysis was done on how many publications can be attributed per 10 million EUR in EC contribution. This shows differences across programmes, with very high numbers of publications in the 'Ideas' Specific Programmes, half of that in 'People', less in 'Capacities' and 'Cooperation' and least in Euratom (Graph 4).

Open access to publications is a powerful tool to improve access to knowledge. Through FP7 support, out of the total of 171,258 FP7 scientific peer-reviewed publications, 92,826 are **open access**[46] (OA), 3,216 are restricted access (i.e. OA but with a more restrictive license), and 315 are still under embargo. This translates into an OA rate of 54% for all scientific peer-reviewed publications created during the lifetime of FP7 so far.

Completed projects have produced more than 7428 **commercial exploitation**[47] such as developing new products and services**,** mainly in four fields: Nanotechnologies Materials Production, Research in and/or for SMEs, Information and Communication Technologies, and Transport. Graph 5 illustrates the distribution and lists the amount of commercial exploitation per programme in FP7.[48]



Graph 4: Number of publications per EUR 10 million of EC contribution in FP7

Source: OpenAire and CORDA 01/12/2015, and survey of project coordinators for ICT

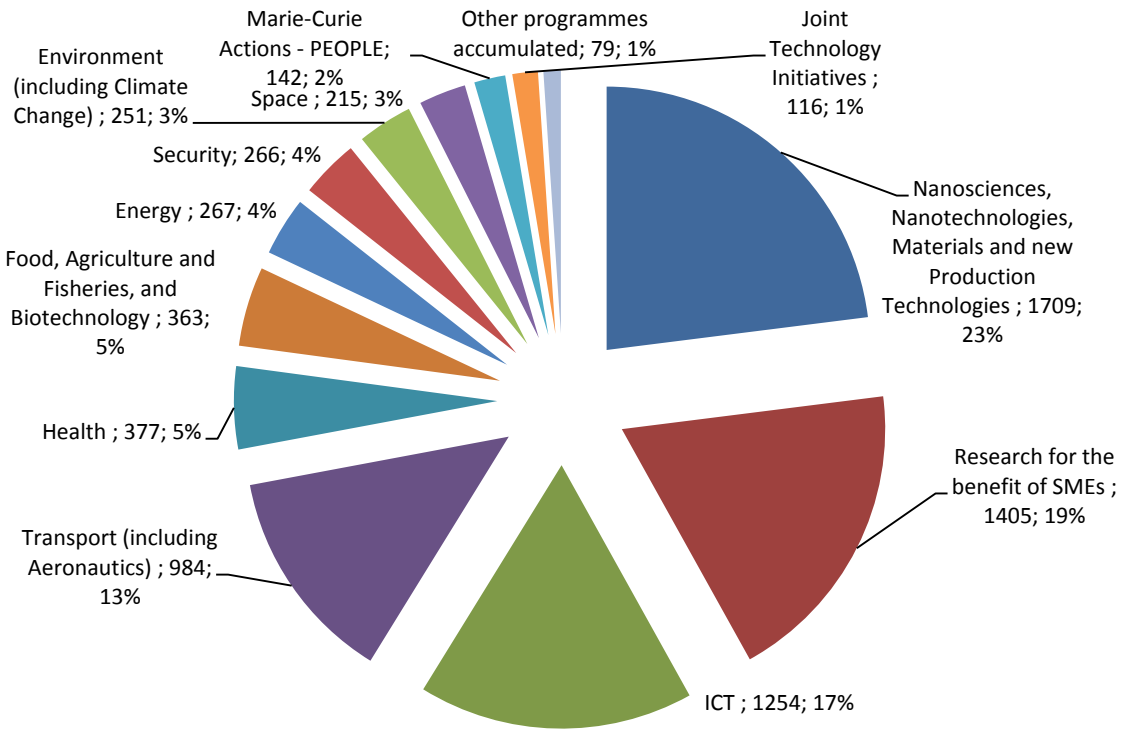
44 OpenAire report, Dec 2015 and see Annex 24.

45 Note that each publication can be attributed to more than one programme, which is why the total of publication per programme is higher, than the total number of publications.

46 Open access (OA) can be defined as online access to the results of publicly funded research at no charge to the end user. The Commission has promoted open access to scientific peer reviewed publications in FP7 in two ways: in selected areas of FP7, through a pilot action based on the "best effort" to make scientific publications open access; and for all areas of FP7, by allowing costs for open access publishing to be eligible for reimbursement. Further information about open access in FP7 is contained in annex 19 as well as in several thematic annexes.

47 CORDA: 01/12/2015

48 Excluding the ERC that does not have these numbers registered for FP7.



Graph 5: Amount and share of commercial exploitations reported by finished projects, by priority
Source*: CORDA-SESAM-RESPIR (information extracted from final reports for ICT)*

The **Technology Readiness Levels** (TRLs) attained by individual projects can be used as proxies for the assessment of their innovation thrust. Survey results show that compared to FP6, projects supported under FP7 have finished at higher TRL levels.[49]

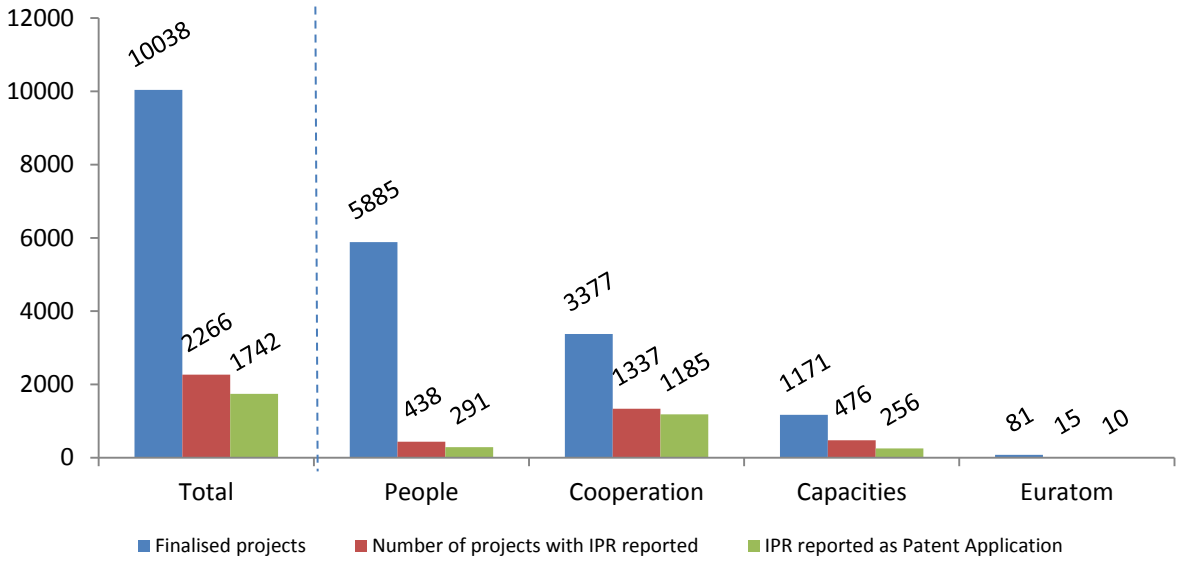
In addition, out of the 10,038 completed projects[50] there are reported 2,266 intellectual property rights (**IPR**)[51] and 1742 **patent applications.** This means that looking at the reports of finished projects in FP7 just under 22% of the projects reports IPR and about 17% of the finished project report patent application. These numbers only reflects those innovative new commercial products or profitable services reported by FP7 beneficiaries during the FP7 project life time. In reality, they are expected to be higher since they could also emerge after the project funding phase. Graph 6 shows the number of finalised projects with reported IPR and IPRs reported as patent applications, in the sub-programmes.[52]

49 See for instance, Annex 10.4 to the SWD.

50 Reported in CORDA: 1-12-2015 with 9901 finalised projects and 137 ICT projects with 295 patents reported from DG Connect. Not including the ERC.

51 The registered IPR can only be used as a proxy since patents are not innovations *per se* but they may lead to new products and services. Whether they lead to innovation can only be identified on a case by case basis.

52 Not including the ERC



Graph 6: Number of finalised projects, number of projects with reported intellectual Property Rights and IPR projects reported as patent applications
Source: CORDA-SESAM-RESPIR (01-12-2015)

Survey results for various thematic areas of the FP7 'Cooperation' Specific Programme:

Energy: On average, projects improved the TRL level of the technology by 2.5 steps. The number of projects that start at higher TRL levels (7 or higher) has increased significantly in FP7. Half of the participants indicated that they expected to reach TRL 9 (application phase) within the next 12 months.[53]

NMP: 35% of survey participants estimated a TRL of 5-6 or 7+ at the end of the project. Compared with large firms, SME-participants are more often active at this TRL level than in basic research.

Transport: Technology-oriented projects accelerated the TRL for 75% of participants. Projects moved from proof of concept (technology validated in lab - TRL 3-4) to the prototype demonstration level (TRL 6). In the second half of FP7, projects started at a higher TRL (6) and reached the demonstration in operational environment or system complete and qualified levels (TRL 7-8). Half of participants expect to reach the application phase (TRL 9) within the following year after project finalisation.

Environment: Projects with innovation results had TRLs between 5 and 7 (around demonstration level). Most innovation budget was spent on medium-high risk ideas, which require a medium- to long-term period to be mature (4.6 years on average).

Surveys suggest that the **commercial exploitation of results** is envisaged by 20-40% of companies involved in completed FP7 projects, possibly increasing the turn-over in companies. There are, however, differences across the thematic areas.

[53] Source: Evaluation of the impact of projects funded under the 6th and 7th EU Framework Programme for RD&D in the area of non-nuclear energy, Technopolis, June 2014.

FP7 – Cooperation - Energy: 73% participants reported a concrete marketable outcome as a result of the project, 20% specified the marketable outcome as a new product or process or service and 7% a new business model as the outcome.

FP7 – Cooperation –Health: 87.5% of R&D SME respondents[54] indicated that their FP7 funding project contributed to advancing their product(s) development pipeline.

FP7 – Cooperation – NMP: About 60% of participants developed a new or significantly improved product, 34% reported new and improved products already introduced in the market. 13% expects that their product will be in the market within two years after project end and 26% within more than two years after the project end[55].

FP7 – Cooperation – Environment: Between 32.4% and 48.6% of FP7 Environment projects are expected to produce innovative outputs [56]

In **FP7 – Cooperation – Transport**, more than 60% of the projects promoted testing activities (validations and verifications) linked to the development of new products or services[57]. The Galileo Sub-theme has had a considerably positive impact on the satellite navigation market, produced a number of new commercial products or services, realised and tested prototypes, and registered patents/trademarks.

FP7 – Cooperation – SSH: Several projects have created spin-off companies[58]. This is the case for IKNOW, which created Futures Diamond, which provides services of Foresight & Horizon Scanning (FHS) processes to users from 112 countries, including the UK Centre for Workforce Intelligence (CfWI) at the Department of Health.

FP7 – Cooperation - ICT: In the area of ICT for ageing well, 25% of projects had secured financing beyond the project for going to the market. In the area of ICT for Health, achievements include successful demonstrator projects with particular practical impact on personalised cardiovascular care[59].

FP7 – Cooperation – Space helped underpinning the innovation capacity and international competitiveness of Europe's space businesses. Around 25% of industrial respondents stated that the programme has had a medium to high impact on their international competitiveness, whereas 15-20% reported improvements in turnover, productivity, profitability and employment. Analysis of results for SMEs reveals stronger figures (+10-20 percentage points) across all performance dimensions from networking to competitiveness.

According to the HLEG, there is indeed evidence of positive impacts in terms of micro-economic effects with participating enterprises reporting innovative product developments, increased turnover, improved productivity and competitiveness but it is too early to make a final assessment of the market impact of FP7 projects.

54 Survey of R&D SMEs which participated in a FP7 Health project.

55 Survey of FP7 NMP participants whose projects are closed. Annex 1, section 4, and section 10 for Evaluation of Thematic Areas in the Cooperation Programme

56 Survey, Annex 9, section 4, and section 10 for Evaluation of Thematic Areas in the Cooperation Programme

57 Survey, Annex 9, section 4, and section 10 for Evaluation of Thematic Areas in the Cooperation Programme

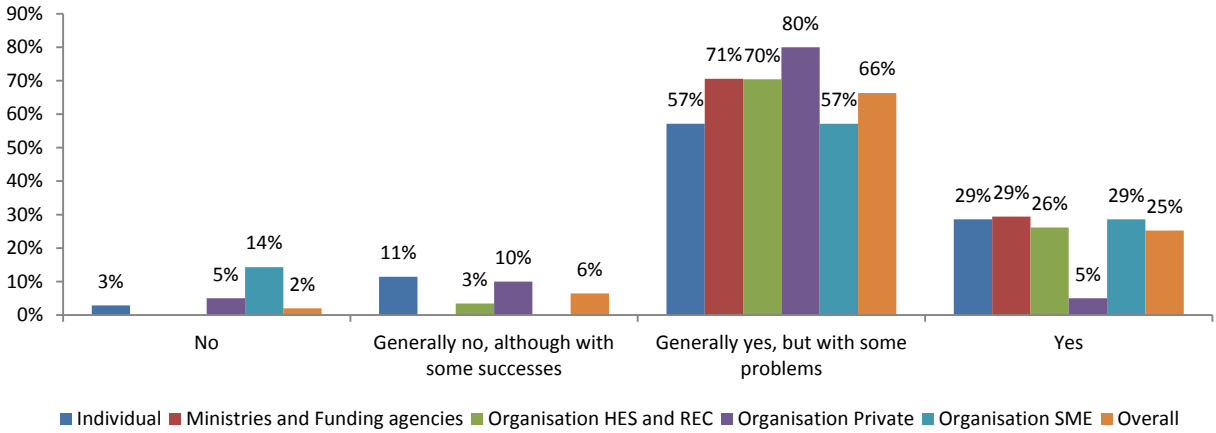
58 Reports on social implications

59 Survey of 50 projects financed.

6. ANSWERS TO THE EVALUATION QUESTIONS

6.1. How effective has FP7 been?

The respondents to the online stakeholder consultation provided a positive assessment of the effectiveness of FP7 (Graph 7), even if a majority indicated that there were still issues to solve.



Graph 7: Share of answers provided to the question "Based on your experience has the implementation of FP7been effective?" in the Stakeholder consultation, by type of respondent.

Source: DG RTD analysis

6.1.1. *Has FP7 been effective in terms of enhancing the competitiveness of European industry through the joint technology initiatives?*

Whether FP7 has been effective in terms of enhancing the competitiveness of European industry depends on whether FP7 enhanced the transfer of knowledge from research to market, and on the propensity of projects to introduce innovations in the form of new products, processes and services. Several **FP7 instruments**, such as the Public-private Partnerships (including both JTIs and contractual PPPs) and the Risk-sharing Finance Facility, significantly increased the presence of SMEs and (other) private partners, which could be an indication of FP7's contribution to EU competitiveness.[60]

Five **JTIs**[61] were set up in the following areas: Innovative Medicines Initiative (IMI JU), Aeronautics and air transport (Clean Sky JU), Embedded computing systems (ARTEMIS JU), Nano-electronics (ENIAC JU) and Fuel cells and hydrogen (FCH JU). These JTIs involved the commitment of massive financial, organisational and human resources and led to a large-scale mobilisation of resources (one-third from the public sector and two-thirds from the private sector). The HLEG concurred that JTIs have been instrumental and effective in terms of bringing together a critical mass of relevant companies, addressing the most important industry needs, and delivering on the high ambitions in terms of both content as well as leveraging additional private funding in a coordinated way.

60 Science Metrix, 2015.

61 The Cooperation Specific Programme identified six Joint Technology Initiatives. The Global Monitoring for Environment and Security (GMES) was implemented not as a JTI but through an agreement with ESA and research grants, on the basis of a decision taken after the launch of the FP.

The **IMI JU** helped establish public-private consortia, opening up routes to commercialisation for SMEs. IMI acted as a "one stop shop" for biomedical research and development. In FP7 a total 56 projects were funded in with EUR 930 million.

The **Clean Sky JU** successfully deployed novel technology and high quality research into running demonstrators (two new engine designs were tested) for the industry to turn into products. In FP7 a total 38 projects were funded in with EUR 142 million.

The **ARTEMIS JU** advanced in technology areas joining industry and academia in embedded computing technologies. In FP7 a total 474 projects were funded in with EUR 198 million.

The **ENIAC JU** played a kick-starting role in nano-electronics innovation in areas like electric cars and energy efficiency. In FP7 a total 63 projects were funded in with EUR 468 million.

The **FCH JU** contributed to placing Europe at the forefront of fuel cell and hydrogen technologies worldwide[62] in the areas of mobility as well as hydrogen production and storage. In the period 2008-2013, FCH projects deployed 150 cars and 45 buses. At least 20 hydrogen refuelling stations will be realized through FCH JU-funded projects. In FP7 a total 152 projects were funded in with EUR 443 million. It increased the number of patents granted in the EU to European companies in the field of fuel cells and hydrogen with 16% annually compared to the average annual growth for all EU industries of 1.5%; the annual turnover increased by 10% per year, R&D expenditures by 8% and market deployment expenditures by 6% since 2007. It is expected that turnover would increase on average by 35% per year and research expenditures by 12% per year towards 2020.

Launched in November 2008, the research Contractual Public-Private Partnerships (cPPPs) were set up as a response to the economic crisis with a view to supporting research, development and innovation in the manufacturing, construction and automobile industries, which had seen demand, plummet. Throughout FP7 three Contractual Public-Private Partnerships were set up to boost industry and SME participation in the FP7:

Factory of the Future (FoF) PPP: FoF is focussing on helping EU manufacturing enterprises, in particular SMEs, to adapt to global competitive pressures by developing the necessary key enabling technologies across a broad range of sectors. About 13% of the projects and of EC contribution are devoted to this PPP. Funding by NMP theme is EUR 400 million out of EUR 600 million EC funding; industry and EC each contribute 50%.

Energy efficient Building (EEB) PPP: The purpose of EEB is to create and integrate technologies and solutions enabling to reduce energy consumption and GHG emissions, to turn the building industry into a knowledge-driven sustainable business, with higher productivity and higher skilled employees. This PPP accounts for about 7% of the projects and for 8% of total EC funding in NMP. Funding by NMP Theme is EUR 250 million out of total of EUR 500 million EC funding; industry and EC each contribute 50%.

Green Car (GC) PPP: Evolved into a lean, fast and efficient instrument for the funding of research, development and innovation in the field of sustainable mobility. It has delivered innovative solutions in the areas of electro-mobility, long distance trucks and logistics, contributing to increased energy efficiency of road transport and lower CO2 emissions and pollution. In total, it has supported 107 research and innovation projects with an EU financial contribution of EUR 420 million in strategic areas such as advance electric energy storage systems, advanced electric propulsion, vehicles grid integration, safety, low emissions, long distance trucks and logistics. [63]

62 Second Interim Evaluation of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) 2013.

63 http://ec.europa.eu/research/press/2013/pdf/ppp/egvi_factsheet.pdf.

The final evaluation of the three research '**contractual Public-Private Partnerships**' (cPPPs) set up under FP7 concluded that:

- They have strong potential to achieve a good overall leverage effect for private investment and have boosted industrial participation (57% in cPPPs);
- They have proved useful in terms of strengthening European value chains and in particular giving a role to SMEs. The cPPPs have all been successful in terms of engaging top industrial companies, SMEs and research organisations within Europe, increasing significantly the large industry and SME participation;
- The research cPPPs provided stability and confidence to industry to invest in participating in projects;
- Research cPPPs have enlarged in the latest calls their coverage of the innovation chain closer to the market[64].

The **Risk-Sharing Finance Facility** (RSFF) was effective in terms of providing loan finance to R&I companies, meeting its loan volume targets, achieving wide geographic coverage and enabling the EIB to increase its capacity to make riskier loans. It achieved a broad sectoral diversification and the instrument was implemented in 25 countries. As of the end of 2013, a total loan volume of EUR 16.2 billion had been approved by the EIB, which had signed loan agreements with 114 R&I promoters for active loans of EUR 11.3 billion.

The participation of **SMEs**[65] increased since the launch of the Programme. Evidence shows that the transfer of knowledge from research to the market and the propensity of projects to introduce innovations in the form of new products, processes or services were both significantly increased when SMEs were involved in projects. Moreover, results of econometric analyses[66] show that SMEs participating in the FPs scored 38% higher than the control group with regard to employment growth and operating revenue for FP7 as well as for FP6[67].

The HLEG concurred that the JTIs, the cPPPs, and the SME-oriented elements of FP7 demonstrate leverage, impact and the development of globally competitive discoveries and outcomes and concluded that "engaging industry and SMEs strategically" was one of the ten key achievements of FP7.

There is some evidence that the different **FP Specific Programmes** promoted innovative product, process and service development, increased turnover, and improved productivity and competitiveness.

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64 Final Assessment of the Research PPPs in the European Economic Recovery Plan: Factories of the Future; Energy-efficient Buildings; European Green Cars Initiative, 2013.

65 FP7 had two main elements in favour of SMEs: a commitment to spend at least 15% of the Cooperation Programme budget with SMEs; and the implementation of SME-specific schemes that aim to strengthen the innovative capacity of low and medium tech SMEs through support for outsourcing R&D (Research for SMEs) and tackling more generic challenges (Research for SME associations). FP7 established a 75% funding rate for SME participants, compared to 50% for large companies.

66 SMEs participating in FP6 grew on average 64% in the period 2003-2011. In the same period, for the control group employment grew 9%. In: Study Performance of SMEs within FP7, Panteia, May 2014.

67 The time after completion of the projects in FP7 is rather short to identify impacts on the business performance of participating SMEs; therefore a similar analysis on participants in FP6 was performed in order to get an indication of possible longer term impacts of participation in the Framework Programme.

By funding frontier research, the FP7 'Ideas' Specific Programme (European Research Council) provided researchers with the freedom to explore ideas at the frontiers of knowledge, a proven way to generate radical breakthroughs.[68] Surveys launched on the different thematic areas of the FP7 'Cooperation' Specific Programme confirm that participants consider that FP7 had a positive impact on competitiveness. For example, in a survey launched in the Security area, around 70% of respondents judged that FP7 security research had a high or medium impact on improving the global competitiveness of the EU's security industry and on supporting its expansion.[69]

The FP7 'People' Specific Programme, and notably the Marie Curie Actions, supported research that could lead to improved products or processes in the future (acknowledged by 61% of beneficiaries), helped beneficiaries to become more aware/confident of the commercial potential of their research (45%), and helped gain new commercial contacts in the project network/partnership (including industry) (41%).

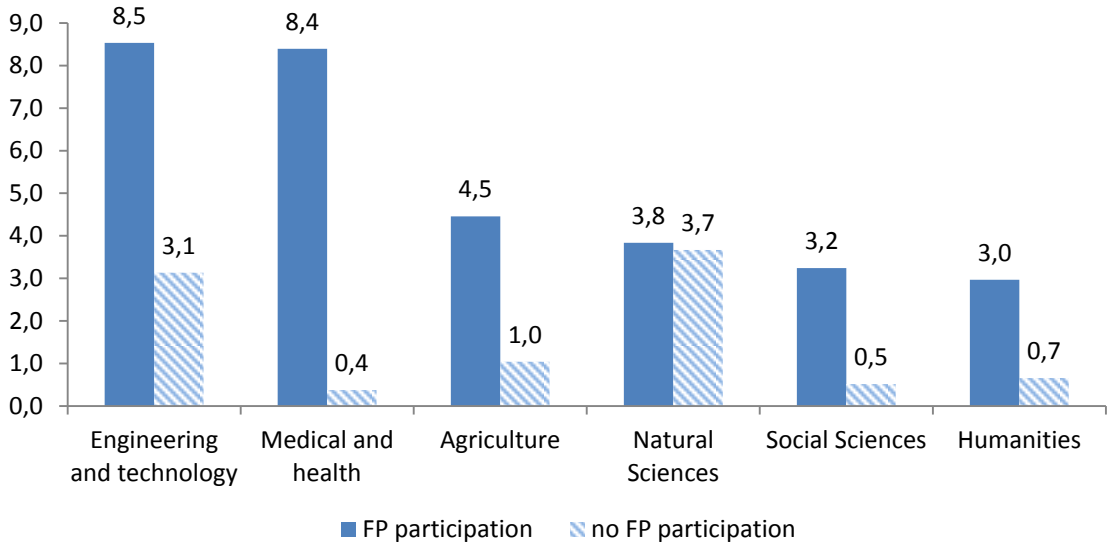
Through the creation of Fusion for Energy (F4E) and an increasing focus on technology, Euratom supported the first steps in the design of a fusion industrial policy in Europe, including the appropriate management of intellectual property assets across the domain and a growing focus on spin-off potential from fusion to other high-tech areas.

Finally, an analysis of the Community Innovation Survey shows that innovative companies supported by FP7 were more likely to introduce product, process or service innovations new to the market. FP7 thus supported innovative enterprises obtaining on average a higher proportion of turnover from innovation than those not supported.[70] Similarly, a counter-factual analysis assessing the 'average number of patent applications per researcher' showed that, on average, researchers in organisations participating in FP7 tend to apply for patents more than researchers in organisations, which do not take part in the EU FP (Graph 8).

[68] Classical distinctions between basic and applied research have lost much of their relevance at a time when many emerging areas of science and technology (e.g. biotechnology, ICT, materials and nanotechnology, and cognitive sciences) often embrace substantial elements of both, and for sure originate from fundamental scientific ideas. Frontier research therefore often generates unexpected or new opportunities for commercial or societal application from the immediate term to the very long term.

[69] Final Evaluation of Security Research under the Seventh Framework Programme for Research, Technological Development and Demonstration (Technopolis, 2015).

[70] Analysis of the Competitiveness and Innovation Survey. See Annex 26 for details.



Graph 8: Average number of patent applications per 1,000 R&D personnel, Comparing FP participating and non-FP participating research performing organisations (2013)
Source: RTD-A5 based on the ERA survey 2013.

6.1.2. *Has FP7 been effective in increasing European wide S&T collaboration and networking for sharing R&D risks and costs?*

Several Member States assessing the impacts of FP7 have highlighted the increased networking and international cooperation as well as the continuation of work activities after project finalisation as some of the most important FP7 outcomes.

A study analysing the networks of FP7 shows that, when analysing the network effect of FPs, both new participants and repeat participants are important. New participants in FP7 projects will generate new knowledge and innovations. Continuity is important because FP7 projects drawing on results from FP6 projects involve a better transfer of research results.[71] As regards new participations, the study shows that out of the organisations that participated in FP7 72% were new. The contractors found that out of the 525,000 FP7 collaborations between pairs of organisations,[72] 86% were new.

FP7 supported international collaboration and networks. On average about 11 organisations, six countries and nine regions participated in each collaborative FP7 project.[73]

FP7 Cooperation - Health had high structuring effect on the development of a single ERA by creating a closely interconnected network of organisations and thereby facilitating knowledge flow in the ERA and beyond[74]

FP7 People – MCA provided attractive opportunities to create new, or join existing, international research networks for 91% of beneficiaries.

71 Science Metrix et al: Study on network analysis of the 7th Framework Programme participation, 2015

72 This is measured in terms of "dyads". A diad reflects pairs of distinct institutions collaborating in a same project. Overall, 458,278 dyads were identified in FP6 whilst there were 525,474 in FP7. Ibidem

73 FP7 overall excluding the People and Ideas Programmes which mobilise single institutions. The results are partial as the study covered projects until December 2014

74 PPMI, Ex-post Evaluation of the HEALTH Theme in FP7: preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015, p. 100

Euratom supported extensive (international) collaboration under the umbrella of bilateral agreements between the European Commission and third countries and through multilateral international agreements such as the ITER Agreement and the Generation-IV International Forum (GIF) Charter and Framework Agreement. It supported the Sustainable Nuclear Energy Technology Platform (SNETP).

FP7 performed well in terms of fostering **interdisciplinary research** linking researchers and projects from fields of science that do not otherwise frequently exchange knowledge. Research generated in each specific field also contributed to knowledge generation in several other fields, as demonstrated by the results of the analysis of FP7-related publications by Specific Programme and/or priority (Figure 2).

The share of researchers participating in projects from different priorities increased throughout FP7, from 5.6% by 2010 to 9.8% in 2011-2014[75].

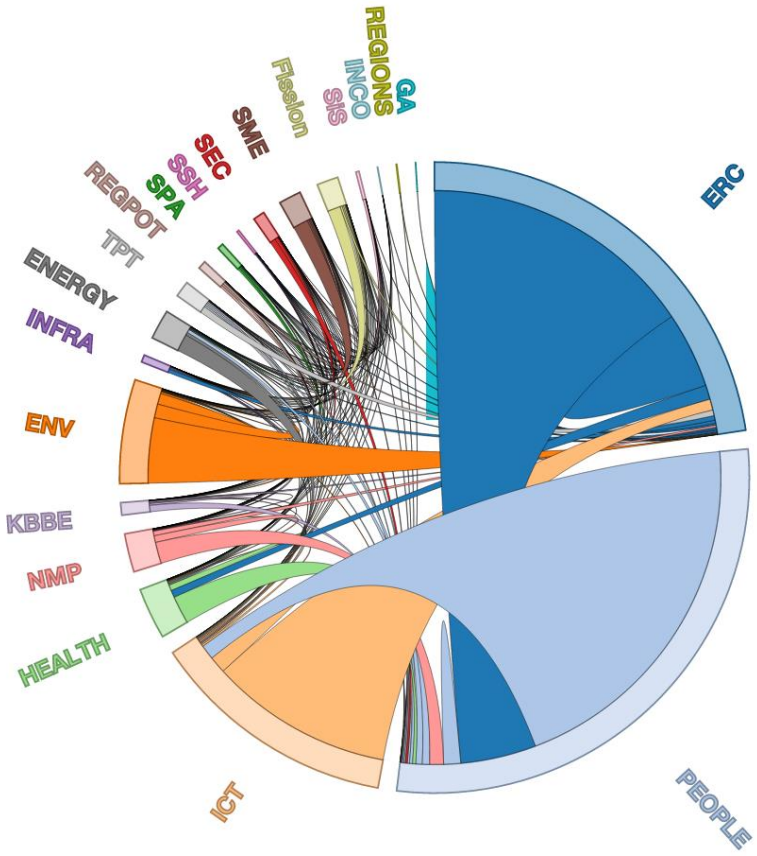


Figure 2: Connectivity across Specific Programmes between disciplines, as reflected by publication contents.[76]

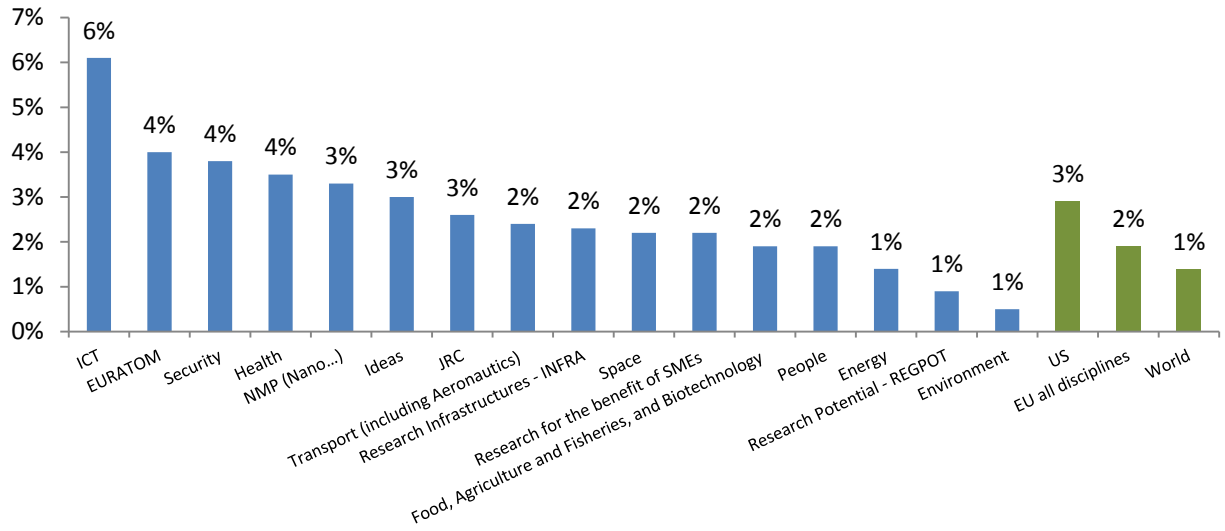
Source: OpenAIRE

75 Science Metrix, 2015.

76 The chord diagram illustrates the bidirectional linking relations (via topics in corresponding papers) among grants funded by the same subdivision or by different subdivisions. The width of each chord is relevant to the existing relations (links) of the grants funded in this subdivision. E.g. if a grant has 7 links to other grants the width will be bigger by 7 monads contributed by this grant. If a grant has 1 link to another grant the width will be bigger by 1 monads contributed by this grant.

The launch of European Industrial Doctorates under the FP7-People Programme promoted **durable inter-sectoral collaboration**. There is as yet no clear evidence on the ideal number of sectors involved in a project. However, too extensive inter-sectoral links could have adverse effects on innovation.

In certain areas of FP7 **collaboration between academia and the private sector** was above EU, US and World averages e.g. with 6% of publications in the ICT area being published in collaboration between academia and industry (Graph 9).



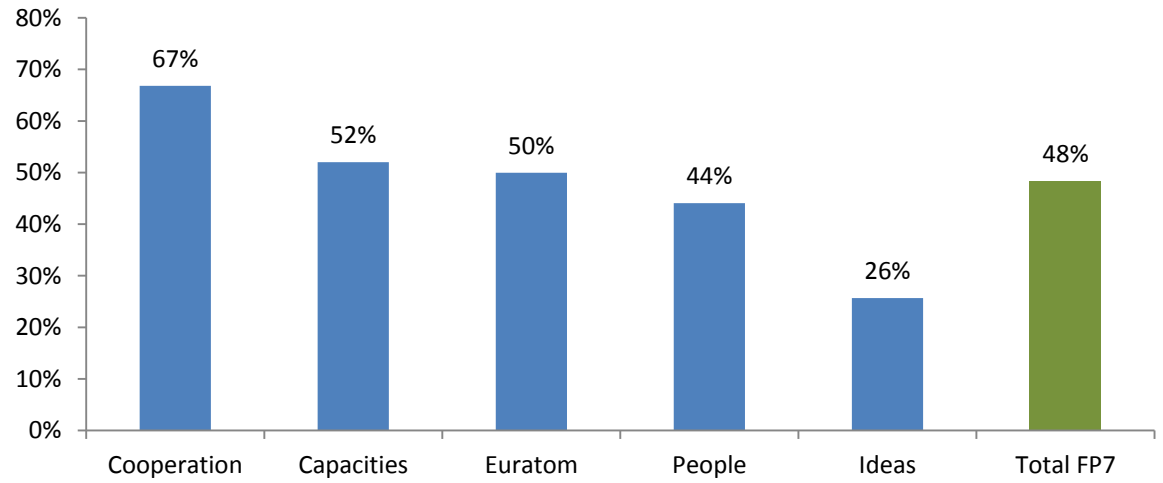
Graph 9: Share (%) of co-publications Academia-Corporate by priority (2007-2015).
Source: SciVal based on Corda-Sesam-Respir

According to a study on the participation of research-performing organisations (RPOs) in the FPs[77] the RPOs maintained a high level of collaboration with universities and private sector. RPOs in a narrow sense tend to support the mobility of staff towards both industry and academia to widen their network in a structural manner. FPs allowed RPOs "to play an important role as a link between the universities and industry" by translating basic research results into relevant industrial applications. According to a study on the participation of universities in the FP,[78] across the full sample of FP7 university projects, more than 60% involve collaboration with at least one private company. These data reflect well the growing involvement of European universities in technology transfer activities and the important impact of FPs in terms of supporting the creation of university-industry links. FP7 also increased linkages and stronger **cooperation between the public and private sectors**. An analysis involving a control group shows that RPOs taking part in FP7 have more collaborative agreements with the private sector (+15%) than such organisations not taking part in FP7.[79] According to a study on FP7 network effects,[80] **direct and measurable effects of FP7's network and collaboration approach** include:

77 RPO study, op cit.
78 Role and participation of universities in the Framework Programmes. ISMERI EUROPA Srl, 2015
79 Source: RTD-F1 based on the ERA survey 2013.
80 Study on Network Analysis of FP7 participation, 2014

- Increased integration of Member States, Candidate Countries and Associated Countries
- Increased cross-sector integration
- Inclusion of new participants in research projects with potentially beneficial effects on innovation
- Increased multi-disciplinarity, especially in the FP7 'Capacities' and 'Cooperation' Programmes
- Development of new methods, technologies, concepts, S&T tools, products, and new lines of research that may eventually lead to new disciplines or fields of research.

The **durability of FP7 networks** is demonstrated by the share of FP7 participants that started publishing jointly due to their participation in an FP7 project and continued doing so after the end of the project. As shown by the following graph almost half of FP7 participants kept publishing jointly after the completion of the project (Graph 10).



Graph 10: Share of pairs of researchers which published jointly in FP7 and continued doing so after the completion of the project.
Source; DG RTD based on OpenAire data.

Surveys among FP7 participants in different thematic areas of the 'Cooperation' Programme confirm that FP7 has been effective in establishing collaboration and networks.

FP7 – Cooperation - Health 60% of participants declare that their research network(s) formally continued to operate after the end of the project.

FP7 – Cooperation – Space: strengthened networking between public and private actors with a view to establishing GMES/Copernicus services for land, marine, atmospheric, climate monitoring and in support of emergency response and security.

FP7 – Cooperation – Security the survey showed that participants had strengthened their international partnerships, improved their ability and capacity to conduct R&D, had improved academic links, and improved international visibility/reputation[81].

FP7 – Cooperation - ICT had strong networking effects, especially in terms of the creation of new partnerships and improved R&D linkages with universities and research centres[82].

81 Final Evaluation of Security Research under the Seventh Framework Programme for Research, Technological Development and Demonstration (Technopolis, 2015)

82 PwC and OpenEvidence, forthcoming

FP7 – Cooperation - Transport: more than one third of projects were successful in creating a formal network during the project; more than 86% of project partners continued cooperating after completion; and 75% of the respondents developed contacts with external organisations[83].

FP7 – Cooperation - SSH: 46% of the projects that reported achieving impact on ERA have collaborated with other FP projects, with an average of 2.9 collaborations per project. 20.8% of the projects collaborated with non-FP projects, with an average of 2.5 collaborations per project.[84].

FP7 – People - MCA strengthened research collaborations (90% of beneficiaries), the development of new project applications and/or projects among MCA partners (87%), new collaborations with academic organisations or business enterprises (86%), increased the exchange of knowledge in the organisations or benefitted research and technical staff through the exchange of knowledge (84%).

6.1.3. Has FP7 been effective in contributing to an increase in the level of research investment?

FP7 mobilised both public and private funding. The HLEG estimated "the leverage effect at 0.74, indicating that for each euro the EC contributed to FP7 funded research, the other organizations involved (such as universities, industries, SME, research organisations) contributed in average 0.74 EUR". On top of this is added a GDP multiplier effect of 6.5. The HLEG calculates a total leverage effect of EUR 11 estimated direct and indirect economic effects through innovations, new technologies and products for each EUR contributed by FP7, whilst indicating that these figures are based on a conservative estimate and real effects may be even higher.[85]

As mentioned above, the FP7 contribution represents only a small share of total public expenditure on R&D. Overall, the direct leverage effect on private investment of FP7 was 0.85 EUR for each EUR of EC contribution[86]; the leverage effect of 0.28 EUR on public investment. These figures exclude the indirect leverage effect, which occurs mostly after project finalisation and through accompanying projects, and which cannot be estimated yet.

Case studies reveal that from the perspective of firms and research organisations, FP7 provided the continuity and predictability needed to secure private investments. Article 185 Initiatives, as well as ERA-NET and ERA-NET Plus actions, provided added value through the structuring effect on the European research landscape and by leveraging private and national public funds. The ERA-NET instrument, for example, was found to have an average leverage effect of 10. Differences across themes are significant, with some individual ERA-NETs reaching leverage effects of 50.

In FP7 – Health - Joint Programming Initiatives, a EUR 2 million EU financial contribution for neurodegenerative disease research (JPND) leveraged EUR 75 million. The Joint Programming Initiative on Antimicrobial Resistance (AMR JPI) leveraged EUR 13.8 million via a EUR 1.9 million EU contribution. Six Era-NETs leveraged EUR 119 million via an EU contribution of

83 TRI-Value study.

84 Based on the IMPACT-EV questionnaire, FP7 researchers reported to have collaborated with other European projects and research organisations in relation to their research. Actually, 46% of the projects that reported achieving impact on ERA have collaborated with other FP projects, with an average of 2.9 projects (collaborations) per project. The range of values goes from collaboration with 1 project to a maximum of 6 projects (i.e. INSPIRES project). Furthermore, 20.8% of the projects collaborated with non-FP projects, with an average of 2.5 projects (collaborations) per project. Again, the range of values goes from collaboration with 1 project to a maximum of 6 projects. Regarding the collaboration with research organisations, 12.5% of these projects mentioned this type of collaboration. Some examples highlight, for instance, the HI-POD project which collaborated with a relevant research infrastructure: Dariah-EU (Digital Research Infrastructure for the Arts and Humanities).

85 HLEG p. 60

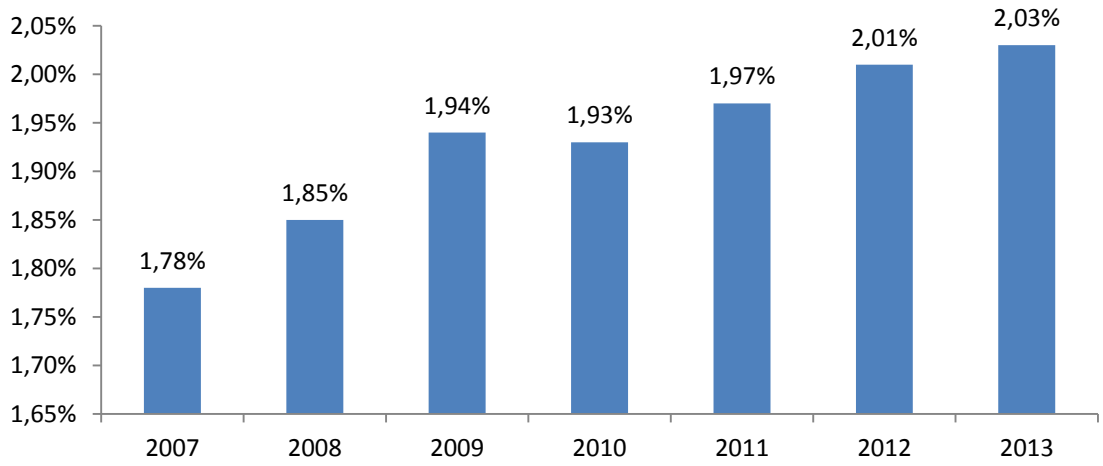
86 Below the estimation (1.1) used at the moment of preparing the ex-ante FP7 IA.

EUR 15 million. Around 56% of participants, regardless of their affiliation, indicate that FP7 funding helped access other funding to expand or continue their research with up to 64% of their current research funding being derived from this leverage effect. As a further indicator of the importance of FP7 funding, 75% of participants acknowledge that FP7 funding represents up to 50% of their total research budget.[87]

FP7 – People - MCA set standards for research training, attractive employment conditions and open recruitment for all EU researchers and achieved leverage. The co-fund mechanism aligned national resources and each euro of FP funding achieved a leverage of 2.4 euros) and influenced programmes at regional and national level. This allowed for co-financing some 167 programmes and support over 9 700 post-doctoral researchers.

RSFF leveraged private funding to increase the contribution to achieving EU objectives. It mobilised a large range of public and private resources notably from the EIB and multiplied the effect of the EU budget, financial intermediaries such as banks, and final beneficiaries. Given its leverage (6.6)[88] and multiplier effect (28)[89], the Court of Auditors[90] concluded that the RSFF had exceeded its initial expectations. The availability of debt financing for riskier R&I projects was also particularly valuable in times of financial crisis, as it was one of the few financial instruments remaining available for companies to help maintain their R&I activities.

During FP7, the share of GDP dedicated to R&D increased, with a slight decrease in 2010 due to the crisis (Graph 11). While it is not possible to identify the direct impact of FP7 funding on the evolution of total R&D expenditure as a share of GDP, FP7 has compensated the sharp decline in public funding for research after the crisis in some Member States.[91]



Graph 11: Share of R&D (both public and private) as % of GDP

Source: Eurostat: 04/12/2015

87 FP7 Health Survey October 2014.

88 Each euro of EU contribution has led to more than 6 euro of the RSFF loan finance.

89 Each euro from the EU budget contributed to total financing of 28 euro of RDI investment.

90 Has the Commission ensured efficient implementation of the Seventh Framework Programme for research? Special Report No. 2, European Court of Auditors (2013), see http://www.eca.europa.eu/Lists/ECADocuments/SR13_02/SR13_02_EN.PDF

91 The HLEG concurred that the FP7 contribution per million EUR of national RTD expenditures is 30% higher in the EU-13 than in the EU-15 and that in the countries that have been heavily hit by the economic crisis, the national RTD expenditures have been cut down, resulting in a comparable high contribution of FP7 to available FP7 funds.

6.1.4. *Has FP7 been effective in improving the coordination of European, national and regional research policies?*

FP7 made a significant effort to align Member State activities by developing common strategic research agendas, aligning national plans, defining and implementing joint calls, using instruments such as the **ERA Networks (ERA-NETs and ERA-NET plus actions) and Article 185 initiatives**, which set common agendas and achieve the funding scale required for tackling important societal challenges. The importance of the coordination of the national programmes is obvious when one considers the amount of funding concerned. FP7 accounts for only 7% of the total public R&D expenditure in the EU, while, for example, the annual budget of DFG in Germany is over EUR 1,000 million and that of CNRS in France is over EUR 2,000 million. According to Eurostat data, 1,47% of GBOARD is transnationally coordinated funding financed by Member States without FP7.

During FP7, 83 ERA-NET and 23 ERA-NET Plus actions mobilised about EUR 2 billion Member State funding. The four Article 185 initiatives[92] launched during FP7 received a total contribution of EUR 500 million from the FP and an estimated EUR 772 million from national authorities. ERA-NETs and Article 185 initiatives received positive feedback from national stakeholders as well as from policy-makers as regards the value of coordinating national research activities.

Since the introduction of the **ERA-NET scheme**, around EUR 2,300 million have been mobilised for joint calls by Member States. During FP7, and in spite of the crisis, the amounts dedicated to joint calls increased: EUR 371 million in 2013, compared to EUR 197 million in 2008[93]. ERA-NETs have had considerable impact on domestic programmes. In a conducted survey on FP7 ERA-NETs 32% of respondents highlighted that aligned new programmes with ERA-NETs. 37% reported a larger programme budget for the ERA-NET theme compared to what that area would have been available in national funding. In many cases, participation in ERA-NETs led to participation in other forms of transnational research programming (ranging from other ERA-NETs to JPIs and bi/trilateral cooperation)[94].

Article 185 initiatives have strongly helped structure research in selected fields. About 50% of total dedicated metrology funding in Europe is coordinated through **EMRP**, contributing to the creation of a "metrology ERA"[95] through the integration of some smaller or "newer" EU Member States via collaborative schemes. **Eurostars** has accelerated the development and roll-out of new and improved products, processes and services, showing a positive impact on the patent portfolio of funded firms[96]. **BONUS** is closely aligned with the EU Strategy for the Baltic Sea Region, in addition to supporting the objectives of the Marine Strategy Framework Directive (MSFD), Common Fisheries Policy, the Helsinki Convention (HELCOM) and facilitating cooperation with Russia.

FP7 – Capacities - Regions of Knowledge played an effective role in creating clusters at regional level and fostering regional investment in research and innovation in areas of strategic importance. This "sets the fundaments for future impacts to occur in terms of an enhanced regional economic competitiveness through R&D activities"[97].

FP7 – Cooperation - ICT contributed to setting national agendas on specific themes pioneered at EU level. Networks as cloud and areas such as e-health, independent living and robotics were pioneered by

92 Active and Assisted Living Programme (AAL), EUROSTARS, European Metrology Research Programme (EMRP), Joint Baltic Sea Research Programme (BONUS).

93 Niehoff, 2014

94 Doussineau, Harrap, Kamil Özbolat, Haegeman and Boden (2014) An assessment of the impact of the FP7 ERA-NET scheme on organisations and research systems, JRC

95 Interim Evaluation of the European Metrology Research Programme (EMRP), 2012.

96 When compared with unfunded stakeholders.

97 Impact Assessment of the Regions of Knowledge Programme, 2011.

the Commission before they were developed nationally. In the case of Ageing and Healthy Living, **AAL** has had a catalytic effect on national initiatives and activities, including leveraging of national funding and a strong commitment by Participating Countries[98].

FP7 – Cooperation - Security helped expand capacity and shape the research landscape, with several pan-EU networks as well as national groups established. It also had a positive impact on Member State investment in security research, e.g. the Tekes Safety and Security programme in Finland and the collaboration and mutual opening up of the French and German national civil security research programmes.[99]

FP7 – Ideas –ERC: Since 2007, 11 Member States have launched new funding schemes inspired by the ERC. ERC also enhanced or consolidated the priority given to basic/frontier research in some national strategies. Increasing competition between EU countries and institutions to host ERC grantees is leading to major reforms in the way research funding is allocated and to more attractive conditions for the best researchers.

Member States, as well as some Associated and Third Countries, put in place incentives at national level to foster the participation of their researchers in the FP. Some Member States also aligned the priorities of their national Research Strategies with the ones in FP7.

53% of National Contact Points[100] rate the importance of FP7 for shaping national/regional research and innovation policies as high or very high while 27% rate it as average. Only 2.8% rate it as very low. Stakeholders indicated that one of the key achievements of FP7 was the joint agenda-setting through joining forces in solving the grand challenges together.[101]

6.1.5. *Has FP7 been effective in strengthening the scientific excellence of basic research in Europe through increasing coordination and competition at the European level?*

The results of the online stakeholder consultation concluded that the greatest impact of FP7 was on scientific excellence and impact on technological or social innovations[102]. For the HLEG, encouraging scientific excellence on individual and institutional level was also one of the ten key achievements of FP7.

Scientific excellence was an overarching aim of FP7. The most frequently used indicators for scientific excellence include the number and citations of scientific publications to indicate quality.

FP7 involved top researchers and organisations in high-quality research. Several indicators could be used to underscore the excellence of FP7. First, an important share of **FP7 publications are among the top 1% and top 5% highly cited publications** in their disciplines, in most cases well above the overall EU average and the US average (Graph 12). Moreover, the HLEG reported that among the most cited publications arising from FP7 and notably with ERC funding, a significant number have been recognised as highly influential on science. For publications in the Ideas programmes 30% of the publications were cited in top 5 highly cited publications and 8% in top 1 highly cited; above EU average (1.5% and world average 6.4%). The ICT part of the Cooperation Programme of FP7 has up to 3.6 points field weighted citation impact, which is above EU average (1.2 points) and US average (1.5

98 Financial contributions run at around 25-30% above the required minimum.

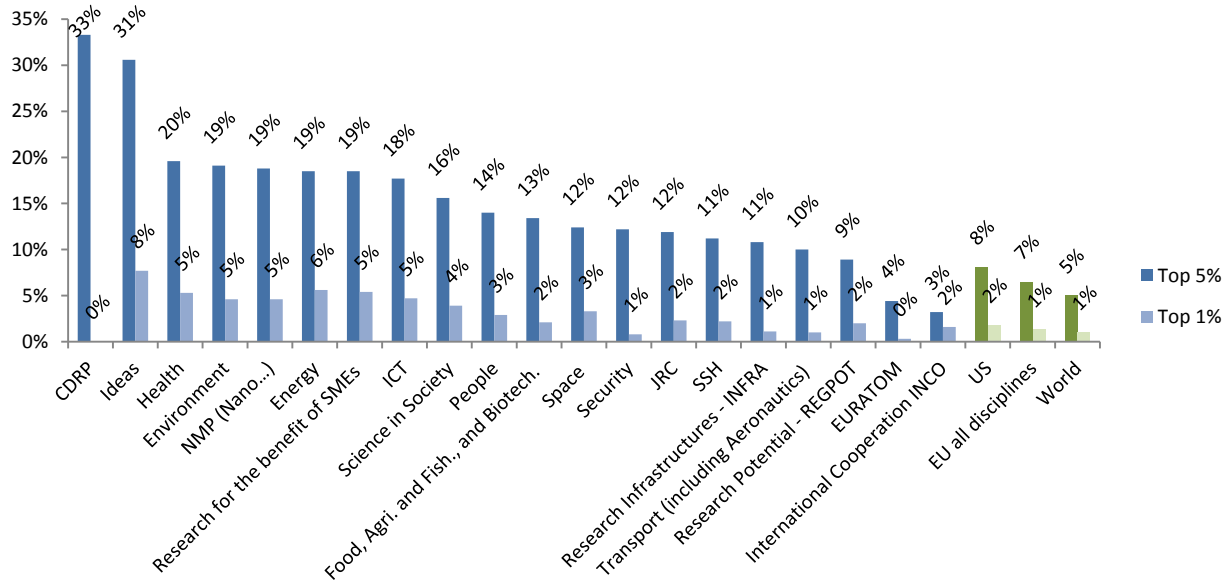
99 Final Evaluation of Security Research under the Seventh Framework Programme for Research, Technological Development and Demonstration (Technopolis, 2015)

100 Source: Supporting expert for the Cooperation programme. This result is rather consistent to the analysis of ERAWATCH country profiles and the analysis of thematic priorities. They are by and large matching national priorities; in some Member States there is even a 1:1 priority setting such as Lithuania.

101 See Annex 2.

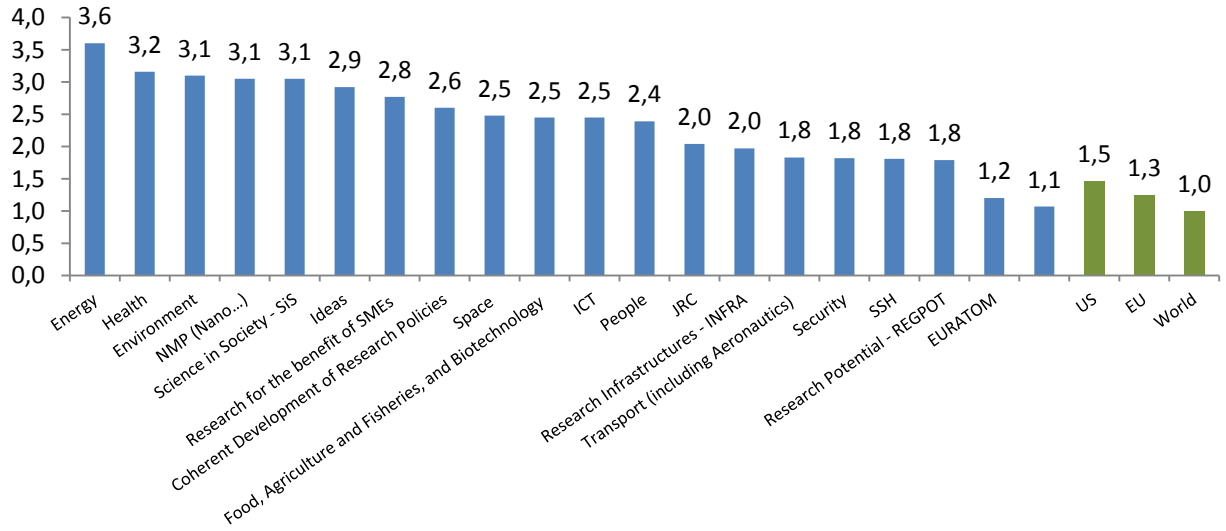
102 See Annex 2.

points). Parts of the Cooperation Programme have up to 75% co-publications with authors from other countries which is well above EU average (35%), US average (30%) and world average (15%).



Graph 12: Share of the priorities' publications in top 1% and top 5% highly cited publications (2007-2015)
Source: SciVal based on Corda-Sesam-Respir

Second, field-weighted-citation impacts[103] of FP7 publications are above the EU average and in most cases above the US average (Graph 13).



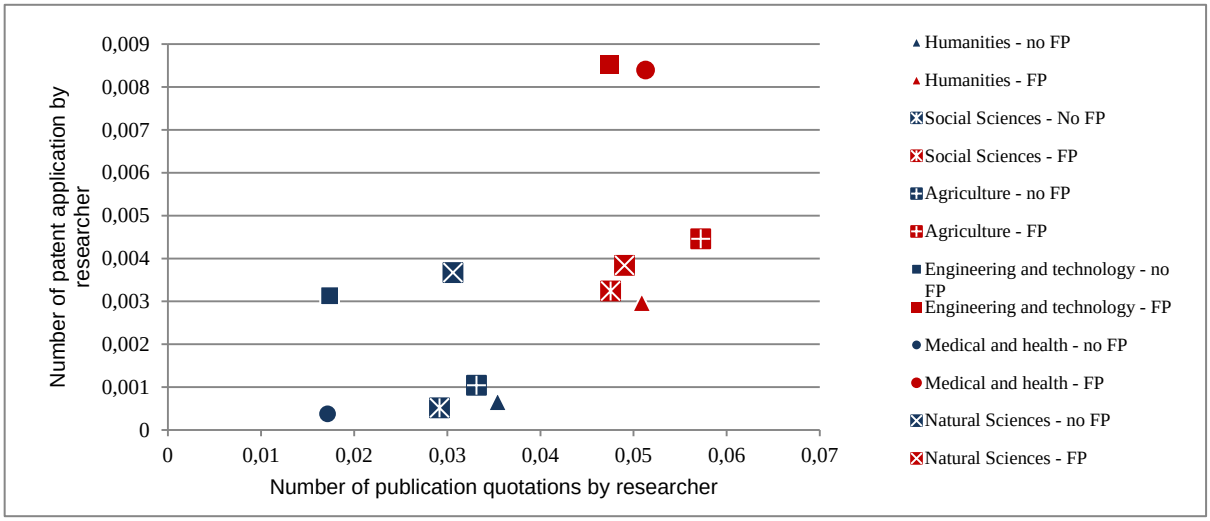
Graph 13: Field weighted citation impact of publications (2007-2015)
Source: SciVal based on Corda-Sesam-Respir

103 Field-weighted citation impact divides the number of citations received by a publication by the average number of citations received by publications in the same field, of the same type, and published in the same year.

In FP7 – Cooperation – ICT, the relative citation impact[104] is above the world average. FP7 research results published in conference proceedings were also found to be of higher quality than the control group[105].

The HLEG report concurs that, between 2002 and 2012, EU-authored articles have become more influential on average and that research output during FP7 increased, particularly publications in highly ranked journals, illustrating the high quality of research.

The findings of a study on university participation in the FPs[106] point to the remarkable, above-average scientific standing of the publications stemming from FP-funded projects as captured by the number of citations received and the impact factor of the scientific journal in which they have been published. The data also indicate that publications from projects with larger size (EUR 5 million) are on average of higher quality. Another indication of excellence is that researchers in institutions participating in the FPs produce more publications and patent applications than researchers in non-participating institutions (Graph 15). The comparison between FP7 and overall EU patterns regarding co-publications between different countries show similar results. The share of cross-border co-publications in all publications is higher for FP7 than for the EU, the US and the world.



Graph 14: Patent applications and publication quotations by researcher in different scientific fields
Source: A5 analysis based on ERA survey

FP7 – Ideas – ERC: over 29,000 publications acknowledging ERC support appeared in international peer-reviewed journals indexed by the Web of Science database[107]. The 314 completed projects reported 10,796 publications[108], with an overall average of 34 publications and

104 Relative citation impact compares the number of citations per scientific paper from a given field divided by the number of citations per scientific paper for the world as a whole.

105 Jacob, J., et al. (forthcoming).

106 An analysis of the role and engagement of universities with regard to participation in the Framework Programmes, forthcoming

107 The Web of Science database maintained by Thomson Reuters covers around 12,000 peer-reviewed journals in the sciences, social sciences, arts, and humanities going back in some areas to the 19th Century.

108 Only those publications which were validated by a digital object identifier (DOI) and identified in the Scopus database are counted. This represents about 80 % of all publications which have been reported. The Scopus database maintained by Elsevier covers around 51 million records from 22,000 peer-

a substantial share ranking among the most highly cited publications worldwide, including in the top 1% category,[109] with marked differences between fields and projects[110].

FP7 – People –MCA involved all 100 best-ranked European universities in the Shanghai ranking. 65% of the outgoing European MCA researchers carried out part of their research in the top 50 world universities. 30 scientists supported by the MCA have actively contributed to the discovery of the Higgs boson (or so-called 'God Particle') by CERN.

FP7 – Cooperation – Health: IMI JU projects have produced over 320 publications in more than 150 peer-reviewed journals including high impact factor journals such as Nature and Science. Another example is the ADITEC high quality vaccine project, where 148 publications can be attributed to one project. 88% of the papers were published in journals with impact factors in the top 25% of their subject category.

Almost 80% of **FP7 – Cooperation - SSH** projects[111] have published articles in peer reviewed journals, on average 16 articles per project. 72% of the articles are published by one third of the projects, indicating the existence of a group of highly productive research teams.

FP7 – Cooperation – Space: About 90% of 545 respondents stated that FP7 space had had a medium to high impact on the EU's technological capabilities and international scientific standing[112].

With **Euratom** support,[113] Europe became world leader in fusion R&D, and was largely responsible for the success in bringing ITER[114] to Europe. The fusion programme resulted in 4,496 publications in peer-reviewed journals while fission projects produced 563 articles, of which 128 were published in high impact journals.

FP7 also funded a large number of **award-winning researchers,** which is another indication that FP7 attracted excellence.

FP7 - Cooperation - Health: over 300 leading researchers participating in research teams were laureates of prestigious national and international scientific prizes (i.e. Lasker Award, Leibniz

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reviewed journals "in the fields of science, technology, medicine, social sciences, and arts and humanities" going back to 1995.

109 One analysis, using the reported publications from the 314 completed projects which could be validated in the Scopus database showed that a significant proportion of ERC publications were in the top 1% most highly cited publications worldwide. Out of the 10,796 publications reported, 7003 (or 64 %) were indexed in Scopus. The analysis using the methodology of the US National Science Foundation and based on all the publications acknowledging ERC funding and recorded in the Web of Science database, showed that overall 12% of these publications were in the top 1% most highly cited publications world-wide. On the same basis, the number of the publications in the Top 10% was 855 out of 1996 or 43%.

110 Projects in Life Sciences have on average 23 publications, Physical Sciences and Engineering 48, and Social Sciences and Humanities 18.

111 Reports on societal implications

112 Participant survey. Annex 10.9

113 In a continuation of the policy established in previous Euratom Framework Programmes, the Euratom Specific Programme in FP7 focused primarily on public-sector and long-term research in the field of nuclear energy, both fission and fusion, and related issues of societal concern such as nuclear safety and radiation protection. Also significant progress was witnessed in research on geological disposal of high-level and long-lived radioactive waste and on radiation protection issues. Finland and Sweden became the first countries in the world to select, with local population support, national sites for such disposal facilities. Similarly, a long-term research efforts, supported by Euratom on the health effects from exposure to low doses of ionising radiation resulted in the creation of the Multidisciplinary European Low-Dose Initiative (MELODI) in 2010. A legal entity under French law, it brings together key organisations from several European countries to coordinate and promote this research effort.

114 The ITER international agreement, signed in 2006 just prior to the start of FP7, heralded a major step in the development of magnetic confinement fusion as a global energy source. The Euratom contribution to ITER, 2007-2013, was implemented by F4E, established in 2007 as a joint undertaking under the Euratom Treaty.

Prize, Spinoza Award, Louis-Jeantet Prize). At least four laureates of the Nobel Prize participated in the programme among which the laureate of the 2014 Nobel Prize for Chemistry, prof. Stefan Hell, who was awarded the prize for the development of super-resolved fluorescence microscopy[115].

FP7 Cooperation – ICT, FET: Overall, 9 Nobel prize laureates are/were involved in FET research[116].

ERC so far supported 11 Nobel laureates[117], five Fields Medallists[118] and the winners of many more internationally recognised prizes. Five of the Nobel laureates were funded by the ERC before receiving the Nobel Prize. The ERC has also received four proposals from Nobel Prize winners that were not funded.

FP7 – People - MCAs: In 2014 alone, 3 Nobel Prize winners were involved in MCA projects.

6.1.6. *Has FP7 been effective in promoting the development of European research careers and in making Europe more attractive to the best researchers?*

The **FP7 – People - MCA** programme contributed in attracting international talent:

- Fellowships were granted to more than 50,000 researchers evaluated for excellence.
- 10,000 PhD candidates, representing over 140 different nationalities located in more than 80 countries between 2007 and 2013.
- Nearly 34% of the fellows were nationals of third countries.[119] MCAs also contributed to retaining the best researchers in Europe:
- 46% of researchers coming to the EU from industrialised countries stayed in Europe after the end of their MCA fellowship.

MCAs supported the development of scientific careers. Survey results show that some 80% of the MCA fellows estimated that their fellowship experience improved their career prospects. 95.4% of MCA fellows were in employment positions two years after the end of their fellowship. FP7 contributed to training and to the development of individual skills and expertise[120] and enhanced the mid- to long-term international mobility of the researchers involved. FP7 participation had a positive impact on the composition of beneficiary research teams, particularly by increasing the share of women and international researchers. FP7 contributed to permanent researcher recruitment as a large share (43%) of temporary

115 PPMI, Ex-post Evaluation of the HEALTH Theme in FP7 : preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015, p. 100:

116 Prof. E. Moser (NO), Professors Serge Haroche (FR), Prof. Andre Geim (Dutch-British), Prof. Konstantin Novoselov (British-Russian), Prof K. von Klitzing (DE) , Prof A. Fert (FR), Prof Peter Grünberg (CZ), Professor Torsten N. Wiesel (SE), Theodor W. Hansch (DE). The full list of the 9 Nobel laureates that are/were involved in FET is in the following article, including the reference to the project they are involved in: http://ec.europa.eu/digital-agenda/en/news/future-and-emerging-technologies-fet-supports-nobel-prize-laureates-their-quest-excellence

117 May-Britt Moser AdG 2010 (Physiology or Medicine 2014); Edvard Moser AdG 2008 and AdG 2013 (Physiology or Medicine 2014); Jean Tirole AdG 2009 (Economics 2014); Serge Haroche AdG 2009 (Physics 2012); Konstantin Novoselov StG 2007 and SyG 2012 (Physics 2010); as well as Ada Yonath AdG 2012 (Chemistry 2009); Andre Geim AdG 2012 (Physics 2010); Christopher Pissarides AdG 2012 (Economics 2010); Jean-Marie Lehn AdG 2011 (Chemistry 1987) James Heckman AdG 2010 (Economics 2000); Theodor Hänsch AdG 2010 (Physics 2005).

118 "Two Fields Medals 2014 awarded to ERC laureates", August 2014 http://erc.europa.eu/sites/default/files/press_release/files/ERC_Press_Release_ICM_2014.pdf

119 The HLEG reports 24%.

120 Study on assessing the contribution of the framework programmes to the development of human research capacity, 2014.

researchers hired by projects stayed in the beneficiary research teams after the end of the project.

The HLEG found that FP7 'People'-funded researchers showed EU wide mobility patterns and results and confirmed that FP7 'People' contributed significantly to intra-European mobility. The HLEG lists the stimulation of mobility of researchers across Europe as one of the ten key achievements of FP7. The HLEG found that whilst FP7 also contributed to attracting researchers from outside Europe, this was limited due to the design of FP7 (FP7 'People' was only open for countries with an STI agreement with the EU and associated countries. This means that only 80 countries are represented compared to 170 countries for FP7 as a whole). Finally, it reported that the monitoring of MCA fellows on strengthening the human research potential only provides a fragmented view of the impact of the FP7 'People' programme and that the surveys conducted have very low response rates.

FP7 – Ideas – ERC researchers reported better working conditions across the board and in particular more time for research as a result of FP support. ERC success is unanimously seen as a new quality marker for research organisations across Europe, which in turn feeds back into actions by the research and university leaders. 7.1% of **ERC** grantees are non-ERA nationals. Around 17% of the PhDs and post-docs in ERC teams (around 2,700) were from outside Europe, of whom the largest number were from China, the USA and India.

FP7 – People –MCA: 76% of beneficiaries indicated that MCA provided more opportunities to attract non-national researchers to their organisation[121]. The European Charter and Code for researchers was embedded in MCAs and implemented during the proposal evaluation process. MCAs strongly promoted and encouraged employment contracts with full social coverage instead of fixed-amount fellowships, inducing organisational behaviour in participating institutions[122], with a positive impact on non-MCA grantees.

6.1.7. *Has FP7 been effective in providing the knowledge-base needed to support key Community policies?*

FP7 contributed to the development and/or implementation of EU policies. The different Work Programmes[123] were generally designed to accompany EU policies such as Climate Change, Environment, Energy, Health, Common Agricultural Policy, Common Fisheries Policies, etc. So far, in 10.540 finished FP7 projects the final reports has stated that results has been used in 374 cases by EU policies, produced 588 standards.[124]

FP7 – Cooperation – INCO encouraged coordination with a broad range of community instruments, including these with a defined geographical focus: the Instrument for Pre-accession Assistance (IP), the European Neighbourhood and Partnership Instrument (ENPI), the Development Cooperation and Economic Cooperation Instrument (DCECI), the Instrument for cooperation with industrialised and other high-income countries and territories (ICI), Asia and Latin America (ALA), the European Regional Development Fund (ERDF), and the European Development Fund (EDF).

121 PPMI, 2013, FP7 Mid-term evaluation of MCA

122 These organisations offered more mobility opportunities (48%), introduced new types of training (41%), improved public advertising of job vacancies (41%), implemented advanced career development, advice and job placement services (35%), introduced new supervision methods (31%) and introduced new welcoming or support services (also 31%). In addition, they introduced contracts with full social security (13%), improved working conditions and made more flexible (19%) and offered more financially attractive salaries (21%).

123 See Annexes 10 to 14 for further details.

124 CORDA: 01/12/2015. 9927 project 613 ICT projects were finalised. Not including the ERC.

FP7 – Cooperation – ICT projects have directly or indirectly contributed to policy-making and supported policy objectives beyond research. For instance, in the field of radio spectrum, EU projects have pioneered the operational usability of TV white spaces, supporting actions in future spectrum regulations[125] and in the field of cloud computing. Other projects supported the preparation of legislation on shadow banking.[126]

FP7 – Cooperation – SSH projects have informed European policies in different fields such as Common Agricultural Policy or security and defence policies.[127]

FP7 – Cooperation – Space contributed to the development of the GMES/Copernicus programme which provides information services in support of policy areas such as environment, energy, climate action, civil protection, external relations and blue growth.

FP7 – Cooperation - Security contributed to the implementation of EU external policies, the Common Foreign and Security Policy (i.e. in support of border control, conflict prevention and crisis management), the creation of an EU-wide area of justice, freedom and security, and policy areas such as transport, health, civil protection, energy, development, and environment.

In **FP7 – Cooperation - KBBE**, more than one third of the development and demonstration research contributed to standardisation and legislation (Common Agricultural Policy[128], Common Fisheries Policies).

For **FP7 – Cooperation - Health**, around half of finalized research projects reported on engagement with civil society actors or policy-makers. Around 25% of these were identified as having had an impact on EU policy.[129,130]

FP7 – Cooperation - Energy has been the most important instrument for implementing the Strategic Energy Technology (SET) Plan, the technology pillar of the EU's Energy and Climate policy.

FP7 – Cooperation - Transport made a substantial contribution to the European transport policy making process[131]. It also contributed to the EU space policy through support given to the preparation for the use of European satellite navigation systems (Galileo and EGNOS) in particular in the areas of road transport, aviation, professional applications and location-based services.[132]

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125 The project COGEU analysed the gaps between frequencies used for television, known as 'white spaces', and developed a solution that can help all citizens gain access to broadband through the airwaves. It has implemented a proof-of-concept tool with which local and short-term spectrum licences are traded through an online auction mechanism and inspired a Commission Decision.

126 The project "Forecasting Financial Crisis" provided the means to understand and forecast systemic risk and global financial instabilities for use by players like the European Central Bank (ECB) and DG MARKT.

127 For example, PRIV-WAR contributed to the European Parliament's Resolution about the development of the common security and defence policy after the entry into force of the Lisbon Treaty.

128 For example, the results of CAP-IRE project carried out under FP7 – Cooperation –SSH have been used as the basis to develop the post 2013 Common Agricultural Policy (CAP).

129 "*Further analysis revealed that active engagement with policy makers was strongly associated with impact on EU policy. About a third of projects that applied some kind of engagement with policy makers had an impact on EU policy*" PPMI, *op cit*, p. 85.

130 For example, the ATOME project proposed revisions of current law to better balance the need to prevent drug abuse while allowing patients access to such medicines.

131 TRI-VALUE study. Project coordinators estimated that 15 to 30% of projects already produced outputs that were "used to date" by the EU Institutions.

132 The funding for Galileo generated a significant amount of new knowledge, bridging gaps between research and market communities and improving relations among businesses and end-users. The most common research outputs were prototypes, product innovations, proofs of concept, trademarks and patents, process innovations and successful trials. For example, the SafePort project developed an Active Vessel Traffic Management and Information System (A-VTMIS) to manage vessel movement, thus improving the efficiency of port operations. The Scutum project promoted the wide adoption of satellite navigation-based technologies for the management of hazardous goods transport.

FP7 – Cooperation - Environment projects are extensively quoted in the IPCC report[133] and in EU climate-related impact assessments.

The **RSFF** improved access to risk finance, an element of the EU's policy outlined in the Commission Communication "A Budget for Europe 2020"[134].

Based on the survey results, policy impact at the national and regional level is perceived as moderate, 18% and 15% respectively. Policy impact is difficult to estimate for participants, as it is often only an indirect consequence of the project activities and it is not easy traceable unless a proper follow up is made, which is not the case for most project financed. [135]

6.1.8. *Has FP7 been effective in increasing availability, coordination and access in relation to top-level European scientific and technological infrastructures?*

EU Research Infrastructures (RIs) including eInfrastructures funded by FP7 reflected the new opportunities that digital and communication technologies offer in terms of designing science research and included world-leading infrastructures and eInfrastructures. They included centralised, as well as physically distributed resources for research, covering major equipment or sets of instruments, in addition to knowledge-containing resources such as collections, archives and data banks, and 'facilities that facilitate research facilities'. E.g. the European Spallation Source (ESS), was designed to be the world's most intense source of pulsed neutrons and the Pan-European Infrastructure for Clinical trials and Biotherapy (ECRIN), which will help to shape scientific communities and build a critical mass at the global level.[136] FP7 funded eInfrastructures give access to innovative infrastructures that offer high capacity services not matched by any commercial or national offer[137].

FP7 RI projects resulted in improved transnational access (~80% of respondents); new or improved simulation and visualisation facilities and techniques (~80% of respondents); the extension of the RI users base, from a scientific and/or research community perspective (~75% of the respondents); and new or improved RI services in general (~75% of respondents)[138].

An external evaluation study highlighted the potential of RIs producing impact on society. E.g. close to 20% of the funding was allocated to the environmental sciences, providing support to networks of RIs and development of new distributed RIs in atmospheric research, arctic, ocean and marine research, and biodiversity. The programme also supported the development of the European life sciences ecosystem of facilities and resources, from biological resource centres to medical research facilities and food and agriculture facilities. Moreover, FP7 fostered the integration of around 900 RIs in networks providing access and services to more than 20,000 researchers worldwide so far and to another 20,000 potential

133 Environment projects also contributed, directly or indirectly, to the EU's Climate Action and Renewable Energy Package, the Floods Directive, the Droughts and Water Scarcity Communication, the Communication and Action Plan on Disaster Prevention and Early Warning, the Environmental and Health Action Plan, the Environmental Technologies Action Plan, the Sustainable Consumption and Production, and the Sustainable Industrial Action Plan, amongst others. It also strongly supported international initiatives, like the International Panel on Climate Change (IPCC) or the Global Earth Observation System of Systems (GEOSS).

134 COM(2011) 500 final

135 Source: Evaluation of the impact of projects funded under the 6th and 7th EU Framework Programme for RD&D in the area of non-nuclear energy, Technopolis, June 2014

136 See, assessing the Projects on the ESFRI (European Strategy Forum for Research Infrastructures) Roadmap, 2013.

137 PwC and OpenEvidence, forthcoming.

138 Final report Evaluation of Pertinence and Impact of Research Infrastructure Activity in FP7 EPIRIA

users in the next years. The RIs were strengthened through the adoption of a Council regulation on the Community legal framework for a European Research Infrastructure Consortium (ERIC)[139].

The HLEG concluded that the combination of support for the European Strategy Forum on Research Infrastructures (ESFRI) and FP7 'Capacities' helped to achieve a more coherent and coordinated development and use of European RIs.

6.2. How efficient has FP7 been?

6.2.1. Has FP7 been cost-effective?

It is difficult to assess whether FP7 has been cost-effective,[140] since many projects are still on-going and there are no similar programmes in the world to which the degree of effectiveness can be compared. Several Member States studies have found the benefits of participating in FP7 outweighed the cost[141].

An independent retroactive CBA of FP7 implementation for the period of 2009-2012 by the Executive Agencies showed that for ERCEA, the ratio of actual administrative budget to actual operational budget was within a range of 1.59-2.34%, well below the overall target of 5% and that the expected savings for the EU budget were achieved[142]. The creation of the Research Executive Agency (REA)[143] led to total savings for the EU Budget of EUR 106.4 million. Finally, the new management modes implemented by the REA and the ERCEA improved proximity to beneficiaries, and produced better service delivery and cost savings[144].

6.2.2. *What are the benefits of FP7 so far?*

6.2.2.1. Impact on participation

This section focusses in particular on the benefits of FP7 for individual participants and SMEs and benefits for countries less advanced in terms of R&I.

Benefits for countries less advanced on R&I

To contribute to cohesion, the **FP7 – Capacities - Region of Knowledge** programme was designed to respond to needs in European regions[145]. It contributed inter alia to the development of regional 'smart specialisation' strategies, in which Member States and regions

139 Adopted on 25 June 2009 to facilitate the joint establishment and operation of research infrastructures of European interest

140 Economical in terms of tangible benefits produced by money spent

141 Annex 21.

142 The ERCEA has remained below its planned administrative budget as set in the Legislative Financial Statement (LFS), a difference ranging from EUR -7.8 million to EUR -9.9 million per year over the period 2010-2012. As a consequence, the unexecuted parts of the administrative budget became available for the operational budget

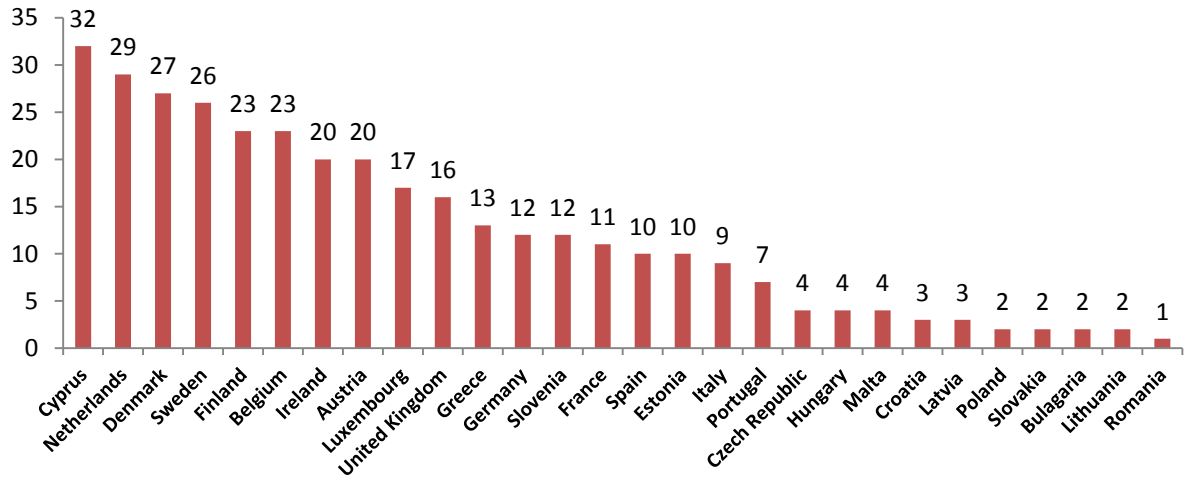
143 Research Executive Agency (REA), has spent EUR 50.7 million (or 20 %) less than estimated This was a result of recruitments on new posts spread throughout the year (rather than as of 1 January), lower salaries, savings on infrastructure costs and – to a lesser extent – savings on administrative costs. cost of coordination was 11.3 Full Time Equivalents (FTE), some 5.3 FTE higher than initially estimated in the LFS, which reduced slightly the savings by EUR 2.3 million.

144 Findings of the evaluations of the REA and the ERCEA

145 'Assessment of the impact of the regions of knowledge programme', European Commission, Directorate-General for Research and Innovation' http://bookshop.europa.eu/en/eu-research-pbKI3211818/

were invited to draw upon, improve and link existing cluster initiatives, innovation strategies, R&D capabilities and industry needs and market strengths. EC contribution per million EUR invested in national R&D was higher for regions with the least research and innovation capacity compared to other regions. In less developed regions, the FP7 - Capacities - Research Potential activity contributed to enhancing the exchange and mobility of staff, along with support in terms of equipment, which helped overcome the lack of national and, in particular, regional funding and resources to hire high-level staff.

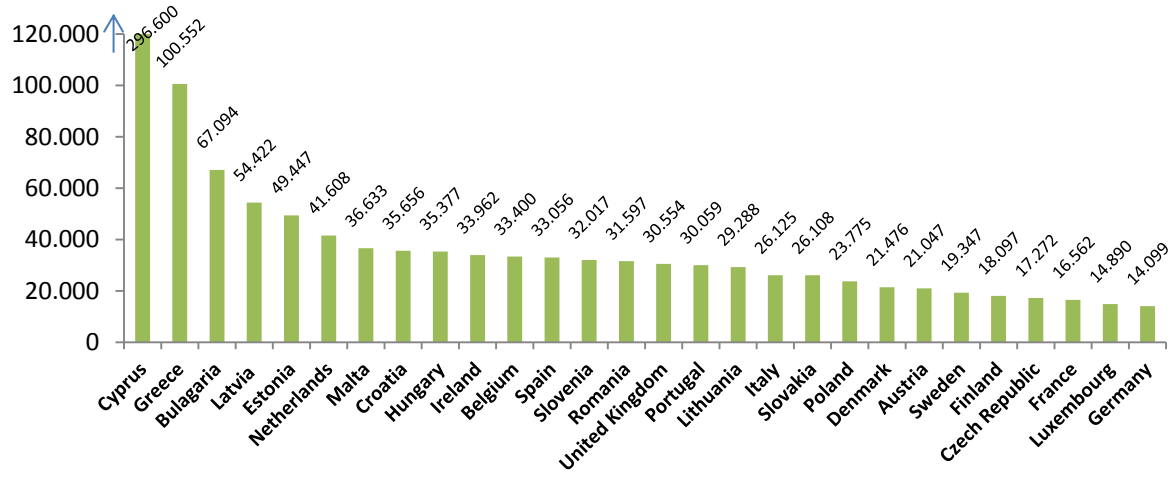
Moreover, FP7 participation from countries less advanced in terms of R&I provided an opportunity to enhance the level of excellence through co-publications with partners from more scientifically advanced countries. Assessing who benefits most from the programme it seems as illustrated in Graph 15 that smaller older EU Member States benefits most per inhabitant, whereas the picture is less clear when analysing the numbers in terms of EC contribution in relations to national RTD expenditure of how much funding the older Member States gets compared to the younger.



Graph 15: Annual FP7 EC Contribution EUR per inhabitant pr. year
Source: HLEG Report p. 33

Graph 16 shows the annual contribution per EUR million in national RTD expenditure. The HLEG found that the new Member States[146] had an average annual FP7 contribution of EUR 29,094 per million EUR invested nationally in RTD, and this number for old Member States was EUR 22,436.

146 Referred to as EU-13 in the HLEG report, p. 34.



Graph 16: FP7 Annual EC Contribution per EUR million national RTD expenditure
Source: HLEG Report p. 33

Benefits for individual participants

According to a study on the impact of FP7 on research capacity, FP7 participation helped beneficiaries to strengthen their strategic orientation towards EU priorities (68%). Teams experienced a significant leverage effect in terms of their ability to attract additional funding, particularly at EU level (83%, and 72% at national/regional level). Regional and institutional attractiveness are positively influenced by FP7 participation and the overall FP7 participation 'track record' leads to increased 'recognition' of researchers, institutions and regions.

FP7 participation had a significant positive effect on the development of individual skills and expertise, contributed to further enhancing the mobility of researchers and offered mid- and longer-term career perspectives to researchers. Almost half of the researchers perceived positive effects of FP participation on their research career (survey data).[147]

Benefits for SMEs

FP7 helped SMEs cover their R&D development costs and foster innovation. According to the HLEG, the strategic engagement of industry and SMEs is one of the ten key achievements of FP7. They found that this underlined FP7's intended role of fostering innovation. In the 'Cooperation' Specific Programme, 64% of participating SMEs[148] stated that the benefits already outweigh the costs (and another 27% expected this to happen in future); for the Research for the Benefit of SME's scheme (RSME), the current figure is lower: 43% now and an additional 42% expecting the benefits to outweigh costs eventually. The overall funding to SME's in FP7 was EUR 6.4 billion, where EUR 4.8 billion came from the Cooperation programme.

53% of SMEs in FP7 'Cooperation' and 62% of SMEs in the RSME scheme stated that they would not have been able to undertake the project at all without FP7 funding. SMEs also benefited from international partnerships that provided access to specialised knowledge and equipment.

147 Study on Assessing the Research Management Performance of Framework Programmes Projects, PWC, 2015.

148 Performance of SMEs within FP7, Panteia, May 2014.

FP7 – Cooperation - Health: Supported the key role of SMEs in the health innovation process. Under FP7 Health, one billion EUR was invested on SMEs (including in IMI), 1,200 SMEs received EU funding. The average EU contribution per SME has doubled from EUR 300,000 to EUR 600,000 throughout FP7 Health. For example, the NABATIVI project helped a small biotech company to develop a promising new antibiotic compound that was recently licensed to a multinational pharmaceutical in a deal worth hundreds of millions of Euros.

In "**Biotechnologies**", more than 500 SMEs (i.e. 38% of project participants) played a crucial role in bringing research results closer to market (46% of the SMEs were involved in the commercial exploitation of results, knowledge transfer and intellectual property rights management) and in promoting innovative solutions (71% of the research and technological tasks relied on SMEs' specialist profiles, expertise and know-how), helping meet "customers' specific and unique needs".

FP7 - Cooperation - ICT helped SMEs to acquire new skills and expertise, allowing them access to facilities and know-how e.g. through Competence Centres that were established to enable access of SMEs to technology and equipment.

Eurostars-funded R&D-performing SMEs showed twice as much employment growth than unfunded SMEs.

6.2.3. *Has FP7 been effective in reducing administrative burden?*

Several measures were implemented in FP7 in order to simplify the management of proposals and grants compared to FP6 and reduce the administrative burden. These included the unique organisation register; clearer guidance; the introduction of a web-based electronic system for collecting financial reports ("forms C"); the extension of reporting and payment periods from 12 months (in FP6) to 18 months; and a certain reduction of ex-ante controls, made possible due to the introduction of the participants' guarantee fund: a reduced number of certificates on financial statements and fewer ex-ante financial capacity checks.

A recent study provides a **quantitative estimation** of the budgetary impact of the changes in the cost calculation regime in FP7 as compared to FP6 and its effects on the administrative burden for participants. Based on a survey of 124 FP coordinators and an adapted version of the Standard Cost Model, the study estimates that four main simplification measures adopted in FP7 and related to cost reporting i.e. introduction of web-based electronic system for collecting financial reports ("Forms C"); extension of average reporting and payment periods from 12 to 18 months; decreased number of certificates on financial statements; clearer guidance) produced savings in terms of administrative effort and related costs of EUR 551 million in FP7 (compared with FP6) at the whole programme level and EUR 14 million in FP7 Euratom.[149]

As stated in the Interim Evaluation Expert Group Report, the perception of the impacts of simplification measures varied[150]. FP7 participants were satisfied with some changes such as:

- The introduction of a unique registration facility (URF)
- The reduction in the number of certificates related to financial statements,
- The reduction of ex-ante financial capacity checks controls.

However, participants identified the still excessive time-to-grant, the overly demanding reporting obligations, and the inconsistency between different Commission services in the application of rules or implementation of procedures as major obstacles.

149 Study on "Budgetary impact of the changes in the cost calculation regime in FP7 (EC and Euratom) as compared to FP6 (EC and Euratom) and its effects on the administrative burden for participants", (2015).

150 Assessing the Effectiveness of Simplification Measures under FP7, 2011

Most importantly, the European Court of Auditors, in its 2014 annual report, states: "The persistently high level of error in research and innovation spending reflects risks inherent in the design and implementation of the Seventh Research Framework Programme. Eligibility rules are complex and the programme has multiple funding rates."

The above findings provided important input for the design of the rules, processes and IT tools for Horizon 2020 that resulted in large-scale simplification of the funding rules, processes and IT.

6.3. How relevant was FP7?

The intervention logic implemented in FP7 contributed to achieving the objectives and to increase the relevance of the Programme. It also adapted its focus to address the global economic-financial crisis and contribute to the Europe 2020 Strategy.

Citizens agreed that FP7 was relevant, with some caveats. According to a survey, FP7 met the expectations of EU citizens, although some respondents indicated that certain changes in the priorities could be envisaged[151]. In terms of themes, 'health and medical care' were prioritised, followed by 'protection of the environment' and 'energy supply, and 'availability of quality food'. The HLEG assessed the FP7 impacts on citizens and society and found that citizens and civil society organisations were not very involved in relevant FP7 programming decision-making bodies; that dissemination and outreach activities lacked in terms of the targeting and tailoring of these activities for different audiences with different purposes of communicating scientific outputs; that civil society organisations' involvement as partners in research projects was limited (5% of unique participating organisations); and that the budget of the sub-programmes addressing issues of high importance for citizens and society (SSH and SiS) was comparatively small.

6.4. How coherent was FP7 internally and with other (EU) actions?

6.4.1. Internal coherence of FP7

FP7 was made up of four Specific Programmes. By definition, each had specific objectives with regard to the area of European research that it supported: collaborative research, frontier research, human resources and mobility, as well as capacity-building in research. As each of the four Specific Programmes had relatively similar success rates (Cooperation 19%, Ideas 12%, People 21% and Capacities 20%), this would suggest that a different financial allocation within FP7 between the four Specific Programmes would not have generated more research.

The HLEG stated that "FP7 created compartmentalization and duplication of themes. Furthermore it expressed that some successful elements of FP7 were provided through certain sub-programmes, even though they would be equally useful in other sub-programmes".[152]

> **FP7 – Cooperation – Health** is an example of complementarity and synergies with other 'Cooperation' themes, as well as with the 'Capacities' (esp. Infrastructures, Science in Society) and 'People' Specific Programmes. These programmes have both implemented research projects of common interest, and indirectly targeted similar research topics. The most interrelated programmes were ERC (207 relations based on the scientific topics of the publications produced with Health's projects), People (65 project relations), ICT (45 project relations), INFRA (24 project relations), NMP (22 project relations) and KBBE (16 project relations)[153]

151 Eurobarometer

152 HLEG Report pp. 8-9

153 PPMI, Ex-post Evaluation of the HEALTH Theme in FP7: preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015, pp 23-25 & 91-92

6.4.2. Coherence with other interventions

In the period 2007-2013, two other initiatives should be mentioned in this context: the Competitiveness and Innovation Programme (CIP) (with an overall budget of EUR 3.621 million) and the European Institute of Innovation and Technology (EIT) (with a budget of EUR 308.7 million).

The CIP was designed specifically to offer new possibilities for synergies with FP7 and the Structural Funds, creating a continuum of EU support for technologies of strategic importance developed through FP7. In some areas of the CIP, such as eco-innovation, research previously funded under research FPs was picked up and taken towards the market. Many CIP coordinators of projects were involved in EU-funded research. A clear progression was commonly seen through each of the two Framework Programmes – from research through to applications on the ground. Each programme had a common reference point in the overall EU Strategy as established formerly in the revised Lisbon Strategy and more recently in the Europe 2020 Strategy[154].

The EIT contributed to overcoming the fragmentation of the research and innovation landscape via its Knowledge and Innovation Communities (KICs). The EIT invested in fostering entrepreneurship and innovation competences and in making education more responsive to business and societal demands. It has been acting as an 'innovation catalyst' by accelerating the take-up and exploitation of technologies and research outcomes. The 2009 KICs working in the fields of climate change, sustainable energy and ICT have been closely involved in several FP7-funded projects.

Cohesion policy[155] allocated almost 25% (around EUR 86 billion) of its Funds (European Regional Development Fund (ERDF), Cohesion Fund (CF) and European Social Fund (ESF)) to "investment in research and innovation" during the period 2007-2013. According to external experts, the linkages of CIP with other programmes could have been better exploited and institutionalised[156].

The **FP7 – Capacities - Research Potential** programme was a pioneer in promoting the coordinated use of funding of FP7 and regional policy[157]. It helped build capacities in terms of infrastructure and human resources for research organisations in less favoured regions. Often, this prepared the ground for significant investments from the structural funds. **FP7 - People** also created synergies with the structural funds.

> The SoMoPro project in the South Moravian Region (Czech Republic) combined MCA-co-funded fellowships with other programmes funded by structural funds in order to successfully develop a knowledge-based strategy for the region.
>
> Some **Research Infrastructures** projects under the ESFRI Roadmap were supported by FP7 and ESF, illustrating concrete synergies: The Extreme Light Infrastructure (ELI) project, which aims to

154 CESS. 2011. Final Evaluation of the Competitiveness and Innovation Framework Programme.

155 Structural Funds financing RTDI projects represent a very significant part of public support to RTDI in many Member States. In some, in particular in EU-13 Member States, Structural Funds for RTDI are of the same order of magnitude as or exceeded the national budget for civil R&D, so that Structural Funds roughly double (or more than triple in the case of Latvia) the volume of government funding to R&D in the country. In EU-15 Member States, Structural Funds for RTDI are more modest compared to the national civil R&D budget (1 % to 5 %) but still substantial, in particular in Portugal, Spain and Italy http://ec.europa.eu/research/innovation-union/pdf/competitiveness_report_2013.pdf

156 https://ec.europa.eu/research/regions/documents/publications/synergies_expert_group_report.pdf

157 COWI final evaluation 2014.

create the latest laser equipment in the world as a distributed infrastructure in the Czech Republic, Hungary and Romania; the European Spallation Source (ESS) project, which aims to build a powerful neutron facility of the next generation in Sweden.

The interim evaluation of F7 concluded that a strategic shift is needed to establish stronger and better connections between research, innovation and education (the so-called knowledge triangle). The HLEG concurred that FP7 was a key element of the Union's efforts to achieve policy coherence, horizontally and vertically, in the European research and innovation systems. At the same time, in their view, the initiatives often appear loosely coordinated.[158]

6.4.3. *Coherence with wider EU policies and international obligations*

FP7 contributed with its results to the development and implementation of EU policies (see above) and contributed to important international commitments such as the Kyoto Convention, the Convention on Biological Diversity, the Biosafety Protocol, the Plan of Implementation adopted at the World Summit on Sustainable Development, the Millennium Development Goals and the Sustainable Development Goals. Such contribution came from different channels, like:

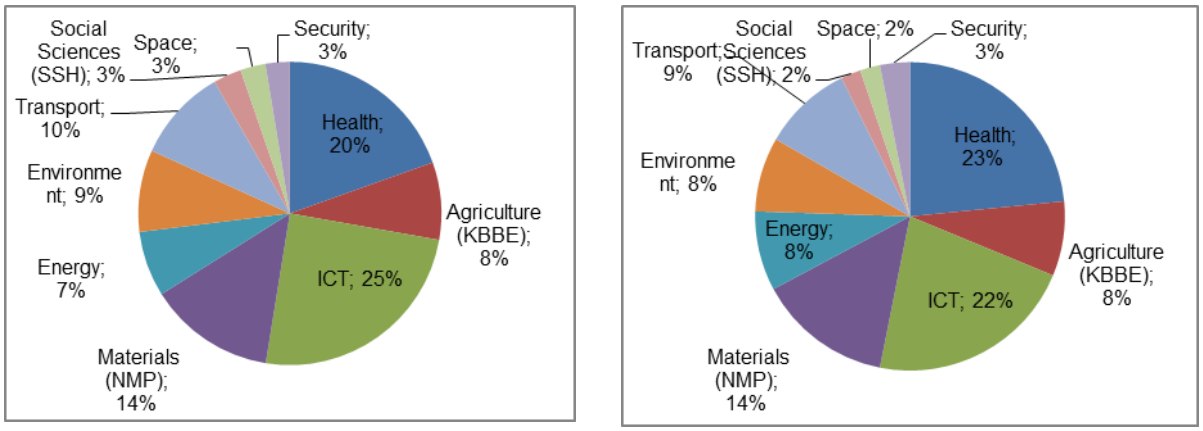
- Knowledge creation, through projects that were funded by FP7. This evidence and analytical tools were then used to design policies, either directly or indirectly (i.e. "translated" to policy by knowledge brokers such as the European Environmental Agency, the JRC or consultancies).
- Creation of international scientific communities/networks that provided the relevant evidence, expertise and scientific consensus for those policies and international commitments.
- Through the involvement of the own European Commission staff in international negotiations, based on the knowledge created by FP7 projects. This is the case of the recently approved SDGs and their references to Science, Technology and Innovation based on co-creation, i.e. beyond the tradition technology transfer approach.

Another example is the active role played by FP7 in implementing the Global Earth Observation System of Systems (GEOSS). GEO is an intergovernmental organisation of 89 governments and around 80 international organisations, which together develop projects and coordinate their strategies on earth observation. GEOSS is critical to tackle global challenges such as climate change, energy and food security, or health. The European Commission is one of the four co-chairs of the Group on Earth Observation (GEO), and FP7 contributed through projects and coordination (see also the example below, of the IPCC – it is a similar case, less known).

One important milestone in the development of international climate policy is the adoption of the International Panel on Climate Change (IPCC) report. Results from at least 728 FP7 Environment projects were quoted in the 5th IPCC Report. FP7 - Cooperation - Environment facilitated the international co-development of climate change models, ensuring the completeness of systems. It helped create a process of mutual learning and efficient knowledge creation and international standards to avoid fragmentation of research and funding. Similar progress is apparent in areas such as greenhouse gases (GHG) measurement and ocean acidification and carbon sequestration. FP7 strongly contributed to the sustainable

[158] HLEG p 58.

development strategy[159]. Overall, about 75% of the topics, 69% of the projects and 76% of the funding (i.e. EUR 19.6 billion) contributed to sustainable development (measured by the EU Sustainable Development Strategy - EU SDS). Graph 17 shows how this contribution was made by the different priorities.



Graph 17: Share of projects and of EC contribution to project contributing to at least one of the 78 EU SDS operational objectives in the FP7 - Cooperation 2007-2013.

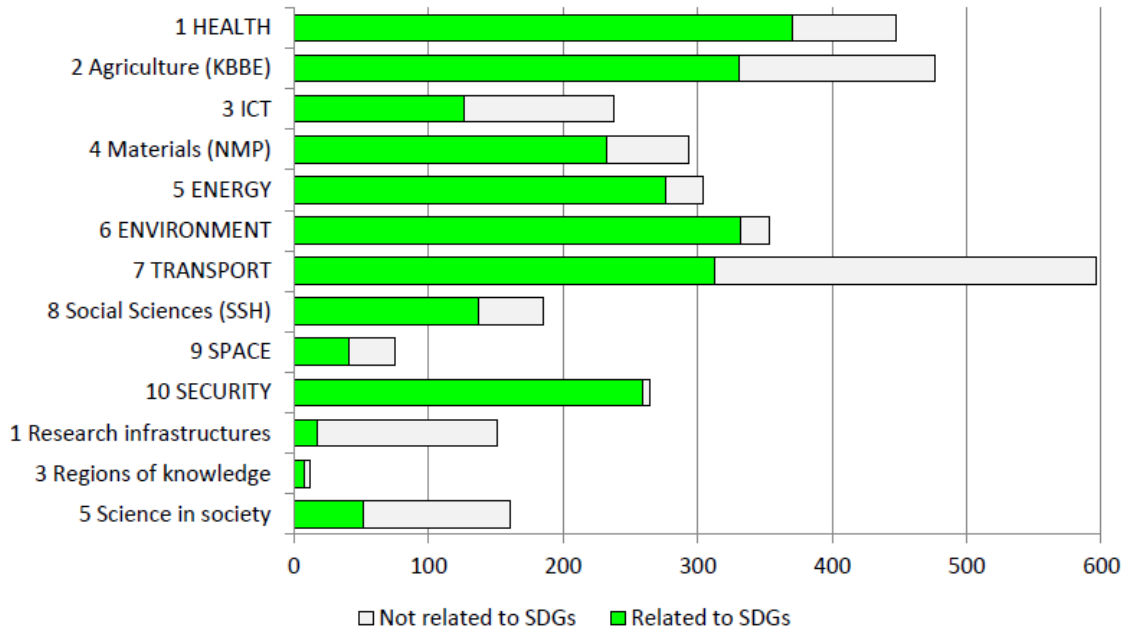
Source: R4SD study

Furthermore, FP7 ('Cooperation' and 'Capacities' Specific Programmes) was already in line with the targets of the "Sustainable Development Goals"[160] (SDGs) adopted by the United Nations in September 2015 (Graph 18). Overall, about 2,500 topics from 2007 to 2013 were related to one or more of the 17 SDGs. In particular, projects contributed to ensuring sustainable consumption and production (SDG 12), promoting health and well-being (SDG 3), improving cities and human settlements (SDG 13), promoting access to energy (SDG 7) and building peaceful and inclusive societies (SDG 16). This corresponds to a share of 70% of all topics. The 4,980 projects received an FP7 contribution of about EUR 20 billion, corresponding to 72% of the financial contribution in these Specific Programmes[161].

159 The overarching aim of the Co-operation Specific Programme was to contribute to sustainable development. The monitoring system focused the analysis on the projects funded by this Programme. The study comprised information on about 3,234 topics (from the 'Cooperation' Work Programmes 2007 to 2013) and 6,967 projects (from the years 2007 to 2013) with more than 79,000 project participations and a total EC contribution of EUR 25.7 billion.

160 Transforming our World: The 2030 Agenda for Global Action (Final Draft of the outcome document for the UN Summit to adopt the Post-2015 Development Agenda)

161 Ibidem



Graph 18: Number of topics related to the 17 SDGs in FP7 "Cooperation" and "Capacities" Programmes
Source: R4SD study

6.5. What is the EU added value of FP7?

6.5.1. Additional value resulting from the EU intervention

As regards EU Added Value, the HLEG endorsed the conclusion that FP7 has demonstrated improvements in the areas of developing a culture of networking and cooperation; facilitating European excellence and capacity building; developing critical mass; fostering mutual learning and harmonisation in Europe; avoiding redundancies and acting economically and effectively; fostering the strategic orientation of participants' research and innovation activities; and enhancing a culture of competition capability and excellence in Europe.[162]According to the respondents to the online stakeholder consultation, the three most important areas of FP7 added value[163] are: tackling pan-European challenges; increasing competition in research; and enhancing researchers' mobility.

6.5.1.1. Economic Impact

An ex-post simulation indicates that the probable cumulative direct job creation effect of FP7 (researchers supported) amounts to 950,000 full time equivalents until 2030. The indirect job creation effect is difficult to calculate, but the same ex-post simulation indicates that the probable cumulative indirect job creation effect of FP7 amounts to 2,900,000 full time equivalents until 2030.[164]

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162 'European added value of EU Science, Technology and Innovation actions, Vullings 2014.

163 The areas of EU added value: Tackling pan-European challenges, Coordination of national research policies, EU scale of dissemination of research results, Pooling of resources (achieving critical mass; economies of scale and scope), Reduction of research/commercial risk, Increase competition in research, Leverage on private/public investment, Improving S&T capabilities and Enhance researchers' mobility. See Annex 2.

164 This result was produced by the Nemesis model (See Annex 23). It is hypothetical as the simulation isolated the impact of the FP7, implying that no further FP7 funding would continue after the

The HLEG estimated that FP7 directly created 130,000 jobs per year over a 10 year period in total 1.3 million jobs per year, and indirectly 160,000 jobs per year, which amounts to 4 million over a period of 25 years. They considered that the results seem modest, but that it has to be considered that FP7 was an instrument of research and innovation policy addressing excellence, competitiveness and societal challenges and not an instrument of job policy.

In terms of contribution to GDP, the ex-post simulation indicates that FP7 resulted in a probable cumulative increase in GDP of EUR 398 billion until 2030, i.e. an extra 0.12% annual GDP growth.[165] The HLEG estimated an additional annual EU GDP of EUR 20 billion for the next 25 years totalling EUR 500 billion.

6.5.1.2. Societal Impact

According to the HLEG, FP7 has strongly reinforced the commitment of the EU to funding research that is of relevance to solving societal challenges. Despite the fact that the evidence on impacts of FP7 on society in general is still very limited, addressing certain societal challenges through research, technology and innovation was found to be one of the ten key achievements of FP7.

Societal benefits can be illustrated by the following examples:

- **FP7 – Cooperation - Health** research provided solutions and best practices for improvement of health care. Achievements include new screening methodologies in diabetes and Alzheimer's disease; a portable PET scan that was brought to market in three years; an oral test for the diagnostic of breast cancer; and more rapid identification of new therapeutic targets in areas of autism and schizophrenia. This will contribute to speeding up the development of new medicines in Europe. A total of 1,008 projects were funded with EUR 4.8 billion.
- **FP7 – Cooperation - ICT** promoted for instance photonics and robotics.[166] Independent experts pointed out that the scientific impact is particularly strong for the ICT programme. Academic areas such as Artificial Intelligence, Internet of Things, Media, and Quantum Computingwere cited as good examples for advancing the state of the art of knowledge areas[167]. A total of 2328 projects were funded with EUR 7.9 billion.
- **FP7 – Cooperation - Energy** research in renewable energies such as wind, solar and biomass, addressing the performance of materials and hydrogen storage, in order to improve energy efficiency and the security of supply and to reduce pollution. A total of 374 projects were funded with EUR 1.9 billion.

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completion of FP7. The economic impacts simulated in this evaluation cannot be compared with the simulations in the ex-ante impact assessment of FP7 due to different methodologies being used.

165 Annex 23

166 The robotics programme is international recognised in areas such as eInfrastructures and SmartCities and collaborates on coordinated calls with Japan and Brazil, and targeted openings with Korea, South Africa and China. ICT has also supported a quick evolution in eInfrastructures, identified as GÉANT. From an average bandwidths 155Mbps in 2000 GÉANT now operates at speeds of up to 500 Gbps, connects over 50 million users at 10,000 institutions across Europe, and offers unrivalled geographical coverage (43 countries in Europe plus 65 beyond), remaining the most advanced research network in the world. SmartSantander is an example of city-scale "smart city" supported by the programme, making technology and sensors useful for the people. In 2011 the EU "Green Smart City" cooperation with China was launched, establishing an expert framework for promoting EU-China Smart Cities cooperation.

167 PwC and OpenEvidence, forthcoming.

- **FP7 – Cooperation - Environment** addressed environmental, climate change and resource efficiency issues e.g. with projects on earth observation, assessment tools for sustainable development and environmental technologies. A total of 494 projects were funded with €1.7 billion.
- **FP7 – Cooperation – SSH** research contributed to creating jobs and improving the employability of people at risk (minorities, youth, older people) and to stimulating local economies, for instance, increasing tourism as a result of excavations. Other achievements include the development of services for corruption reporting, which have effectively increased citizens' co-responsibility in different EU countries. A total of 253 projects were funded with EUR 579 million.
- **FP7 – Cooperation - Security** stimulated European security research and contributed to reducing the fragmentation of the research community. In addition to the direct benefits resulting from projects, i.e. in the fields of disaster management or societal impacts, FP7 Security Research engaged more end-users in projects, created end-user communities and contributed to standardisation activities. A total of 319 projects were funded with EUR 1.3 billion.
- The **Clean Sky JU** stimulated developments towards the environmental targets for reducing emissions and noise in air transport in Europe defined by the Advisory Council for Aeronautics Research in Europe (ACARE) in Vision 2020. For instance, technologies developed within the Green RotorCraft demonstrator (integration of technologies and demonstration on rotorcraft platforms - helicopters, tilt-rotor aircraft) have resulted in a reduction of 30% for CO2 and 47% for noise compared to the targets of -25% CO2 and -50% noise respectively . A total of 474 projects were funded with EUR 1.9 billion.
- In the area of **Space, GMES/Copernicus** delivered pre-operational services for environment and security. The GMES/Copernicus Emergency Management Service emergency response management service helped the EU and non EU citizens in dealing with emergency situations through rapid mapping during the response phase of natural hazards. As an example, the European Flood Awareness System (EFAS) has been delivering early warnings of possible major flooding events to national services since 2012 across the EU. The GMES/Copernicus land monitoring service contributed to environmental challenges such as deforestation and forest degradation. The GMES/Copernicus marine and atmospheric monitoring pre-operational services produced observations and forecast on the state of the Earth's environment addressing both Europe but also the global aspects. A total of 276 projects were funded with EUR 713 million.
- **FP7 – Cooperation – Transport – Galileo.** The programme brings societal benefits in various areas, for example EGNOS in aviation permits safer flight operations in low visibility conditions (like demonstrated by the HEDGE project). 120 M€ (3 times €40M: 2007, 2008 and 2011) was spent on grants for satellite navigation (Galileo and EGNOS). In the area of location-based services, the INCLUSION project introduced the first sat-nav solution specifically designed to support motor impaired people, aimed at improving their mobility in safe conditions. In the same areas, the LIVELINE project accomplished the objective of developing a secure location sharing service based on EGNOS for vulnerable people such as children and the elderly. A total of 701 projects funded with EUR 2.3 billion.
- New developments realised through **nanotechnology** in the fields of medicine, electronics and materials. A study on Industrial technologies points out the positive impacts of FP7 NMP Theme on the Grand Challenges in EU Member States. A total of 804 projects were funded with EUR 3.2 billion.

A network analysis study found that FP7 contributed to the realisation of ERA by increasing the integration of ERA countries; by increasing cross-sector integration; by including new participants in research projects with potentially effects on innovation; and by increasing multi-disciplinarity, especially in 'Capacities' and 'Cooperation'. [168] According to the HLEG, one of the ten key achievements of FP7 was that it "strengthened ERA by catalysing a culture of cooperation and constructing comprehensive networks fit to address thematic challenges". It concluded that "a unique capability of cross-border and cross-sector cooperation was promoted, with organisations from on average 6 countries collaborating in projects funded by FP7 'Cooperation' and 'Capacities'.[169]

6.5.1.3. Tackling pan European challenges

FP7 addressed **transnational** pan-European challenges (e.g. environment, health, food safety, climate change, security, employment, poverty and exclusion) and facilitated the establishment of a common scientific base in these areas, which could not have been achieved by Member States alone.

FP7 – Cooperation – Security was the first Framework Programme with such a theme. It helped create a true European Security Research Community, reducing fragmentation. There is considerable added value given that the Commission contribution made available through FP7 Security Research represents more than 50% of the EU-wide public financing for security research.

FP7 – Cooperation - Environment enabled the worldwide development and implementation of climate change models, ensuring the completeness of the systems. The global coordination of Member States earth observation systems was attained through the implementation of the Group on Earth Observation (GEO), in which the Commission is one of the four co-chairs[170].

FP7 – Cooperation – SSH contributed to Europe 2020 targets such as increasing employment, reducing poverty, and reducing early school-leaving. TENLAW is an example of a FP7 contribution to successful housing policies for low income households. This project e.g. provided the first large-scale comparative and European law survey of tenancy law.

6.5.1.4. Additionality

The EU added value of FP7 is illustrated by the fact that only a small proportion of FP7 funded projects would have gone ahead without FP7 funding. The HLEG underlined that "additionality was very largely demonstrated" for SME participation.

In **FP7 – Cooperation - Energy**, 70% of survey participants indicated that their project would not have been carried out without EU funding. 40% of unsuccessful participants reported that proposal preparation helped establish business contacts leading to another FP proposal or cooperation activities. Since the percentage of unsuccessful participants seeking other forms of financing was

168 Study on Network Analysis of the FP7 participation, Technopolis (2015).

169 In this context, the RPO study concurs that FPs promoted and fostered cross-border cooperation of RPOs in Europe allowing the knowledge transfer from EU 15 to EU13 (the most frequent partners of EU 13 RPOs were RPOs and universities from Germany and UK).

170 GEO is an intergovernmental organisation of 89 governments and around 80 international organisations, which develop together projects and coordinate their strategies on earth observation. GEOSS is critical to tackle global challenges such as climate change, energy and food security, or health.

not very high (21%), it can be assumed that project participants tend to develop research projects and ideas that are aligned with FP programmes priorities[171].

In **FP7 – Cooperation - NMP**, without FP funding, 46% would have dropped the project; 46% would have looked for other sources of funding, e.g. national programmes; and 8% of survey participants indicated that they would have undertaken the activities in any case. In the case of PPPs, 37% of participants would pursue the project in the absence of FP7 funding as project developments are closer to the markets (i.e. higher TRL).

In **FP7 – Cooperation – Transport**, half the projects would not have been launched in the absence of FP funding or would have been launched on a more reduced scale and scope. This is reported to be particularly true for aviation and shipping, which are by nature international.[172]

In **FP7 – Cooperation – Space**, 58.2% of respondents suggested that their projects could not have been supported by a national scheme or ESA, whereas 34.8% reported that only some of the projects could have been supported under these two possibilities. Only 7.1% of the survey respondents thought that their projects could have been funded by alternative sources.

In **FP7 – Cooperation - Security,** more than 80% of survey respondents indicated that the project would not have been carried out without FP7 funding.

As regards the **FP7 – People –MCAs**, evidence shows that only 1% of projects rejected by MCAs due to budgetary reasons were subsequently implemented as originally planned. Some 17% went ahead with the projects after some changes to the original design. 82% of non-successful applicants abandoned the projects.

FP7 - Capacities: 70% of the projects surveyed stated that their project would not have been possible without FP7 funding; the remaining 30% considered that it would have been possible to find alternative funding, but in almost all cases on a reduced scale or more slowly.

6.5.1.5. Pooling of resources and critical mass

Many societal challenges are of such a scale and complexity, requiring different types of knowledge and skills from different sectors and disciplines to resolve them, that no single Member State can provide the necessary resources. Activities addressing them need to be carried out at EU level to achieve the required critical mass. According to the HLEG, one of the ten key achievements of FP7 is that it reached a critical mass of research across the European landscape and worldwide. The HLEG highlighted in particular the critical mass achieved by the JTIs.

FP7 – Cooperation – ICT-funded eInfrastructures provided access to innovative infrastructures offering high-capacity services not matched by any commercial or national offer. Similarly, for the two FET Flagships (Human Brain Project and Graphene), there was the need to create critical mass (e.g. quantum computing), to reduce costs (e.g. photonics), and to unify resources on a scale that no Member State alone could have afforded, in terms of both financial support and cooperation among multi-disciplinary teams. In the area of "Future Internet", the EU set the research agenda, helping the industry coordinate the various streams of research,[173] and facilitated cooperation in standardisation[174].

171 Source: Evaluation of the impact of projects funded under the 6th and 7th EU Framework Programme for RD&D in the area of non-nuclear energy, Technopolis, June 2014.

172 TRI-VALUE study.

173 Big companies invest large shares of their turnover in R&D, so the level of funding is not comparable to EU resources, but these enterprises invest in technologies that are much closer to the market. The EC plays a key role in keeping open resources for long term risky domains, and it has to engage in strategic thinking and help the convergence process, giving prominence to certain areas. In the telecom area for instance, the main players in the provision of networks in Europe take to the Programme, as they benefit from cooperation in order to maintain their global position. Core work on future generations of

FP7 – Cooperation – NMP: Respondents considered the ability to reach critical mass a reason to participate in FP7[175] as it facilitated access to additional funding (54%) and to external knowledge (44%), and provided the opportunity to work with strategically relevant research units/enterprises, access to networks (36%), and access to R&D networks or research organisations (35%).

FP7 – Cooperation – Transport - Galileo. The projects on satellite navigation drew partners from 48 different countries. There were a total of 425 organisations involved. Three to six partners was the most common format, while groups of up to 13 were occasionally seen, which demonstrate an unprecedented (in the area) approach for developing common technologic solutions across countries.

FP7 – Ideas generated economies of scale. Increased competition led to a higher overall quality of research and promoted specialisation. By deciding centrally what proposals to support, the risk of duplication of research was limited; and it was less costly to employ the experts needed for the high-quality assessment of the project proposals. The quality of the ERC's peer review has already been widely recognised by the research community[176].

FP7 – Capacities - Research Infrastructures including eInfrastructures actions fostered the creation and increase of critical mass in research, including by funding transnational access for small and newer Member States.

FP7 – People - MCA also made a significant contribution to structuring the European research landscape by promoting transnational and inter-sectoral mobility as well as opening research careers at European and international level.

In **Euratom**, FP7 optimised investments from several Member States as they operated collectively to reach a scale beyond individual possibilities in fission and fusion research.

Cohesion policy investments in 2007-2013 focused in particular on the development of research infrastructures, where some 11.4 billion EUR from ERDF have been invested.

6.5.1.6. Creating networks and increasing the EU's attractiveness as a place to carry out research

FP7 helped to create durable cross-border, cross-sectoral, inter-disciplinary networks. The implementation of R&I projects induced well-structured and sustainable teams, well-integrated into global innovation networks (see section 6.1.2). The HLEG concurred that FP7's collaborative approach constructed comprehensive networks fit to address thematic challenges and lists this among the ten key FP7 achievements.

FP7 – Cooperation - NMP: more than three-quarters of participants confirmed that the primary advantage of European level funding is the opportunity to participate in international networks and wider consortia.

FP7 – Cooperation - FAFB: participating public research organisations tend to have more cooperation agreements with the private sector than non-participating ones (+15%).

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telecommunication networks is done in the FP projects, in order to give "breathing space" to these otherwise competitors for research and development work.

174 Interoperability across infrastructures, players and service providers remain a very strong incentive for collaborative research in these domains. Even if the standards are eventually not developed by projects but by companies, their participation in projects allows them to diminish the risk of available options and lower the costs and the barriers. The world standard in the field of car electronics was developed thanks to an EU-funded project CESAR. This puts EU manufacturers who have worked together on this standard at the leading edge world-wide. It also puts car electronics suppliers such as Bosch and Infineon in the pole position. Europe is the world leading region in car electronics with more than 40% of world production done in Europe.

175 Ex post evaluation and impact assessment of funding in the FP7 NMP thematic area, Technopolis/Fraunhofer, 2015.

176 Review of the European Research Council's Structures and Mechanisms (July 2009).

The **Euratom** fusion programme: Through its focus on education, training, mobility and the exploitation of key infrastructures such as the Joint European Torus (JET), enabled researchers from across Europe to participate in a cutting-edge and well-integrated research programme.

FP7 – Cooperation – ICT: In areas such as high-performance computing, collaboration across the EU helped minimise internal disparities, allowing smaller and less-resourced countries to afford advanced systems. Fostering collaboration between universities and industry players was seen as a crucial benefit, encouraging in some cases longer-term thinking and riskier investment, notably by SMEs.

FP7 – People – MCA: Research organisations in EU-15 Member States and large third countries (i.e. US and Japan) acted as gateways for weaker Member States to access excellence networks.

FP7 - Cooperation - SSH: As a result of European cooperation guidelines, 95% of the projects have engaged with citizens or civil society organizations and 92% with governments or policy-makers, enhancing the social and political impacts of research.

FP7 enhanced researcher mobility across borders. FP7 – People - MCA supported about 50,000 researchers (including approximately 10,000 PhD candidates) of over 140 different nationalities working in more than 80 countries between 2007 and 2013. MCA have facilitated industry-academic collaborations on risky and innovative research projects on a European scale, which otherwise would not have been supported.

The findings of a study on university participation in the FPs[177] show that participation in the FPs improved the reputation of the university and increased the frequency of external collaboration. At the same time, the study indicated that participation in the FP had limited effects on the number of students and visiting researchers.

6.5.2. Extent to which the issues addressed continue to require action and consequences of stopping EU intervention

As assessed in detail in the Impact Assessment accompanying the Commission proposal for Horizon 2020, European challenges remained and others appeared after the conclusion of FP7, which continues to justify EU intervention in the field of research and innovation. Stopping EU intervention in the field of Research and Innovation - discontinuation of the FP - is a hypothetical option since the Treaty contains specific obligations to carry out Community research. However, the amount of funding provided at EU level and the content and range of projects financed could vary significantly.

The risks of limiting EU intervention are that it would stop in its tracks the process of building an integrated ERA, and would lead to greater fragmentation and inefficiency of research efforts in the EU. Research teams would carry out far fewer projects on a European scale and would become more dependent on the resources and knowledge available in their own country. Reduced cooperation would have a weakening effect on the transfer of knowledge in the EU. Some important fields of S&T could therefore advance more slowly, while some countries may find that their capabilities in particular research fields are declining due to inadequate interaction with top teams located elsewhere. There would be fewer assurances of coherence and critical mass in research activities contributing to overall EU objectives. In terms of the coordination of national programmes, the EU would return to the uncoordinated pre-ERA period, with 28 Member States and numerous regions defining their research priorities independently from each other and from the EU.

[177] An analysis of the role and engagement of universities with regard to participation in the Framework Programmes is forthcoming.

7. LESSONS LEARNT FROM THE EVALUATION

7.1 Implementation Issues

The evaluation has highlighted a number of significant shortcomings in the implementation of FP7. Notwithstanding the measures that were introduced in the course of the Programme, FP7 did not involve large-scale simplification of rules for applicants and beneficiaries. Overall, the level of complexity and the lack of consistency between different parts of the Programme meant that the rules remained too complex. This explains, at least in part, the relatively high error rate associated with FP7 and is a point that the Court of Auditors has highlighted in its reports.

While FP7 as a whole proved adaptable to changing economic circumstances and the Programme was structured in a transparent way into four Specific Programmes with explicit priorities, the different components of FP7 operated too much in a rigid and isolated manner. This led to overlaps between objectives of different parts of individual Specific Programmes.

FP7 sought to ensure complementarity with other programmes such as the Competitiveness and Innovation Programme and the European Institute of Technology, as well as the Structural Funds. However, the separate legal bases and differences in implementation rules meant that progress was more limited than required to ensure effective synergies between FP7 and other programmes.

7.2 Evaluation Process

Taking stock of the process of carrying out the evaluation also allows us to draw a number of lessons.

Firstly, an impressive evidence base has been compiled as a basis for the evaluation, comprising more than 120 evaluation studies as well as data from Programme implementation, survey information, and stakeholder views.

Accordingly, the evaluation strategy has remained overly bottom-up in approach, with no common methodology for evaluating the different parts of the programme, inadequate co-ordination of the evaluation process from the outset and no common database. For the future, it is essential to apply harmonised evaluation methodologies in order to achieve common and comparable evaluation results. This is a prerequisite for rigorous analysis and comparison across themes, as well as for the assessment of the adequacy of funding instruments.

Secondly, and related to this, the absence in the majority of areas of counterfactual studies has hindered the evaluation of the effects of FP7 funding on participants. Appropriate methodologies for gathering counterfactual evidence must be an integral part of Framework Programme evaluation henceforth.

Thirdly the current approach to Framework Programme evaluation, developed with the aim of demonstrating the direct achievements, is inadequate to demonstrate the contribution of the Framework Programme to the wider economy and society. Accordingly, new data and text-mining techniques and evaluation methodologies are needed in order to be able to evaluate the longer-term socio-economic impact of the Framework Programme.

8. CONCLUSIONS

FP7 was the largest consolidated effort and investment in EU research and innovation history. It was effective in promoting excellence in research and competitiveness, in contributing to solving societal challenges, in strengthening human potential and researcher mobility, and in fostering transnational research cooperation.

FP7 contributed to fostering excellence by attracting excellent EU and non-EU researchers in more than 25,000 projects carrying out excellent, inter-disciplinary, collaborative research and producing excellent knowledge. FP7 publications had a larger than average share among the top 1% and 5% cited publications, more than 1,700 patent applications and more than 7,400 commercial exploitations. Total number of publications that can be attributed to FP7 is more than 170,000.

Given that FP7 only account for a small proportion of total public R&D expenditure in Europe, its economic impacts are substantial, through the leverage effect of various instruments, its impact on GDP and its effects on employment. It is estimated that FP7 will increase GDP by approximately EUR 20 billion per year over the next 25 years in total EUR 500 billion through its indirect economic effects and create over 130,000 research jobs per year and 160,000 additional jobs per year indirectly. There is also evidence of positive impacts in terms of micro-economic effects with participating enterprises reporting innovative product developments, increased turnover, improved productivity and competitiveness. It is, however, too early to make a final assessment of the market impact of FP7 projects.

FP7 created durable, inter-disciplinary, cross-sectoral networks, with organisations from on average six countries collaborating in FP7 funded projects.

The new initiatives launched to engage industry and SMEs (e.g. JTIs and other PPPs) have proven effective in exploiting cross-thematic links and engaging private and public partners. The focus on fostering the participation of SMEs to encourage their growth through new technologies, products and processes paid off at an increasing rate as FP7 progressed. The Risk-Sharing Finance Facility proved effective in providing loan finance to R&I companies, achieving a wide geographic spread and sectoral distribution and enabling the EIB to increase its capacity to make higher-risk loans.

FP7 enhanced the training and long-term mobility of researchers, enhanced the quality of doctoral training, and helped improve working conditions for researchers in the EU. FP7 also supported the development of scientific careers and reinforced the attractiveness of the EU as a place to carry out research.

FP7 helped improve the coordination of European, national and regional research policies. FP7 contributed to smart specialisation strategies, to a broad range of Community instruments and to meeting the international obligations of the EU. FP7 was open to the world with participants from 170 countries. It had a positive effect on widening participation and building ERA.

The simplification measures introduced during FP7 contributed to reducing the overall administrative burden, notably in terms of access to information and application procedures, including ex-ante controls, when compared to FP6. However, further room for improvement remains as confirmed by various stakeholders.

While FP7 as a whole had a clear structure around four Specific Programmes with explicit objectives, this structure led to a silo approach to implementation that proved an obstacle to

its optimum functioning. FP7 could have provided for greater flexibility across its individual Specific Programmes.

Although there was a commitment to capitalising on complementarity with related programmes, differences in legal bases and implementation rules hindered the achievement of the necessary synergies between FP7 and programmes such as LIFE, the Competitiveness and Innovation Programme and the European Institute of Technology, as well as the Structural Funds.

Finally it should be noted that this evaluation cannot and does not present a complete picture of FP7 results and impacts. The main reason is that this evaluation builds to an important extent on project final reports and that so far only 12,149 FP7 projects (accounting for about 50% of the total number of FP7 projects) have finished.

In addition, there is the well-known 'time-lag' issue, i.e. the fact that research projects take time to produce societal impacts: it takes years before the new knowledge generated within the scope of a single project or a portfolio of projects is valorised in the form of new products, processes and services and economic, social and environmental impacts. FP7 also accounts for a mere 7% of total public budgets and outlays for R&D (GBAORD) in Europe and, apart from FP7, a variety of other factors (economic growth, other policies) influence the uptake of research results.

This is a significant point. There are indications that the increased emphasis in the later stages of FP7 on innovation and industry participation in order to respond to the economic-financial crisis is beginning to generate positive micro-economic effects. Participating organisations are reporting innovative product, process and service development, higher Technology Readiness Levels, and increased productivity and competitiveness. However, it is too soon to make a final assessment of the impact of FP7 on EU competitiveness.