EUROPEAN
COMMISSION

Brussels, 19.1.2016
SWD(2016) 2 final

PART 2/3

Ex-Post Evaluation of the Seventh Framework Programme

COMMISSION STAFF WORKING DOCUMENT

Annexes

Accompanying the document

COMMUNICATION FROM THE COMMMISSION TO THE COUNCIL, THE EUROPEAN PARLIAMENT, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

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

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{SWD(2016) 1 final}

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Contents

1. PROCEDURAL INFORMATION CONCERNING THE PROCESS TO PREPARE THE EVALUATION

Lead DG: Directorate General Research and Innovation (RTD)

Agenda Planning number: *2015/RTD/004 Commission Communication on the ex-post evaluations of the EC and Euratom 7th Framework Programmes*

The Ex-Post evaluations of the EC and Euratom Seventh Framework Programmes started in 2014. The main justification derives from Article 7 paragraph 3 of Decision 1982/2006/EC setting up FP7 which stipulates that "two years following the completion of this Framework Programme, the Commission shall carry out an external evaluation by independent experts of its rationale, implementation and achievements".

At the first stage the Inter-Service RTD Evaluation Network functioned as the Inter-Service Group (ISG) for this evaluation. After the adoption of the Better Regulation Guidelines a specific ISG was set up in June 2015 specifically for the preparation of the Staff Working Document on FP7 Ex-Post Evaluation[1]. This ISG met three times before the submission of the Staff Working Document to the Regulatory Scrutiny Board (30 June, 29 July and 3 September 2015).

In accordance with the feedback received from the Regulatory Scrutiny Board, the Staff Working Document has been revised in the following ways. The qualitative assessment of the different aspects of FP7 has been strengthened. This has included greater explanation of the reasons why certain aspects of FP7 were particularly successful while others worked less well.

In this regard, a more detailed assessment of the impact of simplification measures introduced in FP7 has been included. Greater attention has also been paid to setting FP7 in the wide global context and its contribution to the EU's objective of becoming the world's leading research area. Further analysis has also been added as regards the coherence between FP7 and other related programmes, including the Cohesion Funds.

Metholodogical and presentational aspects have been clarified. The intervention logic has been made more transparent. Graphical presentation of data has been streamlined to make FP7 results and outcomes more comparable.

The evaluation studies used for this evaluation are listed in Annex 4 and the results of the over 150 evaluation studies are described in Annexes 9-22. Majority of the evaluation studies were carried out by external experts and contractors.

[1] DGs presented in the ISG: RTD, AGRI, CNECT, EAC, ENER, GROW, JRC, MOVE, SG, HOME, REGIO, TRADE, SJ, EMPL and SANTE.

2. STAKEHOLDER CONSULTATION

Introduction

The Ex-Post Evaluation of the 7th Frameworks Programme for Research (FP7), required also by the legal base, is an important instrument for informing the European Parliament and the Council, Member States, the research community, the general public and other stakeholders about the achievements of FP7. It will also contribute to improving implementation of Horizon 2020 and provide a solid evidence base for designing future framework programmes. The evaluation will examine the effectiveness of FP7 implementation, the efficiency of resources used and the wider socio-economic impacts of the Framework Programme.

In order to provide the evaluation with a range of opinions and views about the functioning, achievements, and impacts of FP7, a public consultation ran from February to May 2015 allowing for contributions both from those with direct experience with the FP7, as well as groups or individuals who wished to give their views.

This is an overall summary of the contributions to the consultation.

2.1. Executive summary

In general FP7 was well received: The overall satisfaction with FP7 was high (80 %) among those who participated in the consultation. The key strengths of the programme can be summarised as follows:

- Creating the European Research Area through cooperation and competition: Networking people and organisations over the geographic, sectorial and disciplinary borders (international, inter-sectorial and interdisciplinary collaboration) and funding the highest quality research through competition
- Joint Agenda-setting: Joining forces in solving the grand challenges together (e.g. through JTIs, PPPs, ETPs)
- European Research Council (ERC)/IDEAS Specific Programme was a great success
- Marie Curie Actions/PEOPLE Specific Programme made an important impact for the future of research through training and creating opportunities for mobility

At the same time there were some shortcomings:

- Administrative burden was high and financial and legal rules were cumbersome
- Societal impact was not addressed to a sufficient extent
- Perception of sometimes narrow topics and of difficulty to enter for newcomers: Game of big entities who know how the system works
- Regarding the impact of the Programme, according to the respondents, the biggest impact of FP7 was on scientific excellence and on technological and social innovations.

According to the input received, among the ERA priorities, FP7 contributed most to i) Optimal transnational co-operation and competition, ii) Optimal circulation, access to and transfer of scientific knowledge, iii) Open labour market for researchers. More specifically for SMEs the ERA priority to which FP7 contributed the most was "Open labour market for researchers". At the overall level EU added value of FP7 was demonstrated through: i) Tackling pan-European challenges, ii) Increased competition in research, iii) Enhance researchers' mobility. For individuals the most important area of EU added value was the enhancement of researchers' mobility whereas for ministries and agencies the most important areas were the improvement of S&T capabilities and the increased competition in research. The simplification measures taken were well received, and the need for further simplification was raised by a number of respondents.

2.2.1 EECS/RTD Event "Have your say on FP7"

On 27 October 2015 from 14:30-18:00 the EESC together with RTD held an event on the public consultation. About 120 people participated. The purpose of the conference was to present:

- The FP7 Ex Post Evaluation set-up
- The findings of the online consultation on FP7
- Expert opinions on scientific impact
- Expert opinions on impact on innovation
- Expert opinions on socio-economi impact
- Expert opinions on European added value
- Key achievements and shortcomings of FP7

All the presentations can be found on this link.

The presentations were followed by a moderated discussion allowing participants to air their thoughts and views. The main topics for discussions were: Simplification, open access and industry collaboration, discussion on scope, civil society's role and Technology Readiness Levels.

2.2. Context of the public consultation on FP7

Framework Programmes

The Framework Programmes are the EU's main instruments for the funding of research and innovation in Europe. Based on the Treaty establishing the EU[2], the Framework Programmes serve two main strategic objectives: strengthening the scientific and technological bases of industry and encouraging its international competitiveness while promoting research activities in support of other EU policies.

The 7th Framework Programme (FP7) pursued the general objectives described in the Treaty to strengthen industrial competitiveness and to meet the research needs of other Community policies, thereby contributing to the creation of a knowledge-based society, building on a European Research Area and complementing activities at a national and regional level. It promoted excellence in scientific and technological research, development and demonstration through four specific programmes: Cooperation, Ideas, People and Capacities.

Horizon 2020 is the on-going EU Research and Innovation programme with nearly €80 billion of funding available over 7 years (2014 to 2020). Horizon 2020 aims to contribute to building a society and an economy based on knowledge and innovation across the Union by leveraging additional research, development and innovation funding and by contributing to attaining research and development targets. Horizon 2020 supports the implementation of the Europe 2020 strategy and other Union policies, as well as the achievement and functioning of the European Research Area (ERA).

Evaluation framework

The Decision[3] setting up FP7 stipulates that "two years following the completion of this Framework Programme, the Commission shall carry out an external evaluation by independent experts of its rationale, implementation and achievements." The evaluation is an important instrument for informing the European Parliament and the Council, Member States, the research community, the general public and other stakeholders about the achievements of FP7. It also contributes to improving implementation of the current Framework Programme, Horizon 2020 and provides a solid evidence base for designing future framework programmes. The evaluation examines the effectiveness of FP7 implementation, the efficiency of resources used and the wider socio-economic impacts of the Framework Programme. The evaluation covers the entire period of FP7 implementation in between 2007-2013.

In order to provide the evaluation with a range of opinions and views about the functioning, achievements, and impacts of FP7, the public online consultation was set up to allow for contributions both from those with direct experience with the FP7, as well as any groups or individuals who wished to give their views. The questionnaire is attached as Annex 1.

Responses

202 responses were encoded to the public online consultation between February and May 2015. The responses came from 24 EU member states (all except for EL, HU, LV

[2] The Treaty on the European Union and the treaty on the functioning of the European Union

[3] Article 7(3), see OJ L 412 of 30 December 2006, p1.

and SK) and additionally 6 responses were sent from other countries (such as Switzerland and Turkey). The respondents were asked whether they respond as individuals or whether they represent an organisation. The results are presented separately for overall, individual respondents and for different types of organisations.

- 88 (44%) higher education and public research organisations (HES & RES)
- 70 (35%) individuals
- 20 (14%) private sector (PRC)
- 17 (8,4%) ministries and agencies (PUB)
- 7 (3,5%) SMEs

Most of the questions in the questionnaire were compulsory single/multiple choice questions. In addition the respondents were provided with an option to comment on each theme with an optional open reply. In addition to the responses to the online questionnaire 10 organisations[4] provided their individual written contributions separately. These contributions are referred to at each relevant section of this analysis (*Separate written contributions*).

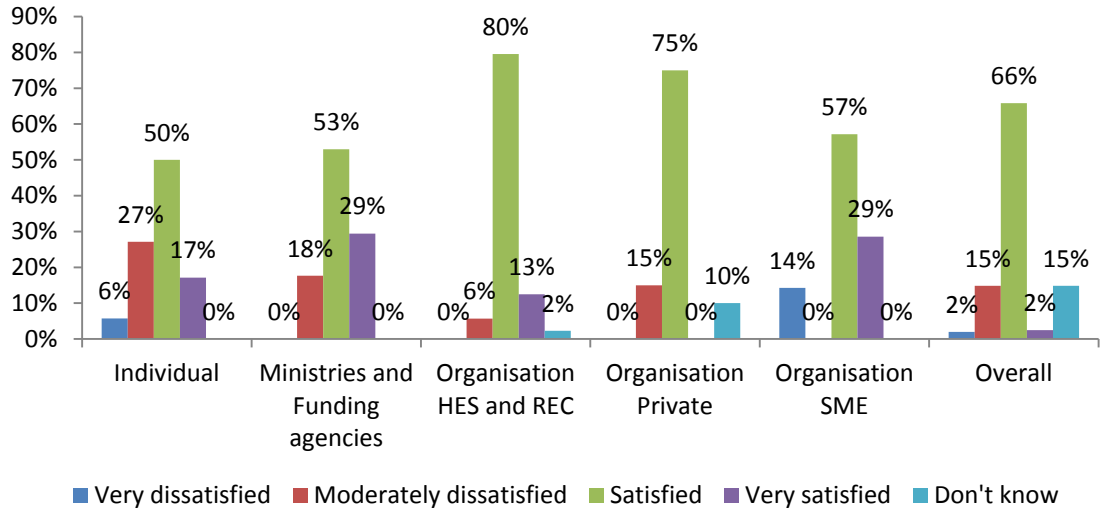
2.3. Key figures on the public consultation and main outcomes

Overall satisfaction and effectiveness of implementation

At the overall level 68 % of the respondents were satisfied or very satisfied with FP7 whereas 17 % were moderately or very dissatisfied. Only a handful of respondents indicated that they were very dissatisfied. Ministries and funding agencies responded "*Very satisfied*" most often, whereas individual respondents tended to respond "*Moderately or very dissatisfied*" more often than other groups of respondents. SMEs were more likely to reply "*Very satisfied*" or "*Very dissatisfied*" compared to other respondents.

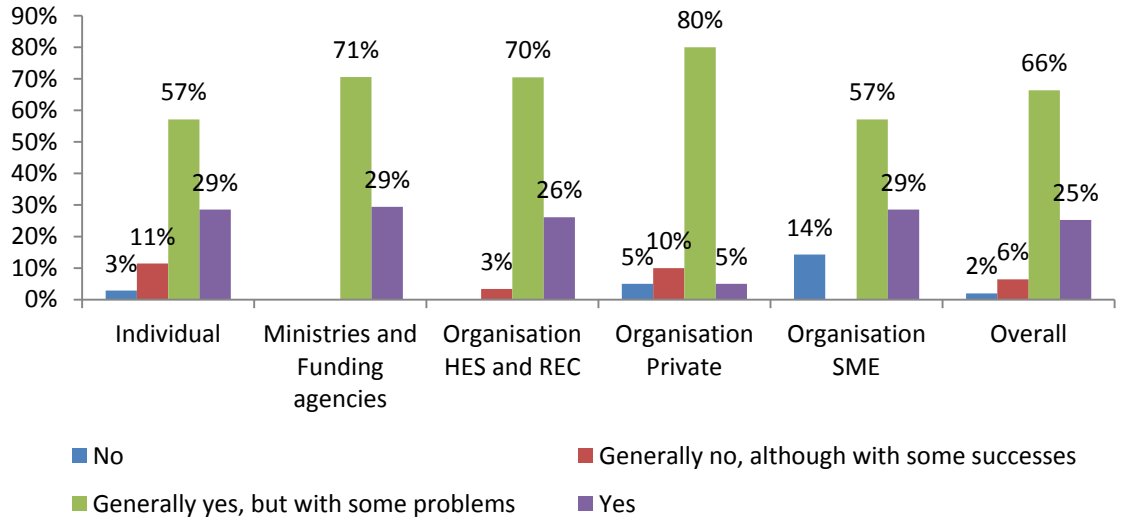
Figure 1. Overall are you satisfied with FP7?

[4] European University Association, Science Europe, Science Europe Scientific Committees of Social Sciences and Humanities, Association of European Research Establishments in Aeronautics, UK Department for Business, Innovation and Skills, Research Councils UK, UK Higher Education International Unit and Universities UK, Swiss National Science Foundation, FR Chambre de Métiers et de l'Artisanat and the National Environmental Agency of Georgia.



The large majority of the responses (92 %) agreed that the implementation of FP7 was effective in general whereas only 8 % considered that the implementation has not been effective.

Figure 2. Based on your experience has the implementation of FP7 been effective?



In the comments received a number of respondents, both public and private bodies, noted that the incoherence in the implementation of rules and regulations influenced the effective implementation of the Programme negatively. According to LERU (League of European Research Universities) "*the vast majority of the problems faced were related to the administrative overhead and red tape they were confronted with when participating in, and especially when coordinating, an FP7 project*."

Separate written contributions

According to the contribution from the European University Association (EUA) FP7 was a key driver of enhanced European university research and innovation development and cooperation. Also, according to the UK higher education institutions the impact of European research depends crucially on international collaboration and the mobility of

researchers across Europe. FP7 was vital in enabling that collaboration and mobility. The Swiss National Science Foundation (SNSF) reported that in general the implementation of FP7 was mostly successful. On the other hand, in its separate input Science Europe, UK Department for BIS and Research Councils UK (RCUK) call for more transparent governance (including consistency, coherence and transparency) and for a more balanced mix of top-down and bottom-up approaches.

Key achievements and strengths of FP7

Question: What are the key achievements/strengths of FP7 in particular?

Key achievements reported by the respondents:

- Creating the European Research Area through cooperation and competition: Networking people and organisations over the geographic, sectorial and disciplinary borders (international, inter-sectorial and interdisciplinary collaboration) and funding the highest quality research through competition
- Joint Agenda-setting: Joining forces in solving the grand challenges together (e.g. through JTIs, PPPs, ETPs)
- European Research Council (ERC)/IDEAS Specific Programme was a great success
- Marie Curie Actions/PEOPLE Specific Programme made an important impact for the future of research through training and creating opportunities for mobility
- SMEs highlighted especially the networking effect of FP7 and efforts made to involve all the different parts of the value chains. For the private companies, one of the key achievements seemed to be the JTIs setting the agenda jointly for the public and private actors. According to HES and REC the key achievements of the Programme were investing firstly in collaborative, transnational research and networking and secondly in scientific excellence through ERC. For Ministries and Agencies the main achievements of FP7 were the input to scientific excellence, notably through IDEAS Specific Programme and to research careers and mobility.

Other observations on achievements by several respondents:

- Level of funding was good (especially compared to the national R&I funding)
- The efforts made to simplify were welcome (e.g. Research Participant Portal) although not sufficient
- The efforts made to widen the access to major research infrastructures were appreciated

Shortcomings

Question: Are there shortcomings in FP7 that you think should be corrected? According to your experience have these already been addressed to in the Horizon 2020 Programme?

Main issues reported by the respondents

- Administrative burden was high and financial and legal rules were cumbersome
- High oversubscription
- Societal impact was not addressed in calls and/or projects to a sufficient extent

- Too narrow topics and too limited call scopes
- Industry participation was neglected: FP7 did not enhance industry participation enough
- Difficult to enter for newcomers: Game of big entities who know how the system works, lack of transparency
- FP7 was fragmented and inconsistent: Need for Commission and Agencies internal coherence (e.g. different interpretations of rules)

While some of the respondents representing industry claimed that the Programme was directed towards the needs of the academia, at the same time some respondents from the HES and REC side considered that public funding should not be channelled to respond to the interests of the private companies. But overall the respondents were quite unanimous irrespective of their background (private or public, SME or individual). Also, it was noted repeatedly that many of the shortcomings of FP7 have been corrected in Horizon 2020. As one individual respondent put it: *"Many shortcomings were addressed in H2020, namely: faster time to grant, more possibilities for open topic calls, decreasing of the fragmentation by programmes, types of instruments etc."*

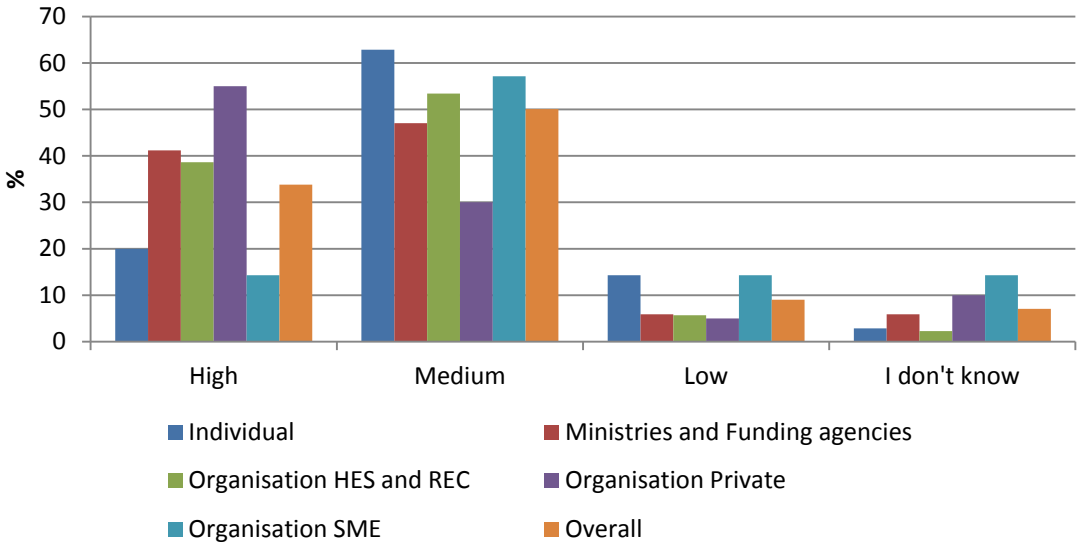
Separate written contributions

SNSF highlighted the following issues as shortcomings: Fragmentation, regulatory and administrative issues (lack of clarity and consistency)

The endurance of FP7 impact

At the overall level nearly 90 % of the respondents considered that FP7 research activities produced enduring impact to high or medium extent. Less than 10 % of the respondents perceived that FP7 produced enduring impact only to low extent. Private organisations (other than SMEs) were more likely to consider that FP7 activities produced enduring impact to a high extent. Individual respondents and SMEs were more likely than others to respond that FP7 produced enduring impact only to a low extent.

Figure 3. Based on your experience to what extent did FP7 research activities produce enduring impact?



Regarding the question "*To what extent did FP7 research activities produce enduring impact for you as FP7 beneficiary (e.g. networking, benchmarking, joint agenda setting and harmonisation of peer review systems)?"* for the individual respondents and for the SMEs the impact on networking was clearly the most important. For the HES and REC the comments concerned the FP7 having a great impact in increasing the collaborations in research projects, partnerships and networking. According to the private companies the impact of FP7 is based on the joint agenda setting and strategic cooperation. For the Ministries and Agencies, the biggest influence of FP7 was on the contribution to the peer learning and exchange of good practices in addition to the networking effect.

Separate written contributions

According to EUA FP7 facilitated scientific and technological cooperation across European universities which will have a lasting effect with respect to academic research staff and young researchers exchange and career development. RCUK believes that funding for transnational pan-European collaborative research lies at the heart of the Framework Programme.

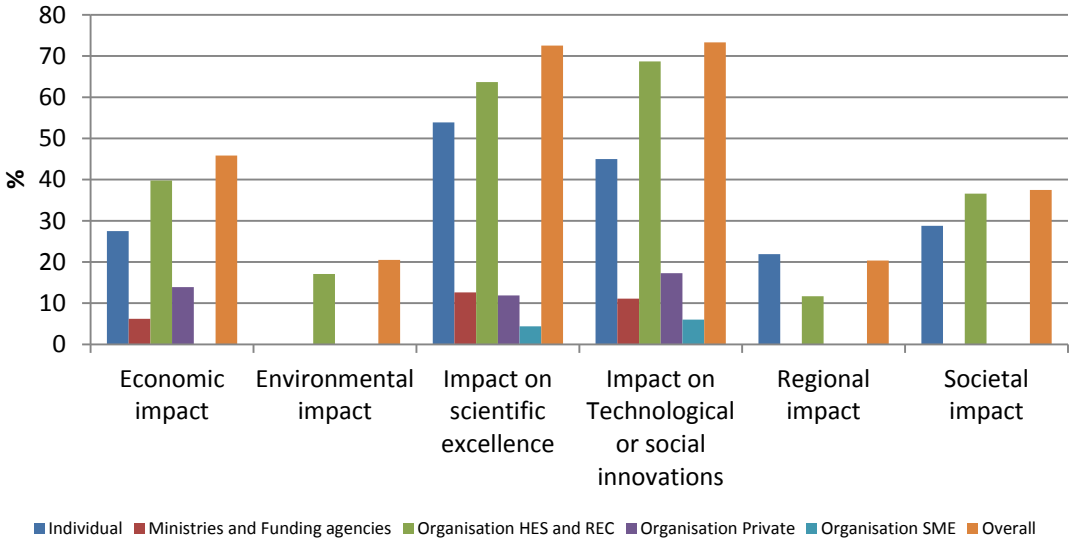
Impact of Specific Programmes

The respondents were asked to assess, for each of the four Specific Programmes of FP7, the areas to which that specific programme created most impact[5].

For all the four Specific Programmes the respondents perceived that the impact of Specific Programmes on scientific excellence was the greatest followed by the impact on technological and social innovations and the economic impact. For the People Specific Programme the Societal impact was considered more important than the economic impact. For Capacities Specific Programme the regional and societal impacts were considered more important than for other Specific Programmes.

Regarding the views of different respondent groups, interestingly societal impact was considered more important by individuals and HES & REC than by other respondent groups.

Figure 4. In which of the following areas did COOPERATION Specific Programme of FP7 generate most impact?



5 The question: "For each of the 6 areas (impact on scientific excellence, impact on technological or social innovations, economic impact, societal impact, environmental impact and regional impact) per specific programme please select the 3 areas which in your view generated most impact and rank them accordingly (3 generating most impact)." In questions 3.1 (Impact of simplification measures), 4.1 (Impacts of Specific Programmes), 4.5 (Contribution to ERA) and 5.1 (European added value) respondents were requested to select among the answers a limited number of the most important issues, ranking them according to their importance. In all cases, only the 3 highest ranked answers were retained for the analysis. According to the ranks provided by the respondents, the answers were weighted as follows: rank "1" was fully weighted, rank "2" was weighted by 0.9, and rank "3" was weighted by 0.8. In this way, the relative importance of each answer could be established.

Figure 5. In which of the following areas did IDEAS Specific Programme of FP7 generate most impact?

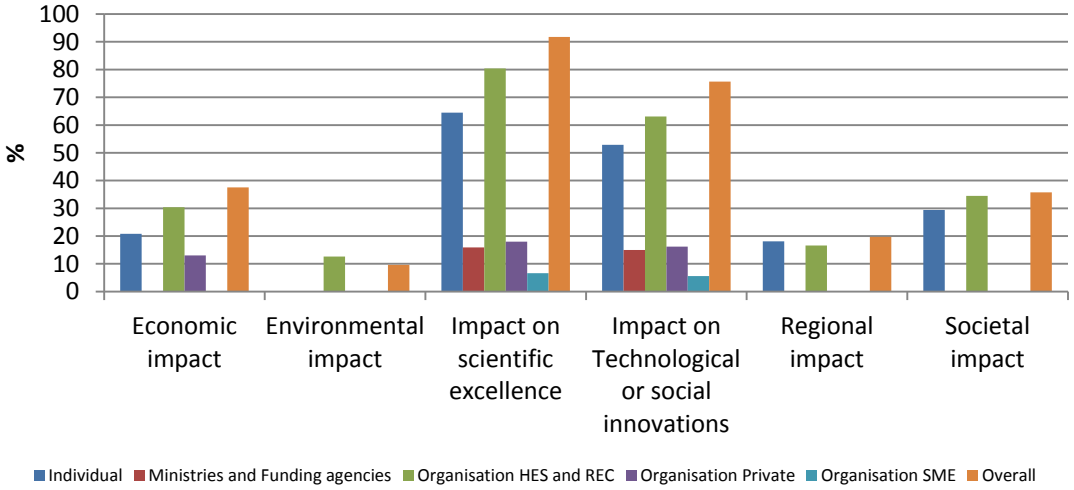


Figure 6. In which of the following areas did PEOPLE Specific Programme of FP7 generate most impact?

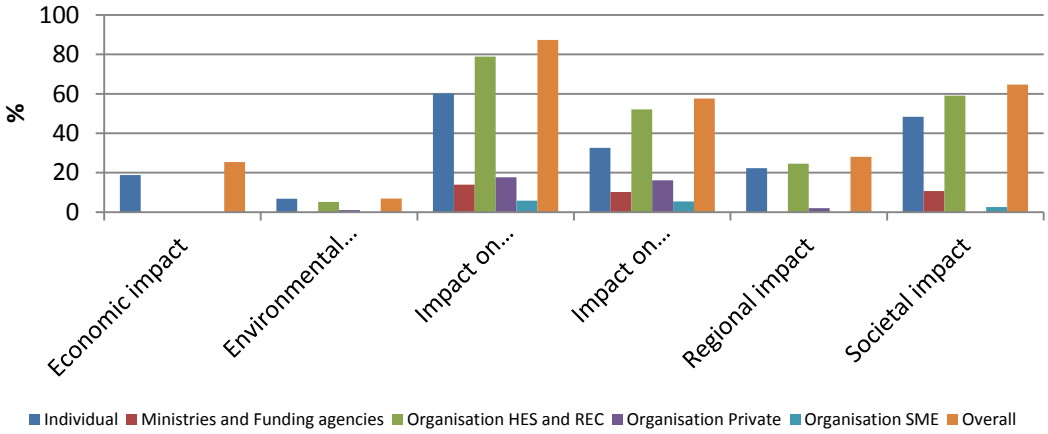
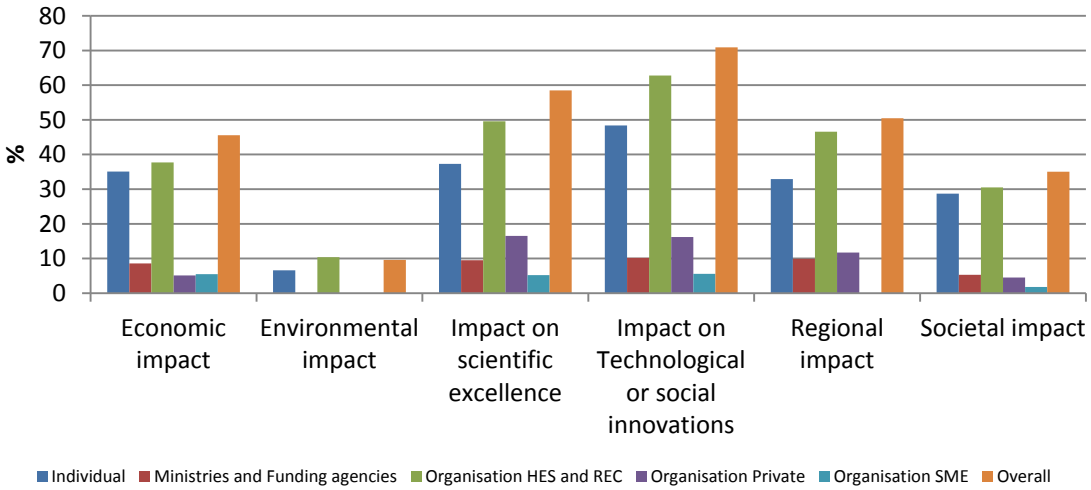


Figure 7. In which of the following areas did CAPACITIES Specific Programme of FP7 generate most impact?



In the optional open comments the respondents highlighted the underlining objectives of FP7 to support excellent science and technological and social innovations thus stating that FP7 was achieving the objectives set in these terms. At the same time some respondents made the remark that for the evaluation of the societal or economic impact of FP7 an in-depth analysis would be required. Overall, according to the input received the four different Specific Programmes seem to cover the different needs of the complex research and innovation system and thus seem to generate impact as expected. As one respondent from the private side put it: "*In their impact, the 4 Specific Programmes were complementary*".

Separate written contributions

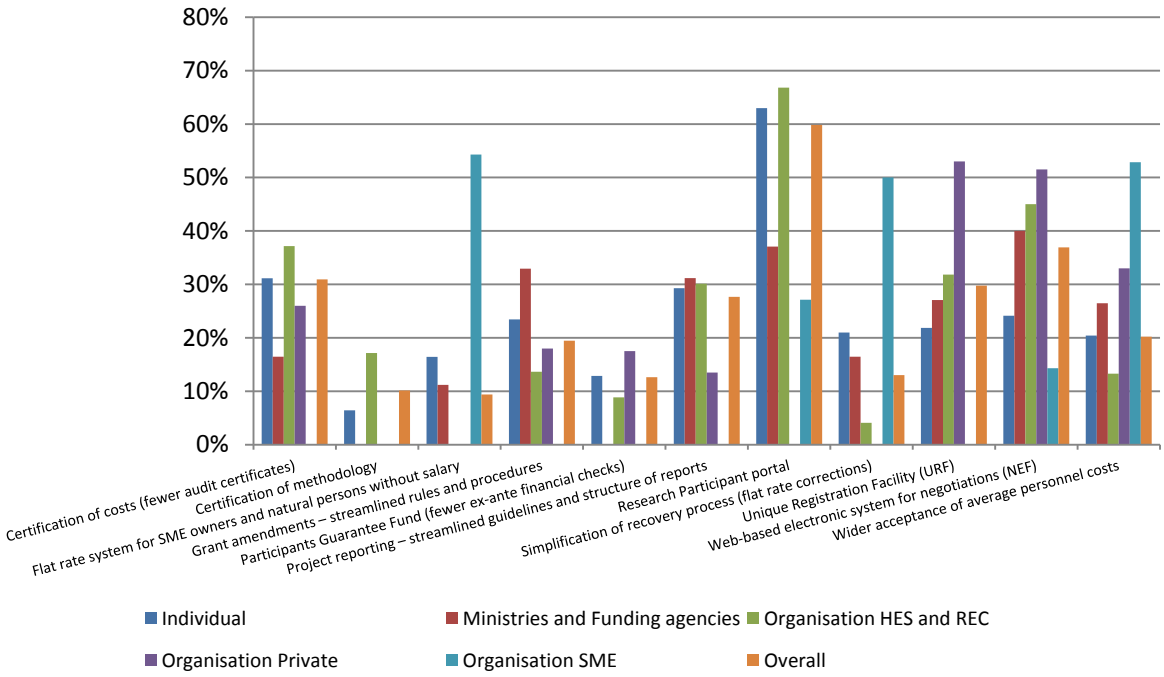
According to the contribution by Science Europe "*excellence fosters excellence*", thus the Framework Programmes must remain excellence-based programmes. Similarly, RCUK recognised the added value of the EU funding for frontier research, mobility programmes, collaborative research and research infrastructures. According to UK Department for BIS FP7 provided significant added value to national research activities and in many areas helped to establish critical mass beyond the reach of national capability but it is far too soon to fully assess the programme's economic impact. This was also backed up by the contribution of UK HE institutions.

The impact of simplification measures

In the course of FP7 major simplification measures[6] were introduced to reduce the burden to the participants. The respondents were asked to assess the impact of various simplification measures[7]. At the overall level "Research Participant Portal" was considered to have been the measure having most impact on simplification. This is clearly the view of the individual respondents and the representatives of HES&REC.

SMEs considered that the flat rate system for SME owners and the wider acceptance of average personnel costs were the most efficient simplification measures. For the other private sector organisations the simplification measures having most impact were the unique Registration Facility (URF) and the web-based electronic system for negotiations (NEF).

Figure 8. Which of the following FP7 simplification measures generated most impact?



In the replies to the optional open question on simplification measures the views of the respondents were divided. On one hand a number of respondents highlighted their experiences on the administrative burden, notably on the usefulness of the reporting

[6] Certification of costs, Participants Guarantee Fund, Unique Registration Facility, Certification of methodology, Web-based electronic system for negotiations, Project reporting (streamlined guidelines and structure of reports), Grant amendments (streamlined rules and procedures), Research participant portal, Simplification of recovery process (flat rate corrections), Wider acceptance of average personnel costs and Flat rate system for SME owners and natural persons without salary

[7] The question: "Out of the 11 FP7 simplification measures listed, please select the 5 which in your view generated most impact and ranks them accordingly (5 generating the most impact)." In questions 3.1 (Impact of simplification measures), 4.1 (Impacts of Specific Programmes), 4.5 (Contribution to ERA) and 5.1 (European added value) respondents were requested to select among the answers a limited number of the most important issues, ranking them according to their importance. In all cases, only the 3 highest ranked answers were retained for the analysis. According to the ranks provided by the respondents, the answers were weighted as follows: rank "1" was fully weighted, rank "2" was weighted by 0.9, and rank "3" was weighted by 0.8. In this way, the relative importance of each answer could be established.

requirements. On the other, many respondents underlined the success of the simplification measures taken, especially the Participant Portal and the Electronic System for negotiations. As one respondent put it: "*The simplification measures succeeded in making the implementation of the FP7 projects manageable and smooth. The Research Participant Portal has been the most useful tool for the negotiation, implementation and reporting*."

Separate written contributions

According to LERU the FP7 simplification measures were "*reasonably successful*". Furthermore LERU stated that "the level of detail requested at reporting stage has increased significantly throughout FP7 turning it into a laborious exercise." According to the contribution of EUA "*the overall effectiveness could have been enhanced more with greater simplification of the procedures and regulations governing the grants and contracts*". In detail, EUA asks for further simplification of rules and regulations, procedures and cost recovery. According to Science Europe the complexity of funding instruments made the access to FP7 more difficult to newcomers and the agenda-setting less transparent. UK Department for BIS reported that no single simplification measure had a major impact but the collective impact was welcome especially because the programme was still regarded as bureaucratic and complex. According to RCUK simplification measures were a welcome step towards reducing the administrative burden.

Contribution of FP7 to European Research Area priorities[8]

The respondents were asked to assess to which of the European Research Area (ERA) priorities FP7 contributed the most[9]. At the overall level the clear majority considered that FP7 contributed most to the ERA priority "Optimal transnational co-operation and competition". This refers also to the specific section on key achievements of FP7 (see section 5.2.).The importance of the contribution by FP7 to the ERA priorities ranked according to the responses:

[8] More information on ERA: http://ec.europa.eu/research/era/index_en.htm

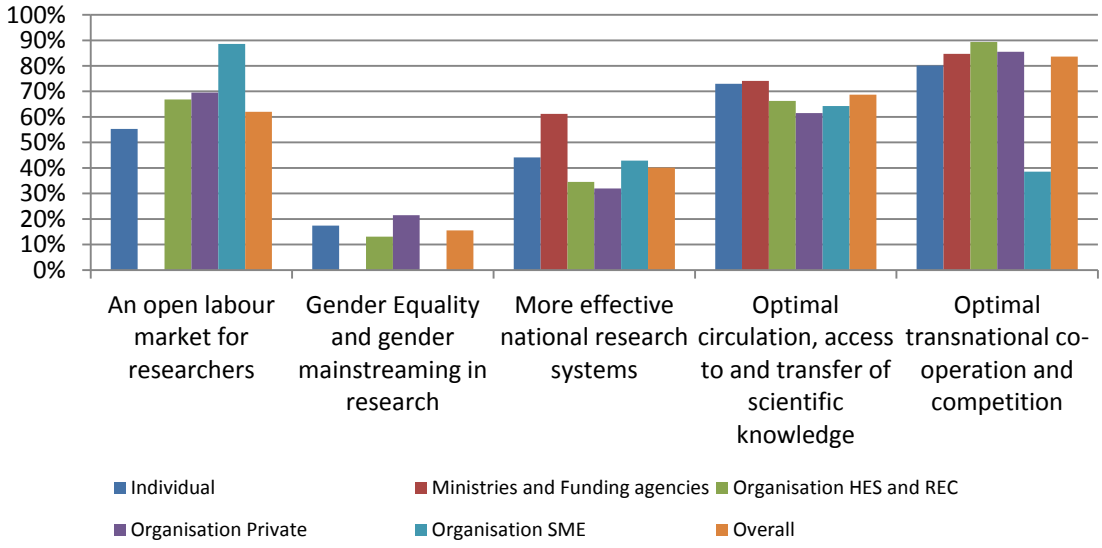
[9] The question: "To which of the following ERA areas did FP7 activities contribute most? Please rank the areas on a scale from 1-5 (5 being the area to which FP7 activities contributed the most." In questions 3.1 (Impact of simplification measures), 4.1 (Impacts of Specific Programmes), 4.5 (Contribution to ERA) and 5.1 (European added value) respondents were requested to select among the answers a limited number of the most important issues, ranking them according to their importance. In all cases, only the 3 highest ranked answers were retained for the analysis. According to the ranks provided by the respondents, the answers were weighted as follows: rank "1" was fully weighted, rank "2" was weighted by 0.9, and rank "3" was weighted by 0.8. In this way, the relative importance of each answer could be established.

1. Optimal transnational co-operation and competition
2. Optimal circulation, access to and transfer of scientific knowledge
3. Open labour market for researchers
4. More effective national research systems
5. Gender equality and gender mainstreaming in research

For SMEs the ERA priority to which FP7 contributed the most was "Open labour market for researchers". Concerning the views of HES and REC, the biggest contribution from FP7 was to the "Optimal transnational cooperation and competition". One respondent from HES found: "*The more funding available for collaborative research the more ERA will become reality, through researchers working together, moving to work etc. Large-scale International projects (enabled by FP7 & H2020) are essential*." Moreover, reflecting the importance of the open labour market perceived by HES and REC, they also underlined the importance of continuing the efforts to improve researcher training, career perspectives and mobility to achieve ERA.

The Ministries and Agencies assessed FP7 having contributed to the more effective national research systems more often than other groups of respondents. In the written comments, one respondent noted: "*The Joint Programming initiatives have increased the effectiveness of research and reduced duplication of efforts by strategically aligning the research funding of member states, implementing joint research agendas and jointly investing in research infrastructures. Secondly, the FP7 has facilitated the spreading of practices such as peer review, competitive funding, open access, transparent recruitment, gender mainstreaming etc*." An interesting aspect is that in the multiple choices question Ministries and Agencies considered that FP7 did not contribute at all the ERA priority "Gender equality and gender mainstreaming in research".

Figure 9. Contribution of FP7 activities to the European Research Area (ERA)



Separate written contributions

According to EUA, "*FP7 has been instrumental in supporting universities in consolidating their actions towards the ERA goals*". Among the key aspects in these terms according to EUA were adequate public funding mix for university activities, nurturing of the open labour market for researchers (especially with respect to university-business collaboration and mobility) and the enhancement of optimal circulation, access to and transfer of scientific knowledge. The shift towards open access and open science in general during FP7 was welcome according to several individual contributions (e.g. UK BIS and Science Europe). Moreover, the ERA-NETs and joint programming were highlighted as schemes offering added value by networking the funding the agencies across the Europe. Furthermore, according to RCUK among others, ERA benefitted from FP7 Research Infrastructure programme.

Success of FP7 in achieving EU added value

The respondents were asked to assess at which of the areas of the EU added value[10] FP7 was most successful[11]. The three most important areas of EU added value where FP7 was most successful ranked according to the respondents:

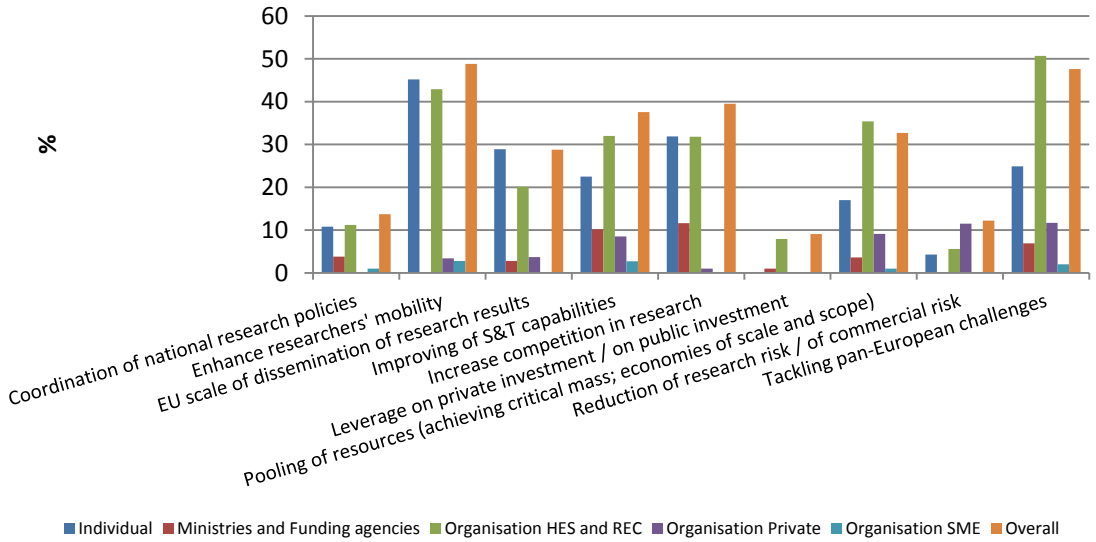
1. Tackling pan-European challenges
2. Increase competition in research
3. Enhance researchers' mobility

For individuals the most important area of EU added value was the enhancement of researchers' mobility whereas for Ministries and Agencies the most important areas were the improvement of S&T capabilities and the increased competition in research. From the perspective of the private bodies, the added value of FP7 was specifically channelled through tackling the pan-European challenges and through reducing the risks. In the optional open comment one representative from the private side noted that: "*By bringing additional public support and fostering critical mass for ambitious but risky research programmes, FP7 has addressed market failures and reduction of technical and business risks."*

[10] 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

[11] The question: "In which of the following dimensions of EU added-value has FP7 been most successful? Out of the 9 areas please select the 3 which in your view have been most successful and rank them accordingly (3 being the dimension most successful)". In questions 3.1 (Impact of simplification measures), 4.1 (Impacts of Specific Programmes), 4.5 (Contribution to ERA) and 5.1 (European added value) respondents were requested to select among the answers a limited number of the most important issues, ranking them according to their importance. In all cases, only the 3 highest ranked answers were retained for the analysis. According to the ranks provided by the respondents, the answers were weighted as follows: rank "1" was fully weighted, rank "2" was weighted by 0.9, and rank "3" was weighted by 0.8. In this way, the relative importance of each answer could be established..

Figure 10. In which of the following dimensions of EU added-value has FP7 been most successful?



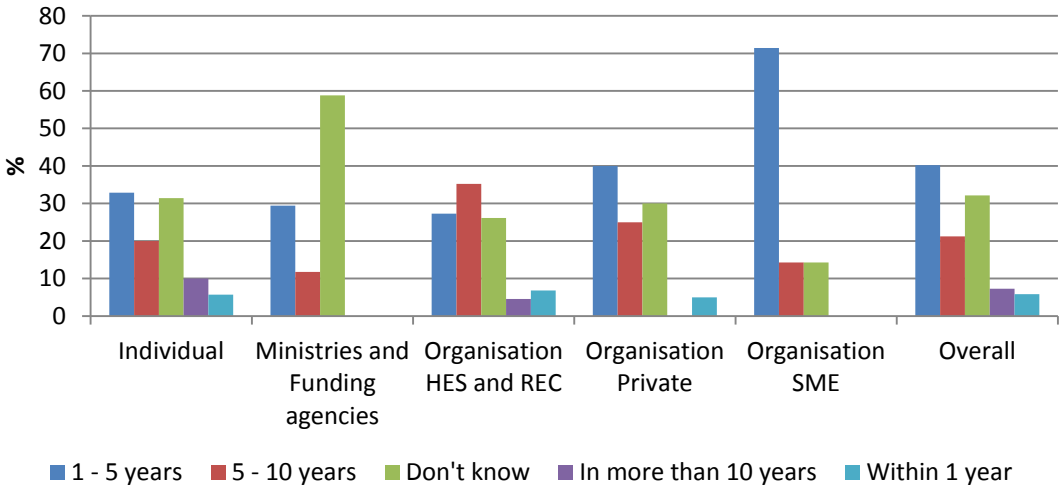
Separate written contributions

In the view of EUA the EU added value of FP7 is illustrated around European Research Council (ERC), Marie Curie Actions and European Institute of Innovation and Technology (EIT). In a similar way, in their inputs, Science Europe and UK Department for BIS considered the ERC and the instruments for researcher mobility as the key strengths of FP7. RCUK considers FP7 successful in terms of funding for EU added value activities and the opportunities for collaboration and competition on a pan-EU scale.

Results to marketable products

At the overall level around 1/3 of the respondents estimated that the results of their research will lead to marketable products and services within 1-5 years and ¼ considered that the same will happen within 5-10 years. A large share of SMEs and the private organisations tend to expect the results of their project to lead to marketable products and services already within one year. However, up to 1/3 of the respondents chose the alternative "Don't know" to this question. This can be explained by the large share of "non-participants" among the respondents (e.g. the Ministries and funding agencies).

Figure 11. How quick do you think the result of your research will lead to marketable products and services?



2.4. Further remarks

On participation and non-participation

Almost 2/3 of the respondents knew theirs partners in the project beforehand and only ¼ got to know their partners only at the start of project. Nearly 90 % of the respondents intend to stay in touch with their project partners also in the future. Less than 20 % replied that they participated for the first time. 92 % of the respondents also intend to participate in the Framework Programmes in the future.

An optional open question was posed for the non-participants on the reasons for not participating ("*In case you have not been participating FP7, please specify the reasons for non-participation*"). The main remarks received commented on the cumbersomeness of big consortia (e.g. finding international partners) and the perception of consortia being "*closed clubs for those who already know each other*". This view was reported by both some individual respondents and some public and private bodies.

Separate written contributions

Important aspects to be further addressed during Horizon 2020 are according to EUA the following:

- The continuation of bottom-up funding instruments and the coverage of the whole value chain by instruments
- Enhancing the integral role of the social sciences, arts and humanities
- Strengthening the international dimension of Horizon 2020 and coordinating regional/national/European R&D and innovation programmes
- Wider interpretation of innovation and further promotion of knowledge partnerships (links between education, research and business)

Science Europe calls for mid- to long-term vision and commitment for excellence research and finds it worrying that the research agenda is more and more industry-led and subject to short-term goals. Furthermore they emphasize the importance of an

instrument portfolio enabling international cooperation and third country participation. Science Europe Scientific Committees of Social Sciences and Humanities provided an input covering specific issues related to the participation of social sciences and humanities in the Framework Programmes. According to this the key achievements of FP7 were the community building, contribution to the growing scientific ambitions, the support for global competition and the investment in infrastructures. As shortcomings of FP7 the Science Europe SSH Committees highlight the project design format more appropriate to industrial processes than for SSH research, the under-estimation of SSH research contribution and the focus on large-scale and rigid linear organisation of the research projects.

2.5. Conclusions

As stated in the Better Regulation Guidelines the design, evaluation and revision of policy interventions benefit from considering the input and views provided by stakeholders. Consultations can also improve the evidence-base of the evaluation. This was clearly the case also for the Ex-Post Evaluation of FP7.

According to the input to the public consultation on the FP7 Ex-Post Evaluation the overall satisfaction with the Framework Programme was good. The respondents of this consultation state clearly that FP7 was creating EU added value, mainly by tackling pan-European challenges, by increasing competition in research and by enhancing researchers' mobility. Strong support is given to boosting excellence in fundamental research, notably through European Research Council.

The respondents find that FP7 contributed to the creation of European Research Area, notably by supporting the optimal transnational cooperation and competition, the optimal circulation, access to and transfer of knowledge and the open labour market for researchers. According to the responses there seems to be clear support for increasing the excellence of European science through policies that reinforce openness and integrity of science. The results also suggest that reinforcing international engagement is needed.

Based on the respondents' perceptions on whether the FP7 has an enduring impact and how quickly the results would lead to marketable products the FP7 made a clear effort to capitalise on the results of research and to create a vibrant innovation ecosystem. Where there was room for improvement according to the respondents a lot has already been done for Horizon 2020. One of the main shortcomings of FP7 was the heavy administrative burden. Here, the efforts made and the measures taken to simplify were welcomed and well received.

2.6. The online questionnaire

PUBLIC ONLINE STAKEHOLDER CONSULTATION ON THE EX-POST EVALUATION OF FP7

I. Context and background

The Decision[12] setting up 'Seventh Framework Programme' (FP7) of the European Community for research, technological development and demonstration activities' stipulates that "*two years following the completion of this Framework Programme, the Commission shall carry out an external evaluation by independent experts of its rationale, implementation and achievements*."

The evaluation is an important instrument for informing the European Parliament and the Council, Member States, the research community, the general public and other stakeholders about the achievements of FP7. It will also contribute to improving implementation of Horizon 2020 and provide a solid evidence base for designing future framework programmes. The evaluation will examine the effectiveness of FP7 implementation, the efficiency of resources used and the wider socio-economic impacts of the Framework Programme.

The evaluation covers the entire period of FP7 implementation in between 2007-2013. The evaluation will cover the objectives of FP7 as set out at the time when the objectives originally were set (2005-2007). At the same time, it should take into account that the context has changed significantly during the period of programme implementation. Several developments (in the context of FP7 or with a significant impact on the programme) influenced the evolution of FP7 over this period:

- The size of the EU Budget allocation to the research activities of FP7 grew substantially both in real terms and as a proportion of the overall budget;
- New initiatives to stimulate the European Research Area were launched;
- The European Research Council (ERC) was created;
- A range of new activities and implementation schemes were introduced during FP7.

Moreover, in the light of the financial and economic crisis, research efforts have been more than ever expected to help address major challenges. Besides these external factors, entry into force of the Lisbon Treaty in 2009 and the Europe 2020 strategy have extended the scope of European research policy and positioned it as a key component of growth and competitiveness, together with innovation.

Furthermore, over the life of FP7 there has been an increased focus on accountability and the need to demonstrate more concretely what impact has been achieved with the resources devoted to the Framework Programme. This aspect was raised in the ex post evaluation of the Sixth Framework Programme (2009) and the Interim evaluation of the Seventh Framework Programme (2010).

The ex-post evaluation covers research programme activities under FP7, involving almost 25,000 research projects and signed grant agreements in four specific programmes - Cooperation, Capacities, Ideas and People[13]. Currently around 50 % of the projects are still running.

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12 Article 7(3), see OJ L 412 of 30 December 2006, p1.

13 JRC direct actions are subject to separate evaluation process.

The ex-post evaluation is carried out by an independent High Level Expert Group, supported by an extensive evidence-base. It will be completed by the end of 2015 as is required by the legal basis [14]. This will be followed by a Commission Communication on the Ex-Post Evaluation.

In order to provide the experts with a range of opinion and views about the functioning, achievements, and impacts of FP7, this interactive consultation has been set up to allow for contributions both from those with direct experience with the FP7, as well as groups or individuals who wish to give their views. The results of this consultation will be made publicly available and will be taken into account in the Commission Communication reacting to the Evaluation Report of the High Level Expert Group.

II. List of questions

1. Information about the respondent[15] (compulsory)

1.1 Do you reply
As an individual
On behalf of an organisation

1.2 Your role in the organisation

- None – I am answering as an individual
- Senior management
- Management
- Researcher
- Strategy /policy function
- Specialist/Expert
- Other (please specify)

1.3 Country of origin (of the organisation when relevant) [*to choose from a list*]

[14] [14] EC Seventh Framework Programme Decision article 7(3) stipulates "Two years following the completion of this Framework Programme, the Commission shall carry out an external evaluation by independent experts of its rationale, implementation and achievements."

[15] Questions 1- 5 were included in stakeholder consultation launched for the IA for the FP7 proposal and question 6 was included in the stakeholder consultation for the FP7 interim evaluation. Additional standard questions on the information of the respondents of the EU Survey Tool will be added.

1.4 Your organisation's geographical area of activities *(indicate your area of activities if answering as an individual person):*

- Local
- Regional
- National
- European
- International
- Not applicable

1.5 Your organisation's type of activity *(indicate your activity type if answering as an individual person)*

- Higher or Secondary Education (HES)
- Research Organisation (REC)
- Private For-Profit (excluding education) (PRC)
- If SME, please indicate
- Public body (excluding research and education) (PUB)
- Research and/or Innovation Funding Agency
- Ministry
- Other
- Other (i.e. NGO, association, please specify)

2. Implementation of FP7[16]

2.1 Based on your experience has the implementation of FP7 been effective? (*compulsory*)

With implementation we refer to the overall management of the framework programme, i.e. communication on calls, application and grant negotiation procedures and dissemination of project findings.

- Yes
- Generally yes, but with some problems
- Generally no, although with some successes
- No
- Don't know

2.2 Has the implementation of FP7 been effective? - Comments (*optional*)

Please specify the reasons for the reply given under 2.1.

2.3 In case you have not been participating FP7, please specify here the reasons for non-participation (optional)

[16] Questions 2.1 and 2.2 were included in the stakeholder consultation for the FP7 interim evaluation. The additional question on non-participation was added in line with the draft outline of the report of the HLEG on the ex-post evaluation of FP7. The short introduction is based on NCP Survey 2013.

3. Simplification of FP7[17]

3.1 Which of the following FP7 simplification measures generated most impact? [18] (*compulsory*)

Out of the 11 FP7 simplification measures listed below, please select the 5 FP7 simplification measures which, in your view, generated most impact and rank them accordingly (5 generating most impact))

- Certification of costs (fewer audit certificates)
- Participants Guarantee Fund (fewer ex-ante financial checks)
- Unique Registration Facility (URF)
- Certification of methodology
- Web-based electronic system for negotiations (NEF)
- Project reporting – streamlined guidelines and structure of reports
- Grant amendments – streamlined rules and procedures
- Research Participant portal
- Simplification of recovery process (flat rate corrections)
- Wider acceptance of average personnel costs
- Flat rate system for SME owners and natural persons without salary

3.2 To what extend have the FP7 simplification measures been successful? - Comments (*optional*)

4. Achievements and impact[19]

4.1 Impacts of each Specific FP7 Programme (*compulsory*)

In which of the following areas did each Specific Programme of FP7 generate most impact?

For each of the 6 areas per specific programme listed below, please select the 3 areas which in your view generated most impact and rank them accordingly (3 generating most impact)

COOPERATION Specific Programme

- Impact on scientific excellence
- Impact on Technological or social innovations
- Economic impact

17 Based on question 4 and 4a) of the stakeholder consultation for the FP7 interim evaluation asking stakeholder whether they were aware of the simplification measures and whether they were successful.

18 Based on the National contact Point Survey for 2012 FP7 Monitoring Report

19 Questions 4.3 and 4.4 are based on questions 2 and 2a) of the stakeholder consultation for the FP7 interim evaluation.

- Societal impact
- Environmental impact
- Regional impact
- I don't know

IDEAS Specific Programme
- Impact on scientific excellence
- Impact on Technological or social innovations
- Economic impact
- Societal impact
- Environmental impact
- Regional impact
- I don't know

PEOPLE Specific Programme
- Impact on scientific excellence
- Impact on Technological or social innovations
- Economic impact
- Societal impact
- Environmental impact
- Regional impact
- I don't know

CAPACITIES Specific Programme
- Impact on scientific excellence
- Impact on Technological or social innovations
- Economic impact
- Societal impact
- Environmental impact
- Regional impact
- I don't know

4.2 Impacts of each Specific FP7 Programme – Comments (*optional*)
Please specify the reasons for the ranking given under question 4.1 and/or refer to any further evidence on impact (scientific, behavioural, technological, innovation, structural, policy, and other) FP7 has had.

4.3 Based on your experience to what extent did FP7 research activities produce enduring impact? (*compulsory*)
- High
- Medium
- Low
- Don't know

4.4 To what extent did FP7 research activities produce enduring impact for you as FP7 beneficiary (eg networking, bench marking, joint agenda setting, harmonisation of peer review systems? – Comments (compulsory)

4.5 Contribution of FP7 activities to the European Research Area (ERA) (*compulsory*)
To which of the following ERA areas[20] did FP7 activities contribute most? Please rank the following areas on a scale from 1 – 5 (5 being the area to which FP7 activities contributed most).

- More effective national research systems
- Optimal transnational co-operation and competition
- An open labour market for researchers
- Gender Equality and gender mainstreaming in research
- Optimal circulation, access to and transfer of scientific knowledge

4.6 Contribution of FP7 activities to the European Research Area (ERA) – Comments (*optional*)
Please specify the reasons for the ranking given under question 4.5

5. European added value

5.1 EU added-value of FP7 (*compulsory*)
In which of the following dimensions of EU added-value has FP7 been most successful? Out of the 9 EU added-value areas identified below, please select the 3 which in your view have been most successful and rank them accordingly (3 being the EU added-value dimension in which FP7 has been most successful);

- 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 risk / of commercial risk
- Increase competition in research
- Leverage on private investment / on public investment
- Improving of S&T capabilities
- Enhance researchers' mobility

5.2 EU added-value of FP7 – Comments (optional)

Please specify the reasons for the ranking given under question 5.1

[20] http://ec.europa.eu/research/era/index_en.htm

6. Final questions[21]

6.1 What are the key achievements/strengths of FP7 in particular? (*compulsory*)

6.2 Are there shortcomings in FP7 that you think should be corrected? According to your experience have these already been addressed to in the Horizon 2020 Programme? (*compulsory*)

6.3 Overall participatory experience (*compulsory*)

- Do you attend to participate again in future? yes/no
- Did you know your partners in the project before? yes/no
- Did you participate for the first time? yes/no
- Do you intend to stay in touch with the partners of your project after the end of the research work? yes/no

How quick do you think the result of your research will lead to marketable products and services?

- Within 1 year;
- 1 – 5 years,
- 5 – 10 years,
- In more than 10 years

6.4 Overall are you satisfied with FP7? (*compulsory*)

- Very satisfied
- Satisfied
- Moderately dissatisfied
- Very dissatisfied
- Don't know

3. METHODS AND ANALYTICAL MODELS USED IN PREPARING THE EVALUATION

This meta evaluation builds on a significant compilation and assessment of evidence base consisting of three combined streams of information, gathered from both internal

[21] These questions were also included in the stakeholder consultation for the FP7 interim evaluation.

(Research and Innovation family DGs) and external sources (European RTD Evaluation Network[22] and from the stakeholder consultation):

Statistics data were extracted from the EC databases CORDA and SESAM RESPIR

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.

As of 20 August 2015, CORDA information about 26,079 grant agreements. Figures are refreshed on a daily basis.

DG	CLOSED	SIGNED	UNDER PREPARATION	TOTAL*
DG RTD	2686	4950	1	4964
DG CNECT	1412	2471	0	2471
DG ENER	43	133	4	137
DG MOVE	19	49	0	49
DG EAC	3	4	0	4
DG TREN	0	0	1	1
REA	6808	12613	175	12831
ERCEA	827	4567	4	4584
GSA	0	0	84	84
CS2	73	483	23	510
FCH2	4	155	0	155
HOME	26	93	0	93
ENIAC	0	63	0	63
ARTEMIS	0	38	20	58
IMI	0	56	1	57
GROW	13	16	0	16
NA	0	0	2	2
Total	**11914**	**25691**	**315**	**26079***

*including cancelled

Number of FP7 grant agreements present in CORDA (20 August 2015)

The SESAM Research Performance and Impact Reporting (RESPIR) tool was launched in 2012 by DG RTD. It presents, for the first time in the history of the Framework Programmes implementation, detailed statistical data on research outputs and impacts (peer-reviewed applications, applications for patents, gender, etc.) based on FP7 project final reports that are submitted and registered in the SESAM application.

[22] The European RTD Evaluation Network is composed of members from EU Member States, EU Candidate Countries and countries that are associated with the EU RTD Framework Programmes. It provides a forum for discussion and analysis of best practice in RTD evaluation methodology, use of RTD indicators and measurement of impact of innovation initiatives and research results.

For FP7, the reference population in SESAM RESPIR comprises processed[23] final reports of all DG RTD and REA FP7 projects. The tool therefore does not cover the whole FP7 as it does not include, for FP7, the activities managed by Directorate-Generals for Communication Networks, Content and Technology (CONNECT), Energy, Transport and Mobility (MOVE), the European Research Council (ERC) and some Joint Technology Initiatives (IMI, ENIAC, ARTEMIS).

To illustrate this, and as noticed in the Seventh FP7 Monitoring Report (2013) referred to in this evaluation, as of 1 December 2014, more than 25,000 grant agreements were signed by the various Commission Directorates-Generals, executive agencies and other services implementing FP7. SESAM RESPIR included statistics from 7,288 project final reports (out of 8,576 closed projects). SESAM RESPIR therefore reported on 41% of FP7 projects[24]. These projects were distributed as follows:

Priority Area		Number of Signed Grant Agreements	Processed Final Reports	
			Number	%
COOPERATION	Health	1.008	400	40%
	Food, Agriculture and Fisheries, and Biotechnology	516	185	36%
	Nanosciences, Nanotechnologies, Materials and new Production Technologies	804	350	44%
	Energy	239	105	44%
	Environment (including Climate Change)	494	216	44%
	Transport (including Aeronautics)	589	280	48%
	Socio-economic sciences and Humanities	253	131	52%
	Space	267	111	42%
	Security	319	79	25%
	General Activities	25	11	44%
	Joint Technology Initiatives (	609	121	20%
Total : COOPERATION		5.123	1.989	39%
	Marie-Curie Actions	10.715	4.361	41%
Total : PEOPLE		10.715	4.361	41%
CAPACITIES	Research Infrastructures	198	88	44%
	Research for the benefit of SMEs	1.030	471	46%
	Regions of Knowledge	84	46	55%
	Research Potential	206	107	52%
	Science in Society	183	90	49%
	Support for development of research policies	27	16	59%
	Activities of International Cooperation	157	60	38%
Total : CAPACITIES		1.885	878	47%
	Fusion Energy	4	3	75%
	Nuclear Fission and Radiation Protection	134	57	43%
Total : EURATOM		138	60	43%
Total		**17.861**	**7.288**	**41%**

Processed Final Reports in FP7 Grant Agreements by Priority Area and Funding Scheme (1/12/2014)

Inputs provided by stakeholders in the 202 responses to the online public consultation

[23] A Processed Final Report is one that i) has been submitted via SESAM, ii) the corresponding assessment is signed and registered by the PO in SESAM and iii) final payment is available or the FO has finalized the calculation of the final payment (PCM status: FROZEN).

[24] For information, as of August 2015, SESAM RESPIR covers 51% of the closed FP7 projects.

Please see Annex 2.

An extensive literature review

This integrates:

A wide corpus of thematic and horizontal evaluation studies which have been carried out over FP7[25] and which have been collected from the Research and Innovation family DGs (see Annex 4)

These evaluations rely on a combination of qualitative and quantitative methodologies. Quantitative methodologies mostly include surveys, descriptive statistics, scientometrics; qualitative analyses methods include mostly interviews and case studies, and to a lesser extent network analysis. Impact measurement techniques include patents analysis and bibliometrics and few studies have implemented microeconomic and macroeconomic modelling methods. A striking feature is that a large majority of these evaluations is based on techniques related to observational and opinion-based investigation modes (surveys, interviews of FP participants, etc.) Most of them usually involve panels, workshops or other forms of stakeholder consultations, at two different and complementary stages: early in the process to collect data, and later on, to share and discuss their preliminary findings.

Assessments provided by the Research and Innovation family DGs services through dedicated and harmonised "building blocks templates" structured along the evaluation questions (see Annex 4);

The evaluation of each of the four FP7 Specific Programmes provided by the four Supporting experts to the High-Level Group carrying out the ex-post evaluation of FP7;

FP7 Annual Monitoring Reports[26];

DG RTD Annual Reports on Programme Evaluation Activities[27];

Other relevant reports such as the ex-ante assessment of FP7 and the FP7 interim evaluation and other official policy documents;

National impact studies collected from the European RTD Evaluation Network.

Furthermore, the methods used in this meta-evaluation were an intervention logic analysis, descriptive statistics, cluster analysis and meta-analysis techniques.

The review of the aboved-mentioned evaluations has a number of limitations. The main limitation relates to their scope (these evaluations are focused on a theme or a specific instrument) and their timing (even though this is less prominent issue as most of the

[25] The first evaluation studies feeding into the exercise were launched in 2010 and the last study results will become available in 2016.

[26] The FP7 Annual Monitoring Reports were produced by the services on the basis of the latest information available from the CORDA database to provide information on the implementation of the programme.

[27] Three DG RTD Annual Reports on Programme Evaluation Activities were produced in 2012, 2013 and 2014, to report on the implementation and outcomes of the evaluation studies released by DG RTD in the year before.

thematic evaluations feeding into this meta-evaluation have been carried over the last two years, once the interim evaluation of FP7 was achieved). These are well-known issues for a meta-evaluation. The main consequence is that it is not possible to aggregate their findings (using for instance an arithmetically based method to derive results at the level of the FP).

This was these limitations were mitigated by strong cooperation with the services involved in the Inter service Group set up for this evaluation and by using the same template to collect data from their evaluation studies. This serves as a matrix design.

Overview of the evaluation methods mostly used in the context of this meta-evaluation:

- Statistical methods.

- Econometric modelling.

- Sociometrics (e.g. Social network analysis).

- Scientometrics & Informetrics (e.g. bibliometric & patent analysis).

- Judgement-based and critical methods (e.g. Surveys, interviews).

4. LIST OF EVALUATION STUDIES

List of evaluations

Area/Activity	SP	Theme/Area	Title
FP7	COOPERATION	Health	Ex-post evaluation of the Health theme in FP7
			Review of Public Health Research Projects Financed under the Commission's Framework Programmes for Health Research
			Report of the Independent Expert Group on the Future of European Public Health Research
			Impact Assessment of the Health Theme and proposal for post 2013 EU support for health research and innovation
			Profiles, motivations and expectations of participants to EC funded research in Health (2002–2010): A statistical analysis
			Evaluation of Health research under FP6 and FP7, In-depth Case studies
		Energy	Mid-term evaluation on the impact of energy EU-funded research and demonstration projects under FP6 and FP7
			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
		Transport	Interim Evaluation of EU FP7 Transport Research, notably within Theme 7 of the Cooperation Programme "Transport (including Aeronautics)"
			TRI VALUE - Ex-post evaluation of the Transport (including Aeronautics) theme of the FP7 Cooperation Specific Programme
		Environment	Research on climate change funded by the Seventh Framework Programme

			Stock-Taking of Results and Impacts of EU-Funded Environmental Research
			State of the Art and Forward-Looking Analysis of Environmental Research and Innovation
		KBBE	Ex-post evaluation and impact assessment of FP7-funded projects in Food, Agriculture, Fisheries and Biotechnology
			Impacts of EU Framework Programmes (2000-2010) and Prospects for Research and Innovation In Food, Agriculture, Fisheries and Biotechnologies
			Small and Medium-sized Enterprises - Participation in FP7 Projects in the Biotechnologies Activity
			Meta-analysis of "Bio-Technology", "Agriculture", "Food", "Marine and Maritime" and Horizontal themes
			Impact Assessment of Food related EU Research in PF6 and FP7
			Ex-post evaluation The Ocean of Tomorrow calls (2010-2013)
		NMP	Ex-post evaluation and impact assessment of funding in the NMP thematic area - FP7 Cooperation Specific Programme
			Comparative scoreboard and performance indicators in NMP research activities between EU and third countries
			Analysis of patenting activity of FP7 NMP projects
			Strategy Definition and Road Mapping for Industrial Technologies to Address Grand Challenges
			Innovation - How to Convert Research into Commercial Success Story? Part 1 : Analysis of EU-funded Research Projects in the Field of Industrial Technologies Part 2 : Analysis of Innovation Successes in the Field of Industrial Technologies
			Ex post Evaluation of FP6-NMP - Project Level
			Analysis of Smart Specialisation Strategies in NMP related areas
		ICT	Interim evaluation of the ICT research in the 7th FP

			Interim Evaluation of AAL Joint Programme
			Final Evaluation of the Ambient Assisted Living Joint Programme (AAL JP)
			Assessing impact of the European Innovation Partnership on Active and Healthy Ageing
			Ex-post evaluation of the ICT research in the Seventh Framework Programme, including the support study SMART 2013/0049 (COOP. and CAP. SP)
		SSH	Evaluation, monitoring and comparison of the impacts of EU funded SSH (Socio-economic sciences and Humanities) research in Europe (IMPACT-EV project)
		Space	Evaluation of socio-economic impacts from space activities in the EU
			Ex-post evaluation of the FP7 Space research actions
		Security	Review of security measures in the 7th Research Framework Programme FP7 2007-2013
			SMEs and their participation in security research
			Final report from the European Security Research and Innovation Forum (ESRIF)
			Ex-post evaluation of the FP7 Security research actions
	CAPACITIES	**SMEs**	Progress Reports on SMEs Participation in the 7th R&D Framework Programme
			Performance of SMEs within FP7 - An Interim Evaluation of FP7 Components
		Research infrastructures	Assessing the Projects on the ESFRI (European Strategy Forum for Research Infrastructures) Roadmap
			Evaluation of pertinence and impact of the EU research infrastructure activity in FP7
		Regions of Knowledge	Evaluation of research intensive clusters as potential vehicles for smart specialisation in the European regions
			Final Evaluation of the Regions of Knowledge (RoK) Programme
		Research potential of	Analysis and recommendations for the future evolution of the Research Potential Activity of the EU-EU FP7 Capacities Programme - Expert Group on Research Potential Project Portfolio - 17 May 2011

Convergence Regions	Final evaluation of FP7 “Research Potential” (REGPOT) Programme, COWI report – April 2014
Science in Society	Ex-post evaluation of Science in Society in FP7
	Interim evaluation and assessment of future options for Science in Society Actions
Coordination of Research Activities	Ex-post evaluation of the research and development programme undertaken by several Member States aiming at supporting research and development performing small and medium-sized enterprises (Eurostars)
	Review of the Joint Programming Process
	Interim Evaluation of the European Metrology Research Programme (EMRP)
Support to the coherent development of research policies	Evaluation of the "Coherent Development of Research Policies" Programme
ERA initiatives	Expert group on open innovation and knowledge transfer
	Support for Continued Data Collection and Analysis Concerning Mobility Patterns and Career Paths of Researchers – MORE 2
	Knowledge Transfer Study 2010-2012
	Evaluation of the EURAXESS Project (2008-2012)
	Monitoring of the human resources policies and practices in research ("European Partnership for Researchers monitoring" EPR)
	Study to monitor the implementation and impact of IP recommendation and code of conduct - Knowledge transfer
	Analysis of the ERA State of play in Member States and Associated Countries: focus on priority areas
	Evaluation of ERA progress in MS and AC
	Researchers' report 2014
International cooperation	International Science and Technology Cooperation in the EU's Seventh Framework Programme: the specific programme 'Cooperation' and its thematic areas

			European Added Value of EU Science, Technology and Innovation actions and EU-Member State Partnership in international cooperation
			Mapping of best practice regional and multi-country cooperative STI initiatives between Africa and Europe — identification of financial mechanism(s) 2008–2012
			Overview of International Science, Technology and Innovation Cooperation between Member States and Countries outside the EU and the Development of a Future Monitoring Mechanism
			International Cooperation in Science, Technology and Innovation: Strategies for a Changing World - Report of the Expert Group Established to Support the Further Development of an EU International STI Cooperation Strategy
			Review of S&T cooperation agreement between the European Union and Russia
			Review of S&T cooperation between the European Union and the USA
			Review of S&T cooperation between the European Union and New Zealand
			Review of S&T cooperation agreement between the European Union and South Africa
			Review of S&T cooperation between the European Union and Mexico
			Review of S&T cooperation between the European Union and Morocco
			Review of S&T cooperation between the European Union and the Federative Republic of Brazil
			Review of S&T Cooperation Agreement between the European Union and Government of the Republic of India
			Review of the S&T Agreement between the European Union and the Republic of Korea
			Review of S&T cooperation between the European Union and Tunisia
			Review of S&T cooperation between the European Union and Argentina
			Review of S&T cooperation between the European Union and Chile
	PEOPLE		Contribution to the interim evaluation of Marie Curie 2014-2020 + ex-post of Marie Curie under FP7
			FP7 Marie Curie Life-long Training and Career Development Evaluation: Individual Fellowships and Co-funding Mechanism
			Marie Curie researchers and their long-term career development: A comparative study
			FP7 Marie Curie Actions Interim Evaluation

	Ex-post Impact Assessment study concerning the 'Marie Curie Actions' under the Sixth Framework Programme
IDEAS	Comparative overview of the current research funding instruments in Europe and selected countries
	Monitoring ERC's implementation of excellence
	Understanding and assessing the impact and outcomes of the ERC funding schemes
	Emerging Research Areas and their Coverage by ERC-supported Projects
	Comparative scientometric assessment of the results of ERC funded projects
EURATOM	Ex-post evaluation of the Euratom Framework Programme (2007-2013)
JRC	Ex-post evaluation of FP7 JRC activities
PPPs	Interim Assessment of the Future Internet Public-Private Partnership
	(2nd) Interim Assessment of the Future Internet Public-Private Partnership
	Interim Assessment of the Research Public Private Partnerships in the European Economic Recovery Plan: Energy-Efficient Buildings, Factories of the Future, and European Green Cars Initiative
	Final Assessment of the Research PPPs in the European Economic Recovery Plan: Factories of the Future; Energy-efficient Buildings; European Green Cars Initiative
JTIs	Interim Evaluation of the Innovative Medicines Initiative Joint Undertaking (IMI JU)
	First Interim Evaluation of JTI ENIAC and ARTEMIS
	First Interim Evaluation of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU)
	First Interim Evaluation of the Clean Sky Joint Undertaking (CS JU)
	Commission Response to the First Interim Evaluation of CS, FCH, IMI Joint Untertakings
	Commission Response to the First Interim Evaluation of ARTEMIS and ENIAC Joint Technology Initaitives
	Second Interim Evaluation of the Innovative Medicines Initiative Joint Undertaking (IMI JU)
	Second Interim Evaluation of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

			Second Interim Evaluation of the Clean Sky Joint Undertaking (CS JU)
			Commission Response to the Second Interim Evaluation of CS, FCH, IMI Joint Untertakings
			ARTEMIS and ENIAC Joint Technology Initatives Second interim evaluation
			Commission Response to theSecond Interim Evaluation of ARTEMIS and ENIAC Joint Technology Initiatives
	EIP		Outriders for European Competitiveness: European Innovation Partnerships (EIPs) as a Tool for Systemic Change
	RSFF		First Interim Evaluation of the Risk-Sharing Financial Facility (RSFF)
			Second Interim Evaluation of the Risk-Sharing Financial Facility (RSFF)
	Executive agencies		External Evaluation of the Research Executive Agency (REA) and the European Research Council Executive Agency (ERCEA)
Horizontal studies		Innovation Union	Interim Evaluation of the Innovation Union
		Impact	Assessing the contribution of the Framework Programmes to major innovations
			Assessing the contribution of the Framework Programmes to the development of human research capacity
			Assessing the research management performance of FP projects
			Understanding the long term impact of the Framework Programmes
		Participation	Network analysis of FP participation
			The role and participation of industry in the FPs
			The role and participation of research organisations in the FPs
			The role and participation of universities in the FPs
			Interim evaluation of the participation of SMEs in the Cooperation Programme and the Research for the benefit of SMEs schemes under the Capacities Programme of FP7 (2007-2013)
			Network analysis of Civil Society Organisations' participation in research framework programmes

	Gender	SHE Figures 2012
		SHE Figures 2015
	Simplification	Assessing the Effectiveness of Simplification Measures under FP7
Other activity reports	Monitoring Reports	Annual Monitoring Reports of FP7
		Innovation Union Competitiveness reports
	Programme Evaluation Activities	DG RTD Annual Report on Programme Evaluation Activities 2011
		DG RTD Annual Report on Programme Evaluation Activities 2012
		DG RTD Annual Report on Programme Evaluation Activities 2013

National impact studies are listed in Annex 21.

5. EVALUATION QUESTIONS

Evidence Building Block 1: Rationale ("why"): Building Block 1 aims to describe the logic of intervention (of the expenditure programme); to analyse the relevance of its objectives; whether the objectives are consistent with the strategic context and the identified challenges in the FP7 period 2007-2013.

Evidence Building Block 2: Implementation ("how"): Building Block 2 aims to describe the FP7 intervention from a process/implementation perspective (how was the programme in your thematic area implemented?) by factually establishing the participation patterns by research actor type; the distribution of funds by research actor type; the changes over different FPs (FP7, FP6, FP5, and prior if relevant); and by analysing the reasons for these patterns, distributions and trends.

Evidence Building Block 3: Achievements ("what") – direct achievements ("outputs"): Building Block 3 describes the "outputs" or direct achievements of "all what is produced" through this intervention at project and programme level per thematic research area or main topic. Building Block 3 also describes and analyses the uptake on cross-cutting issues per thematic research area.

Evidence Building Block 4: Achievements ("what") – wider achievements ("results" and "impacts"): Building Block 4 deals with the "results" of the intervention for the beneficiaries and the wider economic, societal and environmental "impacts" for Europe at large.

Evidence Building Block 5: European Added Value: Building Block 5 deals with European Added Value (EAV). EAV refers to the need for Europe to intervene. EAV is analysed through establishing a need for public intervention (as opposed to market forces) and establishing a need for this public intervention at EU level (as opposed to MS and regional level).

Evidence Building Block 6: Conclusions on FP7 and Outlook for H2020: Building Block 6 wraps up the analysis and concludes per thematic research area the main findings for FP7 and indicates what can be learned from FP7 achievements for the successor programme H2020 and what FP7 shortcomings are already addressed in H2020.

Examples of the specific questions used to build the evidence base under the "building blocks' include the following.

- Guiding questions:
- Has, for each specific programme, clear objectives been formulated?
- Were the programme objectives adequately designed to address EU needs and societal challenges as intended?

- Were the activities and budgets allocated among the areas sufficiently and adequately distributed, in a way that strengthened the scientific and technological base and encouraged international competitiveness?

- How have the objectives and coverage of topics evolved through time, and how did they align to the overall EU policy context?

- Has the programme evolved to become less or more prescriptive regarding research and innovation topics and to allow bottom up approaches to deliver innovative ideas? Did the priority-setting evolve in this respect during FP7?

- Have project outputs lead to

research training and capability effects?

innovation (e.g. innovative new commercial products, profitable new services or starts-ups)? Which fields and which clients/segments of society have benefitted most in this regard?

What were the reasons for success, what are the areas where there is scope for improvement?

Has the programme sufficiently promoted the translation of research and innovation into market applications?

Has the programme supported the demonstration of the market potential of new products or processes?

Has the programme supported policy - making, including standardisation and legislation?

Has the programme had a positive leverage effect in promoting national research efforts? Has it contributed to a better exploitation of results?

Which socio-economic, environmental and other relevant impacts resulted from FP7-funded research projects? What is the causal link between them?

To what extent did FP7 Specific Programmes help address the main societal, environmental and economic challenges? To what extent has it led to innovations that contribute to improving quality of life?

Did FP7 Specific Programmes enable all research and innovation stakeholders – research institutions, researchers, citizens, policy makers, industry, and third sector organisations – to make a full contribution towards the realisation of its objectives?

Overall, did FP7 Specific Programmes help meet the needs, expectations and values of European citizens?

How have the FP7 Specific Programmes influenced research and related policies?

To what extent would researchers have been able to undertake the research project funded through FP7 in the absence of this EU-level funding?

To what extent has FP7 yielded outputs, results and impacts that intervention at Member State level alone could not have achieved?

How did EU support for research add value compared to purely national public funding in terms of elements such as the following?

Pooling of resources and creating EU-Networks(achieving critical mass; economies of scale and scope)

Leverage on public and private investment

Reduction of research and commercial risks

Improving of S&T capabilities and pan-European cooperation

Accelerating the generation of knowledge and research outputs

Increase competition in research

Tackling pan-European challenges

Coordination of national research policies.

6. BACKGROUND TO FP7

The Seventh Framework Programme was designed in a context of the reinvigorated Lisbon Strategy process which had set the European Union a strategy goal to become the most competitive and dynamic knowledge-based economy of the world, capable of sustainable economic growth with more and better jobs and greater social cohesion[28].

The overriding objective of FP7 was to contribute to the Union becoming the world's leading research area.[29] FP7 was also intended to support progress towards the 3% GDP target in R&D by 2010, two-thirds of which should come from the private sector[30], as established by the Barcelona European Council in March 2002. The specific objectives of FP7 were to support the creation of the European Research Area (ERA) and contribute to the development of a knowledge-based economy and society of Europe.

While building on the Sixth Framework Programme, FP7 was thus attributed more ambitious objectives more closely linked with the economic and societal challenges the EU was facing (decelerating economic growth, fiercer international competition supported by rapid advances of new technologies such as ICT, significant environmental degradation caused by global warming and climate change). These new objectives were also established to address three main challenges Europe was facing in the area of R&D: a low level of investment in R&D (1.97% of GDP) notably as compared with the USA (2.59%), a "brain drain" effect leading the best researchers to move abroad, and a deficient capacity in transforming basic research results into marketable innovations, making an economic success of them: "European companies apply for 170 patents each year per million inhabitants compared with 400 for American companies. And the Union's commercial deficit for high-tech products is approximately €23 billion per year[31]".

The following table gives an overview of the expected impacts of the "new FP7" compared with the "do nothing" option.

- Expected impacts of the new FP7 and the do nothing option (business as usual scenario taken as a reference) [32]

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

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

30 Recital 3 of Decision 1982/2006/EC, O.J. 412/1 of 30.12.2006.

31 Communication from the Commission, *Science and technology, the key to Europe's future - Guidelines for future European Union policy to support research*, COM(2004) 353 final, 16.6.2004.

32 Source: Table 3, Commission Staff Working Paper Annex to the Proposal for the Council and European Parliament decisions on the 7th Framework Programme (EC and Euratom), *Impact Assessment and ex ante evaluation*, SEC(2005) 430, 6.4.2005, p. 15-16.

IMPACTS		POLICY OPTIONS	
		"do nothing"	"new FP7"
Expected aggregate impacts on the achievement of the Lisbon, Barcelona and other community objectives	**LISBON OBJECTIVES**		
	Economic growth performance	In the long run, up to 0.84 percent of GDP lost compared to the business- as-usual scenario	In the long run, between 0.45 and 0.96 percent **extra GDP** is generated compared to the business-as-usual scenario, because of **crowding-in** and **rates of return/multiplier effects.** The literature shows that the crowding-in effect of €1 of public R&D funding allocated to business has been estimated to range between €0.7 and € 0.93. The private rates of return to private R&D can be as high as 43 percent, the social ones as high as 160 percent. The rates of return to publicly-funded research could be as high as 67 percent.
	Employment creation	In the long run, up to 800,000 jobs lost compared to the business-as-usual scenario	In the long run, between 400,000 and 925,000 **extra jobs** are created compared to the business-as-usual scenario. The literature shows that the rate of growth of **total factor productivity** (TFP - due to improvements in the efficiency of production or to pure technological progress) has a positive impact on the **employment rate,** with a one-year lag, and that both in the short- and long-term, countries with higher than average TFP growth tend also to have higher than average growth in employment.
	Competitiveness	In the long run, extra-European exports lower by up to 2 percent, imports higher by up to 1.43 percent compared to the business-as-usual scenario	In the long run, extra-European **exports** could be higher by between 0.64 and 1.57 percent; **imports** lower by between 0.3 and 0.9 percent compared to the business-as- usual scenario. The literature shows that publicly funded research is critical for the development of new products, processes and services. Increases in R&D also increase productivity.
	BARCELONA OBJECTIVES		
	R&D intensity	In the long run, Europe's R&D intensity lower by up to 0.1 percent of GDP compared to the business-as-usual scenario	In the long run, Europe's R&D intensity higher by between 0.059 and 0.23 percent of GDP compared to the business-as-usual scenario. This is because of high crowding-in effects (see above under economic growth performance)
	Research employment	In the long run, up to 87,000 jobs lost compared to the business-as-usual scenario	In the long run, between 40,000 and 215,000 extra jobs compared to the business-as- usual scenario.
	OTHER COMMUNITY POLICIES		
	Göteborg strategy	Less informed design of EU Sustainable Development Strategy and disorganised consideration of the three pillars of sustainability	Knowledge-based design of the EU Sustainable Development Strategy and more balanced consideration of the three pillars of sustainability in the decision-making process; EU evidence-based leadership in international negotiations
	Other Community Policies	More ad hoc and inefficient development of perhaps less effective Community policies	Easier development of more evidence-based and effective policies in the fields of agriculture, economic and financial affairs, employment, enterprises, environment, fisheries, food, health, maritime affairs, etc.
Expected impacts of Specific Programmes	**SPECIFIC PROGRAMME: PEOPLE**		
	People	Less European mobility and cooperation; less attractive scientific careers for European citizens (in particular women); Europe less attractive to the best foreign researchers; reduced level and diversity of skills of individual researchers; less sustainable linkages between academia and industry, and across disciplines	More research can be carried out in Europe; research will generally be of higher quality, more inter-disciplinary, and where appropriate take industry better into account
	SPECIFIC PROGRAMME: IDEAS		

Expected impacts of Specific Programmes	**Ideas**	More national, non-competitive and overlapping funding; fewer scientific publications; publications of lower quality and fewer citations as the competition for basic research funding between individual research teams remains organised at national level, i.e. essentially meaningless in highly specialised fields of science in most countries	A better and enlarged knowledge base for European enterprises on which the innovation of products and process can be based; levelling-up effects as incentives are provided to increase institutional and researcher capabilities, produce better research proposals, and carry out higher-level research; structuring effects (dissemination; increased attractiveness ERA)
	SPECIFIC PROGRAMME: COOPERATION		
	Collaborative research	Greater fragmentation and inefficiency of research efforts in Europe; fewer projects carried out by research teams on a European scale and limited to resources and knowledge available at national level; more slow advance in important fields of science; in some countries, capabilities in particular research fields declining due to inadequate interaction with top teams located elsewhere	Some research activities are of such a scale that no single Member State can provide the necessary resources and expertise. In these cases, EU projects can allow research to achieve the required "critical mass", while lowering commercial risk and producing a leverage effect on private investment. EU-scale actions also play an important role in transferring skills and knowledge across frontiers. This helps to foster excellence in research and development through enhancing capability, quality and EU-wide competition, as well as improving human capacity in S&T through training, mobility and European career development. EU support can also contribute to a better integration of European R&D, by encouraging the coordination of national policies, by the EU-wide dissemination of results, and by funding research for pan-European policy challenges.
	JTIs	Reduced competitiveness of European industries; reduced participation of industry in the FP; negative signal given to knowledge-intensive and hightech industries	Important contribution made to the achievement of the Lisbon and Barcelona agenda through the formulation for areas critical for European competitiveness of ambitious, long-term and strategic research and wider policy agenda, the commitment of a critical mass of financial, organisational and human resources under public-private partnerships, indicatively sharing costs in a 1/3-2/3 format.
	International cooperation	Europe reneges on its commitments in international fora and goes entirely against the trend whereby other industrialised countries/regions are seeking to expand their international S&T cooperation.	Socio-economic development and global competitiveness stimulated; contributions made to Europe's many key international commitments (e.g. Kyoto, Convention on Biological Diversity, Biosafety Protocol, the plan of Implementation adopted at the World Summit on Sustainable Development).
	Coordination of national research programmes	Return to the complete fragmentation of the pre-ERA period, with 25 MS and numerous regions defining their research priorities independently from each other and from the EU; waste of already scarce resources; opportunity lost to restructure the European research fabric so as to enhance EU competitiveness	Strong contribution made to the restructuring of the European research fabric in a coordinated and organised way and to the development of ERA.
Expected impacts of Specific Programmes	**SPECIFIC PROGRAMME: CAPACITIES**		
	Research infrastructures; Research for the benefit of SMEs; Regions of knowledge; Research potential; Science in society; Specific activities of international cooperation **• Realising full potential**	• Increased inefficiency and fragmentation of the European research landscape; less coordination of efforts, less possibility to share costs and access, potential duplication, loss of research capability • European SMEs deprived of important resources and opportunities to remain competitive in a global economy	• Better efficiency of public funds and stimulation of increased synergies between public and private funds; seamless access to all kinds of resources spread throughout Europe and the world. • The exploitation by SMEs of their research improved, EU-wide transfer of technology; research results potentially transformed into products and services
Expected impacts of management choices	**Administrative burden**	No administrative burden	Limited administrative burden; cost of participation reduced; procedures simplified and rationalised

The R&D policy context evolved during the implementation of FP7 with the adoption of new initiatives to stimulate the European Research Area on the one hand, and of the Europe 2020 Strategy and Europe Economic Recovery Plan on the other hand.

A first batch of initiatives to stimulate the ERA was launched in 2007-2008 as a follow-up of the ERA Green Paper published on 4 April 2007[33]:
Recommendation on the management of intellectual property in knowledge transfer activities and Code of Practice for universities and other public research organisations[34]. This recommendation was endorsed by a resolution adopted by the Competitiveness Council on 30 May 2008[35].

In June 2008 launch of EURAXESS branding to adapt to new initiatives and ERA needs and to duly respond to users' needs.

Communication 'Better careers and more mobility: a European partnership for researchers'.[36] Related Council conclusions were adopted on 26 September 2008[37].

In November 2008 the Commission launched the Human Resources Strategy for Researchers implementing the Commission Recommendation 2005 of the European Charter for Researchers and the Code of Conduct for their Recruitment.

Communication 'Towards Joint Programming in Research: Working together to tackle common challenges more effectively'[38]. The Competitiveness Council adopted conclusions on this issue on 2 December 2008[39].

Proposal for a Council regulation on the Community legal framework for a European Research Infrastructure (ERI)[40]. This regulation was adopted by the Council on 25 June 2009[41].

Communication 'A Strategic European Framework for international science and technology Cooperation'[42]. It was endorsed by Council conclusions adopted on 2 December 2008[43].

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33 Green Paper; The European Research Area: New Perspectives, COM(2007)161, adopted on 4.4. 2007.

34 C(2008)1329, adopted on 10.4.2008.

35 Council Resolution on the management of intellectual property in knowledge transfer activities and on a Code of Practice for universities and other public research organisations, 30.05.2008.

36 COM(2008)317 adopted on 23.5.2008.

37 Council Conclusions on better careers and more mobility: a European partnership for researchers, 26.09.2008.

38 COM(2008)468 adopted on 15.7.2008.

39 Conclusions concerning joint programming of research in Europe in response to the major societal challenges, 2.12.2008.

40 COM(2008)467 adopted on 25.7.2008.

41 Council Regulation No 723//2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC).

42 COM(2008)588, adopted on 24.9.2008.

43 Conclusions concerning a European partnership for international scientific and technological cooperation, 2.12.2008.

Building on these elements and aiming at meeting the demand of the European Council (ERA to be completed by the end of 2014), the Commission adopted on 17.7.2012 the Communication 'A Reinforced European Research Area Partnership for Excellence and Growth'[44]. Related Council conclusions were adopted on 12.12.2012[45]. A first Progress Report was published before the end of FP7[46]. Most of the actions by the Commission that were announced in the Communication have been completed such as the establishment of open access to scientific publications as a general principle for Horizon 2020, a Communication on access to and preservation of scientific information in the digital age, the launch of RESAVER or are still ongoing as they are part of a continuous process like open access to scientific data, e-science, open innovation, Joint Programming, ESFRI etc.

Furthermore, as a response to the economic crisis, the following initiatives were adopted that had an impact on the objectives and activities of FP7:
As part of the European Economic Recovery Plan[47], three contractual Public-Private Partnerships (Factories of the Future, Energy-efficient Buildings and Green Cars) were established in 2009 to develop new technologies for sectors which have experience significant downturns in demand a s a result of the economic crisis and to foster the transition to a sustainable economy.

The Europe 2020 Strategy for smart, sustainable and inclusive growth[48] was adopted in March 2010 to foster growth and competitiveness by developing an economy based on knowledge and innovation, which would be more resource efficient and greener, and achieve high employment, social and territorial cohesion.

Amongst the seven Europe 2020 flagship initiatives, the Innovation Union was launched in October 2010[49].

Simplification measures[50] were introduced to facilitate the award and management of grants in order to realise European research potential both in Europe and elsewhere.

A detailed intervention logic is presented hereafter.

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44 COM(2012)392.

45 Conclusions on 'A reinforced European research area partnership for excellence and growth', 12.12.2012.

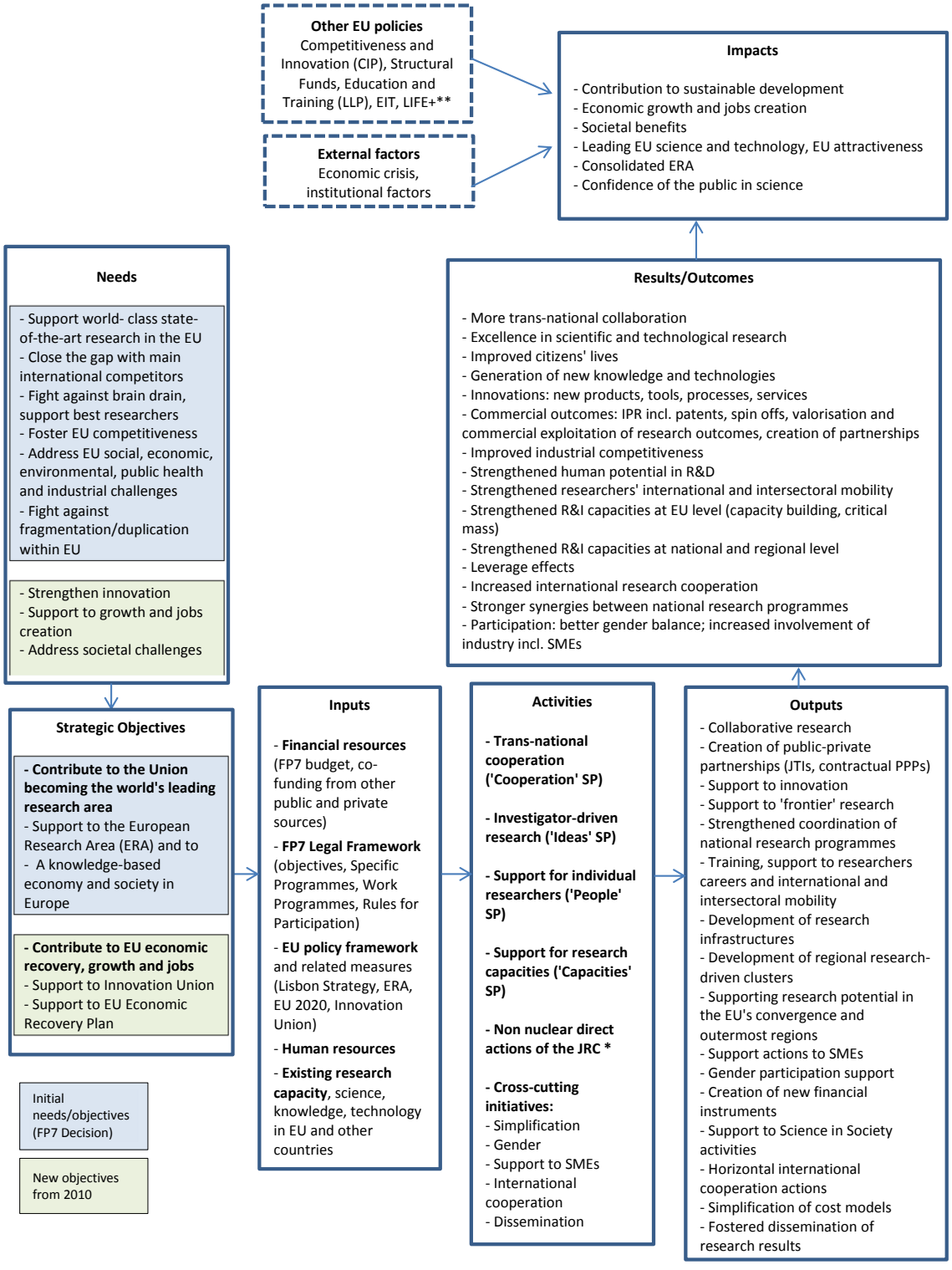
46 COM(2013)639 adopted on 20.9.2013.

47 Communication from the Commission, *A European Economic Recovery Plan*, COM(2008) 800 final, 26.11.2008.

48 Communication from the Commission *EUROPE 2020 A strategy for smart, sustainable and inclusive growth*, COM(2010) 2020 final, 3.3.2010.

49 Communication from the Commission *Europe 2020 Flagship Initiative Innovation Union*, COM(2010) 546 final, 6.10.2010; Europe 2020 Flagship Initiative Innovation Union, SEC(2010) 1161, Brussels 06/10/2010.

50 Communication from the Commission *Simplifying The Implementation of the Research Framework Programmes*, COM(2010) 187, 29.04.2010.



Intervention Logic of FP7

Source: DG RTD

FP7 was the **cornerstone of EU research policy** and a major component of the EU innovation system which includes the following other programmes[51], smaller by their budgets and scopes, which ran in parallel, with their specific objectives, creating a complex governance structure:

The **Competitiveness and Innovation Framework Programme (CIP)** included three programmes: Enterprise and Innovation, Intelligent Energy Europe, and ICT policy (EU budget contribution of €3.6 billion for 2007-2013).

The **European Institute for Innovation and Technology (EIT)** brought together higher education, research and business to stimulate innovation in Knowledge and Innovation Communities (EU budget contribution of €309 million for 2007-2013).

The **Structural Funds (ERDF, ESF, Cohesion Fund)** allocated to R&D and innovation, entrepreneurship, ICT and human capital development (EU budget contribution of €86 billion for 2007-2013)

Lifelong Learning Programme (LLP) included Comenius, Leonardo da Vinci, Erasmus, Erasmus Mundus, Grundtvig, E twinning, Transversal Actions (EU budget contribution of € 6.2 billion for 2007-2013).

The range of **funding schemes** implemented in FP7 was wide, including six schemes:

- **Collaborative projects** were focused research projects with clearly defined scientific and technological objectives and specific expected results (such as developing new knowledge or technology to improve European competitiveness). They were carried out by consortia made up of participants from different countries, and from industry and academia.

- The **Networks of Excellence** were designed for research institutions willing to combine and functionally integrate a substantial part of their activities and capacities in a given field, in order to create a European "virtual research centre" in this field.

- **Coordination and Support actions** covered not the research itself, but the coordination and networking of projects, programmes and policies. This included, for example coordination and networking activities, dissemination and use of knowledge, support for transnational access to major research infrastructures, actions to stimulate the participation of SMEs, civil society and their networks, support for cooperation with other European research schemes (e.g. "frontier research").

- **Individual projects** were carried out by individual national or multinational research teams, led by a "principal investigator", funded by the European Research Council (ERC).

- **Support for training and career development of researchers** from across the European Union and its research partners were implemented in the Marie Curie action.

[51] Those are not included in the scope of this evaluation.

- Research for the benefit of specific groups – in particular SMEs targeted research and technological development projects where the bulk of the research was carried out by actors such as universities, research centers or other legal entities, for the benefit of specific groups, in particular SMEs, or for civil society organisations and their networks.

In FP7, the **cost calculation regime** saw a number of changes as compared with FP7, as illustrated in the tables below. In particular: each beneficiary has a specific Indirect Cost Model (ICM), and the use of lump sums, flat rates and average personnel costs were gradually implemented. Furthemore, a participants guarantee fund was introduced, the number of ex-ante financial capacity checks was reduced (in FP6, all non-public beneficiaries had to be checked, in FP7 only the ones requesting EU contributions > € 500,000), and the number of certificates on financial statements to be provided decreased (in FP6 each cost claim had to be accompanied by a certificate of an auditor, in FP7 a threshold of € 375,000 was introduced).

	RTD Schemes	**CSA Schemes**
Real Indirect Costs (if analytical accounting system)	Real Indirect Costs	Real Indirect costs (to be declared with justification and method calculation)
Simplified Method (if accounting system allows to identify all indirect costs)	Real Indirect Costs	Real Indirect costs (to be declared with justification and method calculation)
Provisional flat rate	60%	20%
Standard flat rate	20%	20% (to be declared – single exception to actual/real costs declaration)
Maximum reimbursement Indirect Costs CSA Scheme		7% (applied by EC during calculation of payment)

Indirect Costs in FP7

Source: DG RTD

Maximum reimbursement rates	Research and Technological Development Activities (*)	Demonstration Activities	Other Activities
Network of excellence	50% 75% (**)		100%
Collaborative project (****)	50% 75% (**)	50%	100%
Coordination and support action			100% (***)

Reimbursement Rates in FP7

Source: DG RTD

(*) Research and Technological Development includes scientific coordination.
(**) For beneficiaries that are non-profit public bodies, secondary and higher education establishments, research organisations and SMEs
(***) The reimbursement of indirect eligible costs, in the case of coordination and support actions, may reach a maximum 7% of the direct eligible costs, excluding the direct eligible costs for subcontracting and the costs of resources made available by third parties which are not used on the premises of the beneficiary.
(****) Including research for the benefit of specific groups (in particular SMEs).

7. OVERVIEW OF FP7 INDICATORS

Indicator		Target	Results/latest state of play
1	Projects that achieved all or most of their objectives…	90% (by 2013)	98 % by Sep 2015 Source: CORDA/SESAM
2	... of which projects that achieved all of their objectives	75% (by 2013)	47 % by Sep 2015 Source: CORDA/SESAM
3	Share of EU financial contribution to Industry (*)	The target depends on the specific thematic area under the Specific Programme "Cooperation" (between 40% for NMP and 3 % for SSH) (by 2013)	24,6 % by Oct 2014 Source: CORDA
4	Share of EU financial contribution to SMEs	15% (by 2013)[1]	17.4 % by Oct 2013[2] Source : AAR 2013
5	Projects producing specific outputs disseminated to policy makers	75% (by 2013)	95% by Nov 2013 Source : AAR 2013
6	Number of international prizes and awards to ERC grant holders	200 (by 2020)	134 by July 2013 Source : AAR 2013
7	Number of scientific publications by ERC grant holders	~40,000-60,000 (by 2020)	~20,000 by Dec 2013 Source : AAR 2013
8	Number of international scientific users having benefited from access to Research Infrastructures	30,000 (by 2013)	18,300 by Nov 2013 Source : AAR 2013
9	Percentage of users satisfied with services offered by research infrastructures participating in Integrating Activities (good to very good overall appreciation)	>97% (by 2013)	97% by Nov 2013 Source : AAR 2013

[1] = For the budget of the Cooperation SP, the following activities are not included: grants to the European Space Agency (ESA), JTIs, General Activities such as the CORDIS services, the horizontal ERA-NET scheme, research organisations in the EU, strengthened coordination with EUREKA, scientific and technological cooperation activities carried out in the COST and the European Metrology Research Programme.

8. BACKGROUND ON CURRENT SITUATION

Since the launch of FP7, the economic context has changed dramatically. A recession triggered by the 2008 financial crisis led to the adoption of stimulus packages to kick-start the economy. The key challenge is to stabilise the financial and economic system in the short term while also taking measures to create the economic opportunities of tomorrow.

The successor of FP7, Horizon 2020, was launched in the beginning of 2014. It brings together all existing Union research and innovation funding, including the framework programme for research, the innovation related activities of the competitiveness and innovation framework programme and the European Institute of Innovation and Technology (EIT).

Horizon 2020 has a number of new features that make it fit for purpose to promote growth and tackle societal challenges. These include:

- Major simplification through a simpler programme architecture, a single set of rules, less red tape through an easy to use cost reimbursement model, a single point of access for participants, less paperwork in preparing proposals, fewer controls and audits, with the overall aim to reduce the average time to grant by 100 days;

- An inclusive approach open to new participants, including those with ideas outside of the mainstream, ensuring that excellent researchers and innovators from across Europe and beyond can and do participate;

- The integration of research and innovation by providing seamless and coherent funding from idea to market;

- More support for innovation and activities close to the market, leading to a direct economic stimulus;

- A strong focus on creating business opportunities out of our response to the major concerns common to people in Europe and beyond, i.e. ‘societal challenges’;

- More possibilities for new entrants and young, promising scientists to put forward their ideas and obtain funding.

Horizon 2020 focuses resources on three distinct, yet mutually reinforcing, priorities, where there is clear Union added value: i) Excellent Science, ii) Industrial Leadership and iii) Societal Challenges.

9. THE COOPERATION SPECIFIC PROGRAMME

Objectives

The Cooperation Programme was the largest single component of FP7, and invested just over € 32 500 million (65% of the total available budget) across a 7-year term, through a combination of collaborative research and various coordination actions across 10 thematic areas:

Health;

Food, Agriculture and Fisheries, and Biotechnology;

Information and Communication Technologies;

Nano-sciences, Nano-technologies;

Energy;

Environment (including Climate Change);

Transport (including Aeronautics);

Socio-economic Sciences and Humanities;

Space;

Security.

The overarching aim of the Cooperation Specific Programme was to contribute to sustainable development. The overall objective was to help Europe gain or consolidate international leadership in a wide range of key scientific and technology areas, in order to ensure European competitiveness at the global level.

The main objectives of the Cooperation Programme were to support:

– collaborative research (through collaborative projects, networks of excellence and coordination and support actions);

– public-private partnerships in research (through Joint Technology Initiatives[52] set up as Joint Undertakings under Article 187 TFEU as well as contractual public-private partnerships directly under the Framework Programme);

– coordination of non-Community research programmes (through ERA-NET[53] and ERA-NET Plus actions[54] as well as joint programmes with Member States under Article 185 TFEU[55]); and international cooperation.

[52] Joint Technology Initiatives (JTIs) are public-private partnerships at European level in the field of industrial research. The five JTIs introduced in FP7 were Innovative Medicine Initiative (IMI) in pharmaceutical development, Clean Sky in the aeronautics industry, ARTEMIS in embedded systems, ENIAC in Nanoelectronics, and the Hydrogen and Fuel Cells Initiative (FCH). Around 10% of the specific programme Cooperation budget hasbeen allocated to JTIs.

[53] FP6 initiated ERA-NETs as an instrument to stimulate better coordination among funding institutions within a number of thematic fields, by linking national research programmes. The

Effectiveness

Collaborative research

In the modern global economy, it can no longer be expected that single teams or even Member State can provide the necessary scale and scope of resources required to conduct research. For example, the average research expenditure of an EU-25 country is just over € 7 billion per year. (% of GDP)

FP-induced collaborative research encourages trans-national partnerships, brings together resources, disciplines, scientific excellence, thus achieving a critical mass which could not be attained at national level.

Participation of different actors - from university, industry and public research laboratories – and the interaction between these actors is also a key aim of EU collaborative RTD actions. The Cooperation Specific Programme was effective in attracting leading public research and private actors, with approximately 75% of participants from the public sector and 25% being from private entities.

Collaborative research projects enable those research teams wishing to develop their S&T capabilities in specific fields to participate in top transnational teams, benefit from learning and synergies. In this way, FP7 had an important structuring effect on the European research system. The Programme was also effective in increasing the breadth of networks and the engagement of players from EU13 countries. In this regard, a striking aspect of FP7 networks was the increase in participant numbers compared to FP6. There were 450,000 new collaborations recorded under FP7. Moreover, almost three-quarters of organisations participating in FP7 were new to the networks, not having participated under FP6.

Moreover, cross-disciplinarity of research is growing, and no Member State can be expert in all fields, especially the emerging ones. Hence researchers must increasingly look beyond their own frontiers if they want to find high-quality expertise in complementary disciplines.

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scheme continued in FP7, and the number of ERA-NETs under FP7 approached 120, with a total public funding commitment of about €2 billion.

54 ERANET Plus facilitates joint calls through topping up the joint national funding with FP7 funds (33% of the joint call). Hence the ERA-NET Plus represents a significant incentive to develop trans-national funding initiatives that attract additional FP funds available for this purpose. Nine ERA-NET Plus proposals have been approved, involving 140 funding partners, with a total trans-national budget of €232 million and a FP contribution of €67.5 million

55 Article 185 of the Treaty on the functioning of the European Union (TFEU), provides a legal basis for the Union to participate in research and development programmes of the Member States, to help the coordination of R&D in Europe and support a more coherent use of resources. Four have been adopted during FP7:

- Ambient Assisted Living (AAL) to enhance the quality of life of elderly and strengthen the industrial base for related industries through the use of ICT
- European Metrology Research Programme (EMRP)
- BONUS Baltic Sea, supporting the European Strategy for Marine and Maritime Research
- Eurostars, for development projects in any field, with specific attention to research intensive SMEs.

JTIs and contractual Public-Private Partnerships

The establishment of the five Joint Technology Initiatives under Article 187 TFEU for Innovative Medicines, Clean Sky, ARTEMIS, ENIAC and Fuel Cells and Hydrogen and the contractual Public-Private Partnerships set up under the European Economic Recovery Plan in the areas of the Green Car, Energy Efficient Buildings and Factories of the Future involved the commitment of massive financial, organisational and human resources through public-private partnerships.

The JTIs and contractual Public-Private Partnerships contributed to increasing industry participation and implementing industry-driven research agendas. They fostered innovation, by bringing together all the stakeholders along the innovation chain, and supporting market uptake.

See Annex 15 and 17

Coordination of non-Community research programmes

The importance of the coordination of the national programmes is obvious when one considers the amount of funding concerned. The Framework Programme accounts for only 6% of the total public R&D expenditure in the EU, while, for example, the annual budget of DFG in Germany is over € 1 000 million and that of CNRS in France is over € 2 000 million. However, prior to the adoption of FP7, publicly financed research and innovation programmes remain largely uncoordinated and are still defined separately in each Member State in many regions.

Before the crisis, EU funding represented more than 20 % of project based funding in Europe, and this has increased since then thanks to higher annual budgets in the Seventh Framework Programme for Research and Technological Development (FP7)[56]. But the bulk of research remains funded at national level. This shows the necessity to better coordinate research in Europe. A significant effort has been accomplished to coordinate MS activities by developing common strategic research agendas, aligning national plans, defining and implementing joint calls.
The new "ERA-NET PLUS" contributed more strongly to the restructuring of the European research fabric in a coordinated and organised way and thus to the development of the ERA. As for Article 169, the number of joint programmes increased and other fields of research were included, thus strengthening the impact on the ERA.

ERA-NETs and Joint Programming Initiative (JPI) received positive feedback from national policy makers as regards the value of coordinating national research activities. The KBBE theme noted clear indications of important 'critical mass' formed as a result of collaboration.

Success of these schemes can be demonstrated for example in the Health theme: The neurodegenerative disease research (JPND), with a €2 million EU contribution, leveraged €75 million, the AMR JPI leveraged €13.8 million via a €1.9 million EU

[56] European Commission, DG RTD, Research and Innovation performance in EU Member States and Associated countries Innovation Union progress at country level 2013, p. 8.

contribution. Six Era-NETs leveraged €119 million via an EU contribution of €15 million.

Overall, in ERA-NETs and ERA-NET Plus, the five most active participating countries accounted for 40% of the participations (FR, DE, NL, AT, DK).

See Annex 16 and examples in the following Annexes.

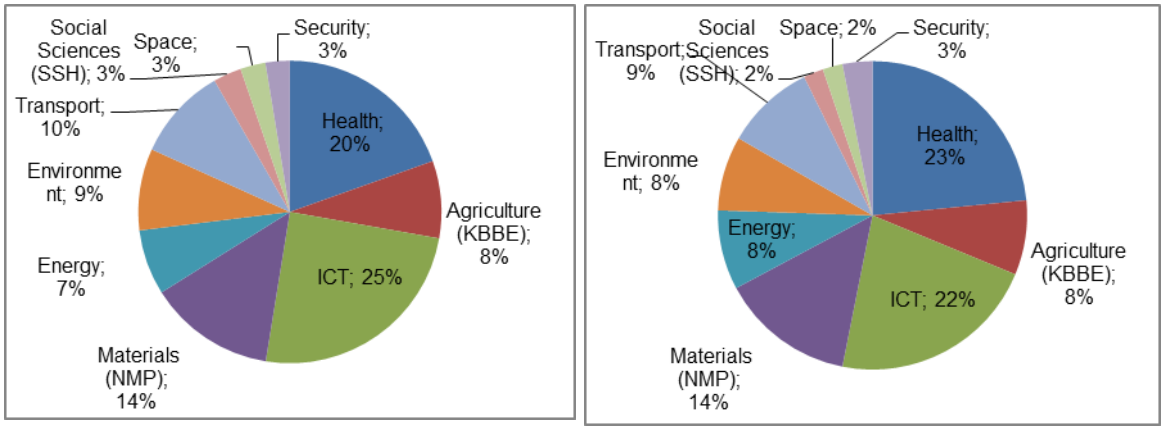
International cooperation

Through the Cooperation programme, contributions was made to Europe's many key international commitments, in particular FP7-Environment played a key role in the development and aggregation of climate change models, with a strong contribution to the International Panel on Climate Change (IPCC). While models could be developed at national level, FP7-Environment provided a unique coordination role, allowing models to be run together, ensuring the completeness of the systems. FP7-Environment thus facilitated the international co-development of climate change models, creating a process of mutual learning and efficient knowledge creation. With its funding activities in this field, the Commission contributes to the creation of international standards that avoid fragmentation of research and funding. Similar progress is apparent in areas such as greenhouse gases (GHG) measurement and ocean acidification and carbon sequestration, where the EU is a leader thanks to its coordination and standardisation role – not to mention the impact of research in these fields on policy and Directives.

Contribution to sustainable development

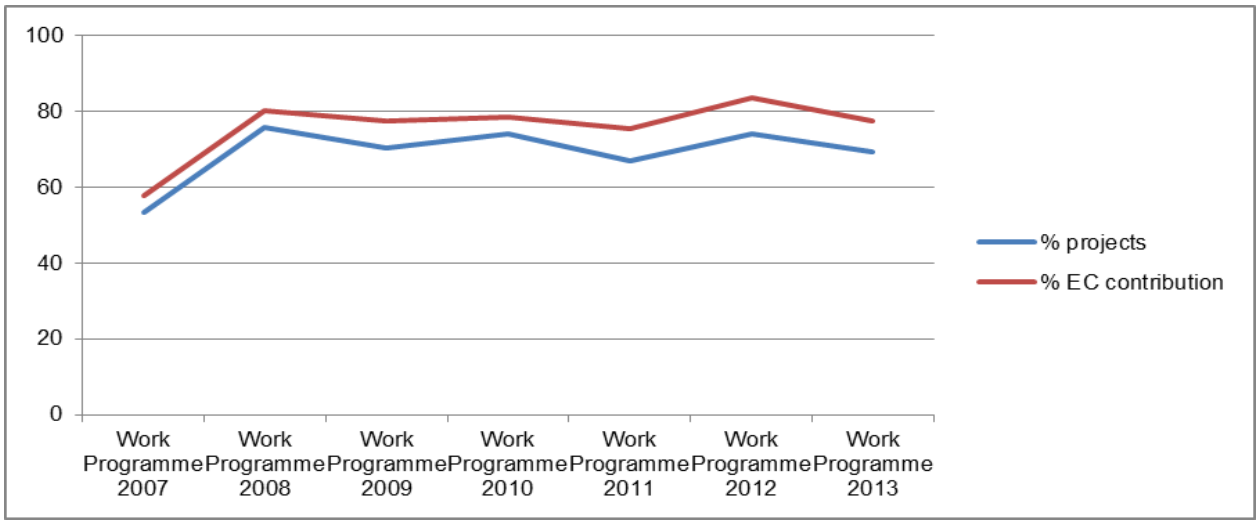
According to the monitoring system FP7-4-SD[57], designed to measure how the FP7 Cooperation Specific Programme contributed to sustainable development (measured by the EU Sustainable Development Strategy - EU SDS), about 75 % of the topics, 69 % of the projects and 76 % of the funding (i.e. € 19.6 billion out of € 25.7 billion) provided by 'Cooperation' live up to the programme's objective of "contributing to sustainable development".

[57] The monitoring system comprises 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 € 25.7 billion. See www.fp7-4-sd.eu



Share of projects and of EC contribution to project cost contributing to at least one of the 78 EU SDS operational objectives in the Cooperation Work Programmes 2007-2013

From a longitudinal perspective, and as figure below illustrates, the share of the European Commission contribution to projects with expected impacts on EU SDS objectives over the Work Programmes 2007 and 2013 has significantly increased, shifting from 57,7% to 77,5%. In the meantime, the share of projects with positive impacts on EU SDS objectives has increased from 53% in 2007 to 69% in 2013.



Share of projects (%) and share of European Commission contribution to projects (%) contributing to EU SDS objectives in the Work programmes 2007 – 2013

Publications

Theme	No. of processed projects	Percentage without reported publications	Number of publications	Publications by project	Pub. in High-Impact Journals	%
Health - HEALTH	337	15%	9614	28,53	5536	57,58%
Food, Agriculture and Fisheries, and Biotechnology - KBBE	125	22%	1551	12,41	666	42,94%
Nanosciences, Nanotechnologies, Materials and new Production Technologies - NMP	289	28%	3628	12,55	1795	49,48%
Energy - ENERGY	88	35%	566	6,43	242	42,76%
Environment (including Climate Change) - ENV	164	35%	2154	13,13	955	44,34%
Transport (including Aeronautics) - TPT	227	61%	447	1,97	134	29,98%
Socio-economic sciences and Humanities - SSH	117	36%	544	4,65	140	25,74%
Space - SPA	73	51%	347	4,75	152	43,80%
Security - SEC	52	58%	191	3,67	26	13,61%
General Activities - GA	10	90%	252	25,20	57	22,62%
Joint Technology Initiatives (Annex IV-SP1) - SP1-JTI	54	93%	10	0,19	5	50,00%
TOTAL COOPERATION	**1536**	**36%**	**19304**	**12,57**	**9708**	**50,29%**

Source: SESAM RESPIR

Efficiency

The two-stage proposal process introduced under FP7 was perceived by Cooperation Specific Programme participants as having lowered significantly the burden for applicants.

The simplification measures introduced were also found to be efficient in most cases. Those rated most favourably by Cooperation Programme participants included:

- introduction of a unique registration facility;

- major reduction in the number of certificates related to financial statements to be provided with periodic claims;

- major reduction in ex-ante controls and revised protective measures for financially weaker participants;

- extension of lump sum financing for subsistence and accommodation costs;

- application of business costs in a manner integrated to the business accountancy system;

- resolution in payments for participation in research by SME owners and individuals without a salary;

- establishment of the Research Clearing Committee.

An area where simplification was found to be less effective was in facilitating information exchange between projects and themes.

10. THEMATIC AREAS OF THE COOPERATION PROGRAMME

10.1. Health

Please note that IMI is presented in a separate annex.

Objectives

The objective of FP7 Health was to improve the health of European and global citizens and the competitiveness of health-related business and industry.

While FP7 Health strongly corresponded to key EU policies and initiatives, the objectives and coverage of the topics evolved over time to ensure coherence with the ongoing economic, social and health developments. For example, FP7 Health's strategic framework was reinforced in 2011 to increase innovation and competitiveness of European health-related industries and services by attracting higher SME participation and funding more research activities aimed at delivering new and innovative products, processes and services[58]. Another example is FP7 Health contribution towards the replacement of animals in better human safety testing as requested by EU law. SEURAT-1[59], a cluster of six large projects was co-financed with Cosmetics Europe as a € 50 million public-private initiative.

How did FP7 Health contribute to the competitiveness of European health industry?

FP7 Health contributed to the competitiveness of European health industry by fostering innovations and supporting the demonstration and development of new products with high market potential.

On average 33% of the FP7 Health projects generated **patents** applications by the end of the contract[60]. More than half of the projects under *Biotechnology, generic tools and technologies for human health* reported at least one IPR (a patent application in 97% of the cases). The figure is 29% for projects under *Translating research for human health* (a patent application in 86% of cases)[61]. By extrapolation, it is estimated that at least 650 patents will be filed as a result of collaborative FP7 Health projects[62]. Evidence from FP7 Health Survey 2014 indicates that at least 65% of the patents have been licensed at this stage. Of the patents filed by SMEs, 47% have been granted at this stage, and 29% have been licensed already[63].

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58 PPMI, *Ex-post Evaluation of the HEALTH Theme in FP7 : preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015*, p. 80

59 SEURAT-1, *Safety Evaluation Ultimately Replacing Animal Testing*.

60 Respir [as of 15.09.2014]. Target was 90% for projects' objectives, 18% for industry participation, 15% for SMEs, 20% projects generating patents. The overall figure for FP7 Health is 25% since projects in public health-related areas and coordination/support action do not generate IPR.

61 Corda database and FP7 Health Survey October 2014, based on the project coordinators' replies. Since at least one third of all respondents are involved in an on-going project that may not have reached yet its full potential in terms of knowledge generation, patents, publications, jobs or new products development, these figures are expected to increase significantly after all project are completed.

62 Respir. [as of 15.09.2014]

63 FP7 Health Survey October 2014. Since two thirds of all respondents are involved in an on-going project that may not have reached yet its full potential in terms of knowledge generation, patents, publications, jobs or new products development, significantly increased figures can be expected

FP7 Health contributed to the development of **innovations**: 85% of FP7 Health projects them led to new methodologies, 40% to new instruments, 38% to new prototypes and 33% to new demonstrators[64]. 29% of the completed projects reported evidence of commercialisation activities[65]. As a significant number of projects was undergoing when this survey was carried out, it is expected that these percentages will increase.

According to a survey of R&D SMEs which participated in a FP7 Health project, 87,5% of respondents indicated that their EU funding project contributed to advance their product(s) development pipeline[66].

What is the current stage of development of your product(s)/ prototype(s)/ technology (-ies)? (Several answers possible)	Total	%
Development phase / laboratory tested	44	55,0%
Available for demonstration	15	18,8%
Available for demonstration / field tested	28	35,0%
Already on the market	25	31,2%
N/A	10	12,5%
Grand Total	122	152,5%

Development stage of deliverables of FP7 Health projects involving SMEs

Furthermore, FP7 Health supported the key **role of SMEs** in the health innovation process to an unprecedented level. Under FP7 Health, one billion € was invested on SMEs (including in IMI), 1,200 SMEs received EU funding, accounting for 1,800 participations. About 75% of projects have at least one SME, and SMEs are increasingly scientifically leading in projects. The share of industry participation reached 20.7%, with 18% for SMEs. The fact that out of the portfolio of SMEs supported under FP6 and FP7, 30% have fewer than 10 employees, and about 30% do not yet generate a turnover[67] indicates that the FP7 Health programme has targeted one of the gaps in innovation cycle funding, which are the very high risk and early-stage SMEs. The average EU contribution per SME has doubled from € 300 k to € 600 k throughout FP7 Health. This shows to what extent FP7 Health helps SMEs securing significant funding over reasonably long period of time (3 to 5 years) while ensuring support for ground-breaking research and technologies.

How did FP7 Health contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

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once all project are completed. Comparison of data regarding the FP7 Health survey of October 2014 and the RESPIR database (the latter concerning only completed projects) hint at an increase of 70% of the figures regarding the number of filed patents.

64 FP7 Health Survey October 2014

65 Respir. [as of 01.01.2015]

66 A. Mialhe, *Questionnaire: SMEs in Health SBIR-like topic 2013*, DG RTD, November 2012.

67 CORDA, Directorate E SME survey (2012)

FP7 Health contributed to **increasing European S&T collaboration**. FP7 Health accounts for the quasi totality of the 2 750 cross-country links established under FP7 in health-related projects (i.e., including with a health component in other priorities)[68]. There is a significant concentration of links between EU15 countries. In 2011, in FP7, links between EU15 countries accounted for 92.2% of links between all MS. From FP6 to FP7, EU12 countries have increased their proportion of links (by 1.4% in 2011). The overall figures, however, might mask some trends, for example, while the three most highly linked EU12 countries in FP6 (PL, CZ and HU) currently have fewer links in FP7, RO, SI, EE and BG have increased their links by 193%, 101%, 100% and 96%, respectively. Among EU15 countries, as early as 2011 in FP7, EL, FI and NL had already increased their number of links by 40%, 32% and 24%, respectively, compared with FP6.

FP7 Health has been very effective in bringing together **public and private sectors** to collaborate all along the innovation chain. In particular, the involvement of SMEs has been strong (see above).

Overall, *FP7 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*[69].

Another example of public-private collaboration is the SEURAT-1 initiative funded by FP7 Health with matching funds from the Cosmetics Europe industry to develop a strategy to replace animal use in toxicity testing.

A main characteristic of the cooperation initiated and strengthened by FP7 Health research is the **durability of the collaborations**. New, durable research partnerships are a clear outcome of EU funded health research. 60% of participants declare that their research network(s) formally continued to operate after the end of the project[70].

FP7 Health produces a **considerable amount of sustainable collaborations**. Its structuring effect is exemplified by the establishment of the European Malaria Graduate School, created under EVIMalaR, an FP7 Network of Excellence, as a follow-up to FP6 Network BioMalPar. BioMalPar has been the basis of a truly European PhD school that has already produced more than 50 European and African PhD candidates in the field of malaria research[71]. Europe is now recognised as the world leader in the biology malaria. No euro spent at national level could have had such an impact; only the funding provided at EU level can support this structuring effect.

At the **international level**, FP7 Health programme succeeded in developing a single network connecting all the major continents and countries of the World. The top 30

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68 Health Competence

69 "The assessment of key FP7 Health (2007-2013) network structural characteristics and indicators revealed a very close interconnectedness between the participant organisations. […] 12% of all the cooperation ties developed between 2007 and 2013 were the ties between the organisations that together cooperated in more than one project" PPMI, *op. cit.*, p. 84

70 FP7 Health Survey October 2014

71 EVIMalaR It has significantly increased the coordination of new collaborative projects between institutional laboratories within Europe and with African partners. The number of publications released by the consortium's members is around 400 and includes a large number of high profile ones (Nature, Cell, Science etc.).

most central countries in terms of their overall number of research collaboration ties developed in FP7 Health between 2007 and 2013 included five third countries [essentially] the US, Australia, India, Russia and Canada. European organisations played the key role as the hubs interconnecting other countries and continents into a single research network[72].

During FP7, FP7 Health provided the lion's share of the EC contribution to Third Countries: 29% (accounting for 40% of the Cooperation specific programme). It amounted to € 210 million, that is, 2.5% of the overall EC contribution to FP7 Health projects. A total of 123 countries participated in FP7 Health, 35 more than those involved in the FP6-LifeSciHealth programme.

The impact was therefore quite high: African countries, for instance, received € 65 million (30% of the contribution to Third Countries) following, notably, a specific call for proposals aimed at strengthening local S&T capacities in Africa. In terms of structuring the cooperation between the EU and Third Countries, FP7 Health introduced the concept of *programme level cooperation* on topics mutually agreed with given Third Countries' funding agencies, thereby enhancing the reach and possible scope of our funded projects by leveraging of 3rd country investments. Another large portion of this EU contribution went to USA (€ 52 million), largely thanks to the special reciprocity agreement between the EC and the National Institute of Health, an agreement that strongly benefits, in absolute terms, to the community of EU health researchers[73].

How did FP7 Health contribute to improve the coordination of European, national and regional health research policies?

FP7 Health played a major role in **coordinating national health research policies**, **structuring EU research** and **providing EU standards**.

At European level FP7 Health played a pioneer role in launching the first EU Joint Programming Initiative (for neurodegenerative diseases), the first inducement prize (in vaccines) and a pilot scheme for involving SMEs, inspired by the US SBIR experience. At national level, evidence has accumulated that health research is often fragmented and lacking coordination. This leads to unnecessary duplication of efforts. Another example is the ERA-NET project on Cancer Registries EUROCOURSE that has tackled fragmentation and streamlined cancer data collection in Member States by linking national and/or regional cancer registries and enabling exchange of technical expertise and best practices. This has led to the establishment of the European Cancer Observatory, a comprehensive resource combining all the information currently available in Europe on cancer incidence, mortality, survival and prevalence.[74].

Through its ERA-net and JPI schemes, aimed at aligning national research agendas and facilitating cross-fertilization, FP7 has substantially contributed to reinforce

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72 PPMI, *op. cit.*, p. 82

73 US teams represented 0.3% of participations in FP6 and this figure reached 1.1% in FP7.

74 Other examples include EUROGENTEST2, that provides for genetic testing in Europe, harmonising, validating and standardising their development, or CARDIOSCAPE (http://www.cardioscape.eu/) that has performed a survey of the European cardiovascular research landscape and recommendations for future research strategy, or TISS.EU, that has produced a repository of central normative documents, as well as soft law regulating human tissue research in the European countries..

coordination and alignment of national research efforts as regards complex chronic and degenerative disorders and AMR[75].

Several support actions were also funded to develop strategic European research agendas. An example is project PerMed[76] where MS research funders in personalised medicine came together with other stakeholders to develop a research agenda for their future co-investments. Other examples are ROAMER (roadmap for mental health research) that is influencing national research agendas (of Italy and Spain, notably), WhyWeAge[77] and FUTURAGE[78], that develop RTD roadmaps, respectively, on the molecular biology of ageing and on all aspects of ageing.

Furthermore, FP7 Health has had a positive **leverage effect:** its investments in programme-level cooperations have catalysed national funders to join and co-invest towards common objectives. For ageing research, EU funding had a clear positive leverage effect resulting in increased national funding. Regional and national initiatives for ageing-related research started in a number of MS. Examples are the *Centre for Membrane proteomics of the Goethe Universität* in Frankfurt, the *Frankfurter Forum für interdisziplinäre Alternsforschung* (FFA), or the *European Research Institute for the Biology of Ageing* (ERIBA), officially opened in 2013 at UMC Groningen[79].

FP7 Health has supported the **development of standards**. The Eurogentest project[80] has contributed to harmonization and quality standards for genetic testing in Europe and beyond. Through international consortia such as IHEC or IRDiRC etc., FP7 Health contributed to developing standards and quality control for data gathering, and in providing safe access to data.

How did FP7 Health strengthen the scientific excellence of basic research in Europe?

FP7 Health attracted the **best research organisations** in the field, both as coordinators and project participants[81] and excellent researchers. Two EU Nobel laureates were involved in the EDICT project[82], Hartmut Michel and Sir John Walker[83].

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75 Two examples of ERA-net projects: TRANSCAN, (http://www.transcanfp7.eu) aimed at coordinating regional and national programmes on translational cancer research. With 25 partners from 19 MS and associated countries, it has been instrumental in facilitating the establishment of a common research agenda in MS, who have already mobilised, € 50 million to support calls. Similarly, the objectives and topics related to brain research have been identified as priorities and taken up at national level, as can be illustrated by the transnational calls for proposals issued under the umbrella of the Neuron ERA-Net (http://www.neuron-eranet.eu/). Neurodegeneration, mental disorders and cerebrovascular diseases were identified as requiring multinational, multidisciplinary approaches.

76 http://www.permed2020.eu/

77 http://www.whyweage.eu/

78 http://futurage.group.shef.ac.uk/

79 http://www.rug.nl/news/2013/11/1105-umcg-officiele-opening-eriba?lang=en.

80 http://www.eurogentest.org/index.php?id=160

81 Top FP7 Health coordinators: 1) INSERM; 2) Karolinska Institutet; 3) University College London; 4) Erasmus Univ. Medisch Centrum, Rotterdam; 5) Stichting Katholeke Univ.; 6) King's College, London; 7) Univ. Medisch Centrum bij de Acad. Zekenhuis Leiden; 8) Acad. Medisch Centrum bij de Univ. van Amsterdam; 9) University of Oxford; 10) Charité Universitätsmedizin Berlin; Katholieke Univ. Leuven and Stichting VU-VUMC.

FP7 Health achieved excellent results as regards **scientific outputs**: the programme has generated so far 18,600 peer reviewed publications, many of them in top-ranking scientific journals with an SJR value of at least 10, including Nature Genetics, Nature, Cell, Science, Neuron, Immunity and others[84]. Data shows that on average, one FP7 Health project produces 34 peer-reviewed publications, completed by an estimated 14 publications arising after the end of the project. 57% of these publications are published in high-impact journals[85]. By the end of all projects, 35,500 articles will have been published with an average impact factor of 9, an indicator of quality which is well above the European average of 2.

FP7 Health contributed to a **significant increase in the stock of useful knowledge**. 54% of project participants valued as one of the main reason for their participation *The research field significantly expanded beyond the initial state of the ar*t[86]. The average number of PubMed-listed publications generated with a member of a participant's group as first author, as estimated by the participants themselves, is about seven publications per project (though approximately 5% of participants published 15 papers or more). By extrapolation, the total number of PubMed-listed publications generated by Health research in FP6 and FP7 up to 2011 can be estimated at more than 70 000[87]. This volume of research publications indicates a very significant output of original and innovative knowledge in return for public funding of health research in FP6 and FP7. In addition its average impact factor of 9 is indicative of quality of the knowledge generated.

FP7 Health significantly contributed to the generation of **new knowledge** in various FP7 call topics, particularly cancer research, systems biology, large-scale data gathering and research on the brain and brain-related diseases. The research in these areas was both highly productive and of high scientific quality. The knowledge generated in other Health topics which did not receive as much funding as the aforementioned scientific areas was also of particularly high scientific quality. These areas are: high-throughput research, diabetes and obesity, innovative therapeutic approaches and interventions, rare diseases[88].

After completion of 39% of the projects, FP7 Health has already delivered **remarkable results:**

One billion € has been devoted to enabling technologies for the development of personalised medicines (e.g. omics, diagnostics, biomarkers), paving the way for more

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82 European drug initiative on channels and transporters: http://cordis.europa.eu/result/rcn/53645_en.html

83 Hartmut Michel was 1988 Nobel Laureate for the determination of the 3D structure of a photosynthetic reaction centre. John Walker was the 1997 laureate for the elucidation of the enzymatic mechanism underlying the synthesis of adenosine triphosphate.

84 PPMI, op.cit., p. 81. In this evaluation journal impact factor was defined as average citations per document in a 2-year period'

85 Respir [as of 15.09.2014]. High impact journals are here defined to be the top 10% (in terms of SJR index) of all journals within their scientific category.

86 FP7 Health Survey October 2014.

87 Again, the time lag in this output needs to be kept in mind when estimating impact of research as according to respondents - 42% of scientific publications arose after the end of the project

88 PPMI, *op.cit.*, p. 82

accurate preventative and predictive approaches[89]. Projects have developed generic tools and knowledge that will impact directly on progress in personalised medicine for the prevention and treatment of cardiovascular diseases, brain diseases and cancer. Advances include the identification of susceptibility genes to predict diseases, novel targets to overcome drug resistance and biomarkers to stratify patient populations in subgroups. In the MultiMod project, new techniques were developed to help researchers quickly analyse medical databases to identify diagnostic markers and design tailor-made medication for allergy sufferers.

About € 770 million have been invested to create, consolidate or integrate cohort studies, which have the unique potential to relate genetic variants with complex diseases and interactions with environmental/lifestyle factors. Europe is leading the world in this area.

The FP7 Health projects portfolio has advanced the knowledge in important areas of brain diseases, which represent a high societal burden: Alzheimer's and Parkinson diseases, epilepsy and sleep disorders, brain trauma, multiple sclerosis, schizophrenia, autism, depression and bipolar disorders. The comparative effectiveness of existing healthcare interventions has also been addressed: InTBIR, the FP7 Health-initiated International initiative on Traumatic Brain Injury (TBI) is instrumental in identifying the best available treatment for the best outcome, by coordinating and harmonising clinical research activities across the full spectrum of TBI.

FP7 Health has promoted the development of novel therapies, of regenerative medicine, of devices, tools and technologies and supported their transfer to real-world medical use.

Examples of FP7 Health key results

ESN, the European Stroke Network[90] brings together 30 pre-clinical and clinical leading centres, as well as industrial partners and patient organisations, to speed up the discovery and implementation of new treatments for stroke and to tackle the translational roadblocks. The main objective of this multidisciplinary consortium is to further elucidate the role of inflammation in stroke and to clarify why such clinical studies addressing inflammation have failed in the past. First results challenged some dogma of stroke pathophysiology and led to a new approach for targeted, non-invasive gene therapy to the brain. Further ESN research also demonstrated that stroke outcome can be improved by enriching the treatment environment what leads to a remarkable formation of new brain connections.

The *Plasticise* project[91] identified treatments that can restore plasticity in adults back to the level seen in children. The discovery that plasticity can be restored following illness

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89 Examples include three projects on rare diseases (RD connect (http://rd-connect.eu/), NEUromics (http://rd-neuromics.eu/), EURenomics (http://eurenomics.eu/) where relevant -omics platforms are applied to groups of rare diseases and the information gathered is linked with clinical data. Another example is ALPHA-MAN (http://www.alpha-man.eu/) where an enzyme replacement therapy is developed for the rare disease alpha-mannosidosis.

90 ESN; http://www.europeanstrokenetwork.eu/), a combination of the projects EU-STROKE and ARISE

91 http://ec.europa.eu/research/health/medical-research/brain-research/projects/plasticise_en.html

or injury, and that the ability to remember can be restored to Alzheimer's patients, makes a powerful promise that enhancing plasticity will be one of the key approaches for effective treatment of these conditions in the future.

The *Persist* project successful developed new viral and non viral vectors for gene therapy that will be of use to treat rare disease and cancers.

How did FP7 Health promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

FP7 Health has supported science education, scientific literacy and training in health research as precursors of growth and jobs. PhD and post-doctoral fellowships were all generated through participation of a team in collaborative research projects of the Health Programme. Around two thirds of participants claim that they had created new positions. Extrapolation indicates that about 3 630 PhD[92] and 3 130 post-docs positions were or are being created specifically under these FP7 Health projects[93], ensuring the education and advanced training of tomorrow's high potential innovators.

As to FP7-health's attractivity, the review of the successful projects led to the identification of over 300 leading researchers participating in the research teams who were laureates of prestigious national and international scientific prizes (e.g. Lasker Award, Leibniz Prize, Spinoza Award, Louis-Jeantet Prize). At least four laureates of the Nobel Prize participated in the programme: professors Christiane Nuesslein-Volhard, Stefan Hell, John Walker and Harmut Michel. The laureate of 2014 Nobel Prize for Chemistry, prof. Stefan Hell, was awarded the prize for the development of super-resolved fluorescence microscopy. In FP7 Health prof. Hell and his colleagues developed ultra-high resolution and ultra-sensitive methods for objective diagnosis of early disease and disease progression in breast and prostate cancer[94].

How did FP7 Health provide the knowledge-base needed to support key Community policies?

The results or deliverable of several projects are produced specifically to inform policy-makers making informed decisions, especially for public health issues. The projects portfolio related to the health workforce; projects in the field of occupational health, projects related to patient safety directly fed into EU legislation[95].

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92 FP7 Health Survey October 2014, based on the project coordinators' replies. Data extrapolated from completed projects' reports indicate that some 9500 PhD students will have been involved on these FP7 Health projects (source: Respir).

93 FP7 Health Survey October 2014, based on the project coordinators' replies.

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

95 The Commission Communication *Towards a job rich recovery* of April 2012 sets out a range of measures to encourage employment and strengthen economic growth in Europe. It also identifies healthcare as one of three key sectors with a high employment potential and includes an Action Plan for the EU health workforce**.** (see IP /2012/380). This action plan refers to projects RN4Cast, MOHPROF and Health Prometheus. The 2014 Commission Communication on a EU Strategic Framework on Health and Safety at Work 2014-2020 is based on an overall view of research in the field on OHS. The Evaluation of the EU Strategy 2007-2012 on health and safety at work, published 2013 refers to the Healthatwork FP7 project (http://www.abdn.ac.uk/haw/).

"*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*[96]. An example is the projects under SEURAT-1 initiative funded by FP7 Health with matching funds from the Cosmetics Europe industry to develop a strategy to replace animal use in toxicity testing. The scientific evidence of these projects will be feeding into a new legislation limiting the use of animals in toxicity testing.

FP7 Health has fostered new approaches to predictive human safety assessment, including reduction of animals use in research (3R strategy). Through the support provided to research on dementia, the Health Theme has generated a critical mass of data and resources that will support future policy making[97].

Supported by FP7 Health, *hESCreg*, Europe's unique human embryonic stem cell registry was set up to inform all stakeholders about technical details and availability of existing stem cell lines to avoid duplication of efforts and unnecessary derivation of new lines.

How much did FP7 Health contribute to job creation?

As of October 2014 (a stage when only 40% of the project were completed), FP7 Health projects had already generated or were generating around **274 new SMEs** and an estimated 9 770 jobs. An average of 11% of the participants were involved in the creation of one SME or more in relation to their work in the project, 90% of which continued to operate after the end of the project, and 13% of the participants declared that they envisaged creating one or more SMEs in relation to their work in the project[98].

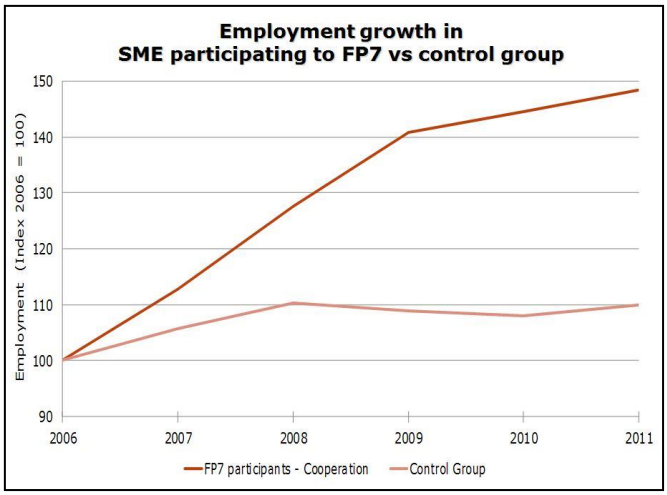
Already 10% of these are considered to be long-term jobs, regardless of additional comparable positions that will emerge at later stage in the projects or of jobs linked to the creation of spin-offs.[99]

96 "*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

97 Closer collaboration and sharing of data and information were the priority objectives set out at the G8 Dementia Summit of December 2013 were. Research collaborations fostered by FP7 Health and the data such collaborations have generated are crucial to contribute to these developments.

98 FP7 Health Survey October 2014.

99 FP7 Health Survey October 2014. Since two thirds of all respondents are involved in an on-going project that may not have reached yet its full potential in terms of knowledge generation, patents, publications, jobs or new products development, significantly increased figures can be expected once all project are completed.



Employment growth of SMEs participating EU projects

To what extent the results of FP7 Health contribute to the achievements of the new Commission's priorities?

FP7 Health has addressed the **main societal and economic challenges** identified in the 2007-2013 period: the ageing of the population and the responses to the economic crisis.

Over the years covered by FP7, with an ageing population, the impact of major chronic and degenerative diseases became gradually stronger. Cardiovascular disease currently accounts for 2 million deaths per annum in the EU and costs around € 192 billion yearly; by 2050, one in three Europeans will be over 60 and over 115 million worldwide will suffer from Alzheimer's disease or another dementia. Objectives of FP7 Health such as the delivery of better and earlier diagnostic, preventive and therapeutic approaches for major chronic and degenerative diseases and the improvement of the quality of life of European citizens, especially the elderly population, have been achieved by supporting many projects in this area. Translational research was central in this achievement. Also, by launching the first Joint Programming Initiative (JPI), targeted on Neurodegenerative diseases (including Alzheimer's) the EU initiated a crucial process of alignment of its Member states (MS)' RTD priorities.

FP7 Health also contributed to the **economic recovery process**. € 875 million have been injected into almost 1 100 research-intensive SMEs, 75 % of which have less than 25 employees or a turnover smaller than € 1 million. This contribution has been instrumental in attracting private fund: the project NABATIVI helped the small biotech company Polyphor to develop a promising new antibiotic compound, which was recently licensed to Roche in a deal worth hundreds of millions of €. By the end of the FP7 projects, 650 patents will have been submitted, and around 100 start-ups created. In addition some 100 000 researchers from Europe and beyond will have worked on the 1 050 projects financed under FP7 Health.

FP7 Health contributed to increase the **knowledge base,** to create products, SMEs and jobs and increase the competitiveness of EU health industries and services, supporting the objectives of the Lisbon Strategy.

While a majority of participants in the FP7 Health come from academia, industry also participates actively: specific incentives in annual work programmes, including SME-targeted topics, succeeded in increasing SME participation. This effective public-private partnership in FP7 Health has contributed to fostering innovations, developing new instruments, methodologies, prototypes and demonstrators which address European societal challenges. More processes and products will be generated from the FP7 projects in the coming years.

As of October 2014 (a stage when only 40% of the project were completed), FP7 Health projects had already generated or were generating around 274 new SMEs[100]. These **spin-offs and the jobs created** in this context illustrate the contribution of FP7 Health to the competitive and dynamic knowledge-based economy targeted by the Lisbon Strategy.

At the same time, all products developed and the increased knowledge-base contributed to improving health care for the benefit of all. Concrete success stories include the generation of an important tool for diabetes research: the first ever human pancreatic beta cell line. It can be exploited to cross-validate animal models, which are used as a key step in drug discovery research, thus saving time and money. Involving patients in the research projects has made it possible to validate patient-reported outcomes in the difficult to treat chronic lung disease chronic obstructive pulmonary disease. Generating the largest ever collection of pooled data from clinical trials in schizophrenia has made it possible to arrive at new algorithms for running such trials, again saving time, money and reducing the need to expose patients to medicines of unknown safety and efficacy.

Strongly based on the portfolio of projects funded under FP7, a policy initiative on personalized medicine is being developed under the mandate of the Juncker Commission.

To what extent was FP7 Health coherent with other EU actions (CIP, ESF) and EU policy?

The ex-post FP7-health study concluded, in its preliminary report, that the specific activities and research topics funded under FP7 Health were consistent with the key policy initiatives and strategic frameworks related to the programme, including the objectives of the EU Health Strategy and the Second Programme of Community Action in the Field of Health (2008-2013). The programme, as well as the Innovative Medicines Initiative Joint Undertaking, were significant contributors to key policy initiatives at the EU level, particularly the Lisbon Strategy for Growth and Jobs, the Europe 2020 strategy and the Innovation Union Flagship Initiative. In line with the actions foreseen in Innovation Union, FP7 Health was instrumental in developing the flagship European Innovation Partnership on Active and Healthy Ageing. The funded research activities of FP7 Health were found to be fully corresponding to the framework set in the legislative basis for FP7[101].

The Health theme also shared several cross-thematic approaches and objectives with other priorities of the Cooperation Specific Programme, e.g., it implemented two special

100 FP7 Health Survey October 2014

101 PPMI, *Ex-post Evaluation of the HEALTH Theme in FP7 : preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015*, p. 91

calls, FP7-AFRICA and FP7-INFLUENZA, through cross thematic collaboration with KBBE and ENV themes.

The special call for Influenza was implemented in 2010 through collaboration with the KBBE theme to address the sudden outbreak of avian influenza.

It should be noted that FP7 Health did not develop the articulation with Regional policy that could provide substantial opportunities. However, in the area of Public Health, around 30 project reported to have effect on regional policy[102].

What was the added value of FP7 Health when compared with national health research and innovation programmes?

The main added value of collaborative Health research at EU level derives from transnational cooperation, the integration of relevant activities and participants, and the concentration of European effort on fewer, but more important priorities. Practically, EU health research:

- Removes barriers to research co-operation between countries, provides structures and incentives to establish multinational consortia and coordinates MS and associated country national funding programmes.

- Provides structures and incentives for cooperation between different types of organisations and disciplines: universities, research centres, hospitals, small and medium-sized enterprises (SME), large companies, foundations, patients' organisations etc, and researchers, engineers, clinicians and industrialists, etc.

- Focuses efforts on issues with a scale which can only be tackled at a European (or global) level, or for which there is significant added value in acting in this manner.

- Generates added value from transnational cooperation, integration of teams and activities, and concentration of efforts on a few important priorities

- Tackling pan-European and global challenges via new types of collaboration

Health issues are global ones. In recent years, the EU has engaged in different types of partnerships that allow tackling complex issues with a bigger impact. This approach has been pioneered by the FP7 Health theme with the private sector and the MS.

To address the global health and major societal challenges, the EU, via the RTD_Health services has initiated a number of such initiatives that involve partnerships with funding agencies, MS and other stakeholders. Eight programme level initiatives have been initiated within FP7 that involve partners from USA, Canada, BRIC countries, Japan among others. These programmes are valued as platforms for research complementarity, protocol harmonization, data and findings integration into common databases and faster result generation with a lower use of resources. Some of the collaborations have already produced significant results[103].

An example is the Global Research Collaboration for Infectious Disease Preparedness (GloPID-R) where funders come together to create a fast and efficient global research

[102] PPMI, *Ex-post Evaluation of the HEALTH Theme in FP7 : preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015*, p. 88

[103] PPMI, *Ex-post Evaluation of the HEALTH Theme in FP7 : preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015*, p. 85

response to a new emerging infectious disease. The EU has established five such international consortia[104]. Its experience in coordinating MS activities proved a real asset to address global issues, as demonstrated in the G7 dementia initiative led by PM Cameron, aimed at identifying a therapy for Alzheimer's disease by 2025: the 2013 G7 Summit called to build on the existing work and capability of the EU, in particular the JPND, to identify priorities and develop a co-ordinated international action plan for dementia research.

- Pooling of resources, achieving critical mass and economies of scale and scope

Some health research activities are of such a scale and complexity that no single MS can provide the necessary resources. They need to be carried out at EU level achieve the required critical mass. In Health research, pooling patient cohorts and constituting biobanks are a significant challenge at MS level. Recruiting sufficient numbers of patients is made easier by trans-European research co-operation. This is notably the case for rare diseases research, where patient cohorts need to be pooled from several MS to constitute statistically relevant sample groups.

Bio-banking is also an excellent illustration of the merits of EU-induced critical mass. A number of EU-supported projects (GenomeEUtwin, ENGAGE, GEN2PHEN, MOLPAGE, Phoebe) have brought together large amounts of data on patients, permitting the identification of susceptibility genes and biomarkers for common diseases. Conducted at national level, the studies would not have the same analytical power. Furthermore, these projects bring together European excellence in the field and develop a pan-European infrastructure for medical research, the Biobanking and Biomolecular Resources Research Infrastructure[105], through the ESFRI initiative. Projects such as EUROGLYCANET and the *European Network of Rare Bleeding Disorders* developed extensive databases and bio-banks for patients affected by groups of rare diseases, with diagnosis and management capabilities, and an invaluable resource for patients and clinicians alike, with partners in 20+ countries.

In addition to other merits previously exposed, EDCTP, the two JPIs as well as the ERA-nets funded all provide significant, obvious, added-value in terms of pooling if resources.

- Reducing research risk and commercial risk. Added value is also conferred by the reduction of research or commercial risk.

Without FP7 Health support, several clinical trials would never have been set up: EU-funded research in those areas requiring multinational input, such as clinical trials on medicines and devices for major chronic diseases, which have seen a decrease of industry input due to their complexity, definitely supported innovation and contributed lowering risk of later product development failure. It also helped reducing the risk for patients by providing crucial information on the potential adverse effects of otherwise useful medicines and medical devices.

This is also valid for academic clinical trials, aiming at the comparative assessment of efficiency and cost-efficiency of given therapies. They can lead to discard expensive

[104] International consortia IRDiRC, GACD and InTBIR have already been presented in section 3.8.

[105] BBMRI aims make European bio-banks more efficient and available for research, to promote the use of research results in a clinical setting and to establish the foundation for personalised medicine

treatments, thereby strongly benefiting to national health systems. Industry may not be inclined to invest significant resources in such potentially unrewarding trials, hence the relevance of EU intervention.

- FP7 Health for Synergy: complementing and leveraging

Leverage on private investment. Through EU research schemes, private companies can collaborate with foreign partners at a scale not possible at national level, in projects tested for excellence, which induces them to invest more than they would under national funding schemes. One example of this is IMI. An evaluation performed by a panel of independent experts found that "*Europe has succeeded in establishing a new business model between public and private sectors, which unites research strengths across European pharmaceutical industry, academia and small and medium enterprises (SMEs)* […] *very important in developing open innovation in the health sector as it has enabled an unprecedented pooling of industrial research assets allowing scientific challenges to be tackled in a manner that could not be done otherwise* […] *In many respects IMI is an incubator for changing minds on how parties can work together across traditional boundaries and is therefore likely to have an important structuring effect in Europe, fully in line with the Innovation Union objectives*".

Improving of S&T capabilities. All of these projects evidently contribute to the improvement of S&T capabilities of the participants: by participating in top trans-national teams, researchers can form world centres of excellence. This is clearly acknowledged and extremely valued by the survey of FP7 Health participants[106].

- Synergies are established with relevant other EU policies and programmes.

"FP7 Health was highly consistent with the overall EU policy context and responsive to the changing needs of its key stakeholders. The specific activities and research topics funded under FP7 Health were consistent with the key policy initiatives and strategic frameworks related to the programme, including the objectives of the EU Health Strategy and the Second Programme of Community Action in the Field of Health (2008-2013). The programme, as well as the Innovative Medicines Initiative Joint Undertaking, were significant contributors to key policy initiatives at the EU level, particularly the Lisbon Strategy for Growth and Jobs, the Europe 2020 strategy and the Innovation Union Flagship Initiative. In line with the actions foreseen in Innovation Union, FP7 Health was instrumental in developing the flagship European Innovation Partnership on Active and Healthy Ageing. Overall, the funded research activities of FP7 Health were found to be fully corresponding to the framework set in the legislative basis for FP7[107]".

FP7 Health also provided research support for performing clinical trials in children with medicines that are not approved in this age group but for which a strong rationale exists that they may be useful. This support is complementary to the EU paediatrics regulation which provides incentives and obligations for entities submitting requests for marketing authorisation to the European Medicines Agency (EMA).

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106 In the FP7 Health Survey conducted in October 2014, almost half of the participants ranked "New resources, including infrastructures" among the most important outputs of the project.

107 PPMI, *Ex-post Evaluation of the HEALTH Theme in FP7 : preliminary analysis of FP7 projects portfolio and their outcome, Jan. 2015*, p. 80

Coordination was also notably ensured with the latter for initiatives relevant to Alzheimer's disease. The Communication from the Commission on a *European initiative on Alzheimer's disease and other dementias*[108] called for better coordination of research on dementias and promote cooperation in public research efforts, targeting key priorities related to neurodegenerative diseases. The Commission supported the concept of a JPI on combating neurodegenerative diseases, in particular Alzheimer's, for pooling and coordinating the efforts of European basic and clinical researchers in this field. This support materialised during FP7 via a € 2 million grant to help MS develop their initiative[109].

Synergies were also noted with the EC action plan against the threats of AMR where, in a coherent fashion and via a one-health approach, research and policy actions are proposed and implemented.

During the implementation of FP7 the feedback from stakeholders implementing legislation proved essential in order to help shaping new or revised European legislation concerning notably clinical trials, personal data protection or medical devices. Likewise, such feedback was also useful to contribute to the debate on the data transparency policy of the European Medicines Agency or on the funding of research involving human embryonic stem cells.

- Leverage effect of FP7 on additional funds

EU funding from the Health programme leverages other sources of support to research in the health field**.** Around 56% of participants, regardless of their affiliation, indicate that EU 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 [110]. As a further indicator of the importance of EU funding, 75% of participants acknowledge that EU funding represents up to 50% of their total research budget.

The extra funding reported to have been obtained included national or regional sources (72% of respondents), other FP programmes (30%), private foundations and charities (24%), industry (19%) and international programmes and agencies (15%). By contrast, only 3% of all respondents who indicated leveraging by FP funding, reported business angel or venture capital sources. Unlike academic researchers, however, 14% of the SMEs with leveraged funds obtained these from business angels or venture capitalists. The RSFF was not reported to be useful to these SMEs, however.

Health in H2020: continuity or evolution?

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108 Commission Communication COM(2009) 380/4 to the EP and Council on a European initiative on Alzheimer's disease and other dementias (http://ec.europa.eu/health/archive/ph_information/dissemination/documents/com2009_380_en.pdf)

109 Established in 2009 as the pilot of the Member State-led JPIs to enable the participating EU MS to better streamline their research efforts, JPND aims at aligning national priorities in the field of age-related neurodegenerative diseases. The support provided under FP7 took the form of a 3-year coordination action, which allowed supporting the development of its Strategic Research Agenda, the establishment of the common priorities to be jointly implemented by MS and the analysis of the state of art of national research activities.

FP7 Health Survey October 2014.

While retaining the successful features of FP7-health : collaborative research, IMI, EDCTP, the new *Health, demographic change and wellbeing* societal challenge under Horizon 2020 will better integrate EU RTD&I funding in health-related areas, as recommended by the 2011 report of an independent group of expert, with the integration of *ICT for health* and *Health and Environment* aspects. It will have an increased focus in innovation and the trend toward broad, bottom-up, of less prescriptive, topics will be continued to better help creative ideas emerge. It will fund research and innovation activities with the following fields:

Understanding health, wellbeing and disease;

Preventing disease;

Treating and managing disease;

Active ageing and self-management of health;

Methods and data;

Health care provision and integrated care.

It will also continue to contribute to the development of the European Research Area through progress in joint programming of national research and innovation activities and through the fostering of international research consortia

10.2. Food, Agriculture and Fisheries, and Biotechnology

Objectives

Securing food production for the increasing human population through sustainable and efficient production systems, protecting the environment and biodiversity are the main challenges addressed in the FAFB programme.

The specific objectives are:
- The growing demand for safer, healthier, higher quality food;

- The growing demand for sustainable use and production of renewable bioresources;

- The increasing risk of epizootic and zoonotic diseases and food related disorders;

- Threats to the sustainability and security of agricultural, aquaculture and fisheries production; and

- The increasing demand for high quality food, taking into account animal welfare and rural and coastal context and response to specific dietary needs of consumers.

The programme’s origins were to be found mostly in 2005 and 2006, predating Europe 2020 and flagship initiatives. It was also developed prior to two crises that now dominate thinking: the global food crisis of 2007-2008 and the financial crisis. The Work Programmes priorities evolved over FP7, taking into account the focus on addressing societal challenges and contributing to economic recovery.

How did FP7 KBBE contribute to the competitiveness of European KBBE industry?

The FP7 KBBE projects have delivered innovations, contributing to the development of new products, processes and prototypes thus helping Europe address global societal challenges.

Proof of concept and prototyping was the most typical way of exploiting results. A highlight was PLAPROVA: Evaluation of potential plant-based vaccines against a number of diseases of great and increasing importance to both the EU and Russia. This project has been flagged as success story by the Commission and the coordinator has been awarded the prize as Innovator of the Year and Most Promising Innovator winner by BBSRC (UK).

Example of a commercial development and new start-up: one of the academic partners in LIFECYCLE launched a spin-off company in February 2013, specialised in aquaculture genetics services. This commercial development represents the commercialisation of over 30 years of basic research on the physiology and genetics of fish muscle growth and flesh quality and was made possible by continuous support from the UK Research Councils and the European Commission, the later through SEAFOODplus (FP6) and LIFECYCLE (FP7). The core business of Xelect is the developing of genetic markers for brood stock selection. Xelect has licensed genetic markers for superior meat yield in Atlantic salmon to SalmoBreed A/s and Landcatch Natural selection and several other license opportunities for this and other traits are currently under negotiation.

20% of the 107 projects report to have taken at least one **patent**, the total number of intellectual property "protections" is 64 with 52 being reported as patent applications. 47 of the 52 patent applications came from the Biotechnology area of the programme, which is to be expected. This can also be reported as 6.2 patent applications per Euros 10 Million invested although this is a crude measure when there are other forms of exploitation which are effective such as copyright, design rights, trade secrets etc. Exploitation and commercialisation are different things. The non -technological forms of innovation may lead to significant benefits in company or social enterprise performance without any patent being filed. Not all projects are intended to produce new products services or patentable items. Indeed, many fisheries, agriculture and food projects do not produce outputs amenable to traditional technology transfer via the protection of proprietary intellectual property, e.g. patenting.

	Projects with a Processed Final Report	No. of projects where there exists at least one foreground		No. of projects with no foreground information		No. of reported foregrounds		Reported Foreground Types				
		No.	%	No.	%	No.	%	Commercial exploitation of R&D results	General advancement of knowledge	Exploitation of R&D results via standards	Exploitation of results through (social) innovation	Exploitation of results through EU policies
Total	**107**	**5**	**5%**	**103**	**96%**	**8**	**100%**	**1**	**0**	**1**	**3**	**0**

Foreground data for completed FP7 projects

The majority of patent applications were submitted to the European Patent Office (EPO). Although the FP7 programme is open to private industry there seems to be no patent applications or intellectual property protection was initiated by the participating industry. As all the projects are not completed yet, these are note deinfitive conclusions, and it is expected that these figures will increase.

An example being one Biotechnology project, MAMBA, where filed patents have already been successfully licensed to industry. The MAMBA project was aimed at the mining of enzymes and metabolic pathways from extremophilic marine organisms and metagenomes from microbial communities from peculiar marine environments and consequent funnelling the new enzymatic reactions and processes towards new biotechnological applications. The MAMBA consortium has more than doubled the number of structures of cold-adapted proteins available in public databases and provided so far the largest set of protein structures from a single cold-adapted organism. 27 peer-reviewed papers have been published in high-impact journals. One patent application has been filed and licensed, with a few more applications pending. The screening platform developed has been useful for functional elucidation of unknown proteins (and potential drug targets) in the important human pathogen H. pylori. Interest has been expressed by a number of companies seeking to use the resources generated.

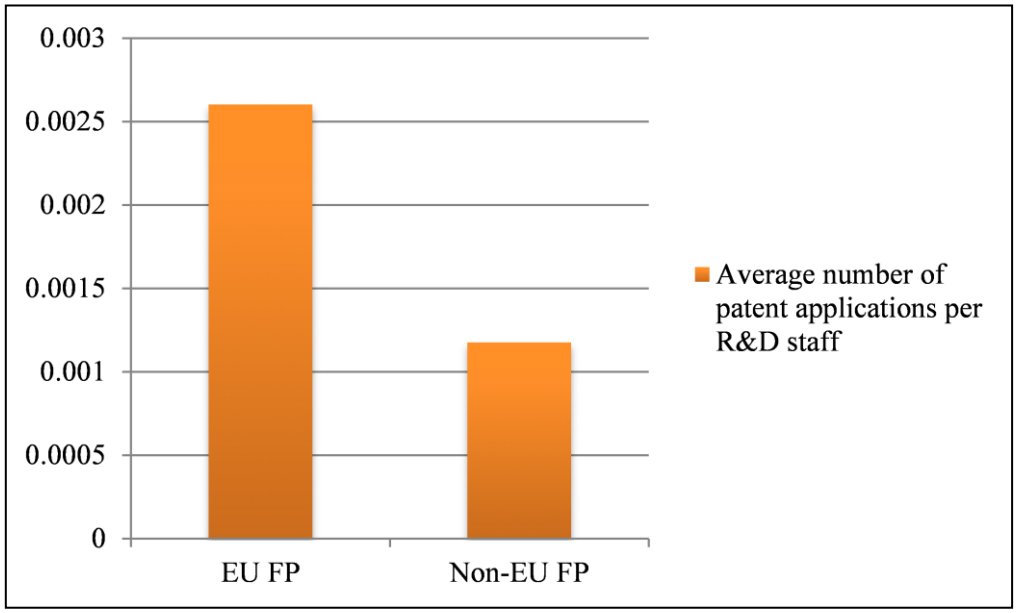
The standard EU collaboration agreement provides a clear framework for managing IPR and there are good examples of this being used well (e.g. TriticeaeGenome). This supports a wide range of approaches including revenue sharing and licensing; license of the technology where partners do not have the production capacity to meet market demand, or joint ownership with access rights granted on a royal-free basis.

Organisations participating in the EU FP7 tend to have more patent applications than organisations which do not take part in the EU FP. The indicator 'average number of patent applications per researcher', which was used in the counter-factual analysis provides a comparison between the innovation performance of organisations which are part of the EU FP and those who are not. On average, researchers in organisations participating in the EU FP7 tend to apply for patents twice as much as researchers in organisations which do not take part in the EU FP.

For instance, the EU-PEARLS project resulted in the production and testing of medicinal gloves and car tyres made of Russian dandelion and guayule, which can constitute an alternative source of natural rubber. The agricultural productivity of Russian dandelion and guayule was investigated in order to allow for the setting up of the production chain for natural latex and rubber in Europe.

The ANIMPOL project used waste streams from slaughterhouses (i.e. resides from animal-processing industries) to produce improved biodiesel (fatty acid methyl esters - FAME). The development of novel biodegradable high-value polymeric materials which are environmentally-friendly was also undertaken, thus achieving cost-efficient and sound alternative products for the polymer industry.

The SPLASH project supported the development of algae biorefineries (i.e. third generation biorefineries) for the production of cups, bottles, cutlery, plates, bags, bedding, furnishings, carpets, film, textiles and packaging materials which are biobased (vs. petroleum-based). The project identified alternative feedstocks for polymers which are renewable and less harmful to the climate and the environment.



Average number of patent applications per R&D personnel EU FP participating and non EU FP participating research performing organisations (organisations active in the agricultural sciences field, 2013)

How did FP7 KBBE contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

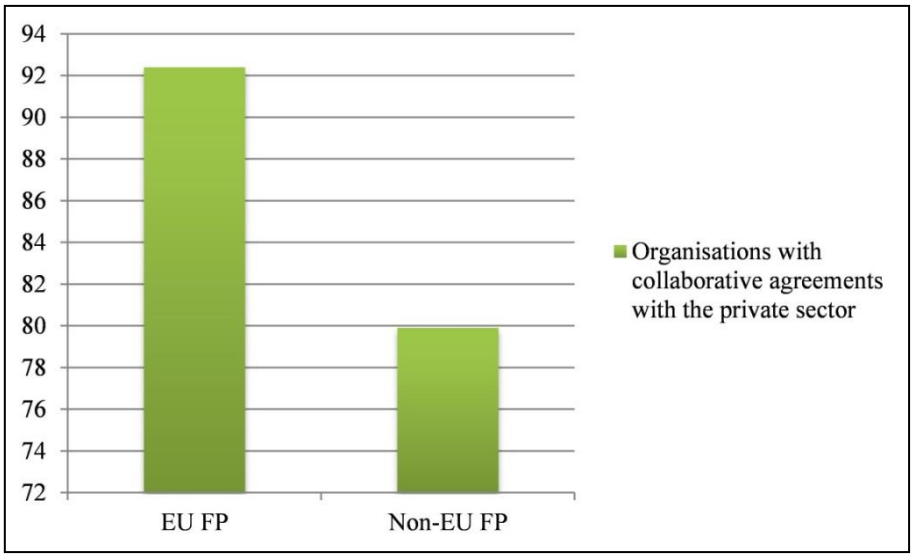
The impact of projects on the development and consolidation of the ERA is found to be very high: 84% of coordinators consider that participation in FP projects has consolidated their permanent network of partners, and half of them stated that their participation has contributed to launching new European projects.
Good examples of long standing cooperation reported include:

- Animal health projects which build on the previous project results and consortia (e.g. STAR-IDAZ-EMIDA-ANIHWA; DISCONTOOLS-ICONZ). Thus we could find a growing amount of shared knowledge and a growing number of researchers working together regularly, providing real added value for the EU.

- Linked to the concentration of biological research (e.g. Strategic support to crop improvement, IPM, PRA) in the EU15, we see long-standing collaborations between particular major public sector research establishments and Universities in The Netherlands, France, The UK, France and Germany in various constellations across the programme.

In contrast to FP6, FP7 includes some very notable ERA-NET success stories in 'agriculture'. These include the animal health and welfare ERA-NET (EMIDA and ANIHWA) and the food security, agriculture, climate change ERA-NET plus (linked to the FACCE JPI).
ANIHWA and EMIDA are particularly noteworthy in investing significantly in animal health and welfare research almost fully compensating for the drop in EU funding (with about €54 million). The FACCE JPI project is also an excellent example of clear collaboration between funders delivering synergies in national funding across Europe. It shows a strong interaction with the ERA-NET Plus on Climate Smart Agriculture. In food, the SUSFOOD ERA-NET resulted in a joint European Strategic Research Strategy and a research funding "organisation" in the area of sustainable food production. This organisation is already in operation with nineteen new projects started with national funding agencies jointly financing the European funding**.**

Participation to the EU FP7 is also linked to increased linkages and stronger cooperation between the public and private sector. The counter-factual analysis shows that organisations which take part in the EU FP tend on average to collaborate more with the private sector. By and large, research performing organisations have collaborative agreements with the private sector, however more organisations participating in the EU FP (+15%) tend to have this type of agreements as shown in figure below.



EU FP participating and non EU FP participating research performing organisations having collaborative agreements with the private sector (organisations active in the agricultural sciences field, in percentage of organisations, 2013)

As regards international cooperation, the top participating countries were China, Russia, the USA, South Africa, India, and Brazil. BRIC countries accounted for 160 participations, 10 of which were SMEs. Regarding the thematic distribution of the 128 projects which reported having a link with one or several of these regions, it should be noted that the distribution is relatively even: 30% of projects in agriculture, another 30% in biotechnologies, 24% in fisheries and aquaculture and 15% in food.

How did FP7 KBBE contribute to improve the coordination of European, national and regional research policies?

The Standing Committee on Agricultural Research (SCAR) played an essential part in improving the coordination of European and national research policies in the agriculture and bioeconomy sector. Through its support to the ERA-Nets, SCAR fostered the development of common research agendas amongst Member States. The ERA-Nets schemes within the KBBE programme mobilised on average the largest number of countries (12.8 countries per call against an average number of 10 for the whole FP7) , had the fourth highest leverage effect (factor 8.6 in FP7) and mobilised a total public funding amount of EUR 348 million. Through its support to the ERA-Nets schemes and the Joint Programming initiatives (e.g. 'Agriculture, Food Security and Climate Change' – FACCE - and 'A Healthy Diet for a Healthy Life' - HDHL), SCAR helped structuring European and national research policies**.**

How did FP7 KBBE strengthen the scientific excellence of basic research in Europe?

Overall, FP projects have had a substantial impact on improving the knowledge base in Food, Agriculture, Fisheries and Biotechnologies, through high scientific productivity combined with novel technological output. For instance, biotechnology publications in 2010 'Nature' journals cited US and Canadian authors in 486 cases and European authors in 641 cases.

Amongst all the projects which have been finalised (107), 80% of them report at least one publication, whilst 20% report no publication yet. The total of the publication at the reporting date of 3rd of March 2014 was 1414, of which 43% are in a high level journal. The KBBE FP7 programme generated until now 54 publications per Euros 10 million invested, of which almost half are in high impact journals. Around 3% of publications were published in the top 20 journals (based on the Journal Rank Indicator). Table below shows a significant number of publications in high impact journals in environmental microbiology, science and medicine (PLoS One), plant sciences and commodity based research as in the Journal of Dairy Science.

Top 20 Peer Reviewed Journals by Number of Publications from FP7 KBBE Projects

KBBE				
		SJR[111]	No. of Publications	% of all publications
1	Environmental Microbiology	2.7	24	1,70%
2	PLoS One	1.8	23	1,63%
3	Applied and Environmental Microbiology	1.6	20	1,41%
4	Journal of Dairy Science	1.2	20	1,41%
5	Plant Physiology	3.1	18	1,27%
6	Plant Journal	3.5	16	1,13%
7	New Phytologist	2.5	15	1,06%
8	Plant Cell	4.8	15	1,06%
9	Proceedings of the National Academy of Sciences of the United States	5.4	14	0,99%
10	Applied Microbiology and Biotechnology	1.2	13	0,92%
11	Mutagenesis	0.9	13	0,92%
12	Food Chemistry	1.7	12	0,85%
13	Plant Biotechnology Journal	1.8	12	0,85%
14	Vector-Borne and Zoonotic Diseases	0.9	12	0,85%
15	Acta Horticulturae	0.2	11	0,78%
16	Biofuels, Bioproducts and Biorefining	1.8	11	0,78%
17	Journal of Virological Methods	0.8	11	0,78%
18	Animal	0.9	10	0,71%
19	Bioresource Technology	2	10	0,71%
20	Journal of Biological Chemistry	2.8	10	0,71%
	Total		290	20,51%

[111] SJR - Journal Rank Indicator, it is a measure of journal's impact, influence or prestige. It expresses the average number of weighted citations received in the selected year by the documents published in the journal in the three previous years (2011)

Publications in high impact factor journals are mostly in the areas of molecular biology and genetics.

Scientific Articles resulting from KBBE Projects in Peer Reviewed Journals by top 10 Journal Rank indicator (SJR)

No.	Journal title	Journal Subject Area	**SJR***	Number of publications (papers)
1	Nature Genetics	Biochemistry, Genetics and Molecular Biology	**19.9**	2
2	Cell	Biochemistry, Genetics and Molecular Biology	**1.,8**	1
3	Annual Review of Plant Biology	Agricultural and Biological Sciences	**14.7**	1
4	Nature	Multidisciplinary	**14.5**	6
5	Science	Multidisciplinary	**11.2**	1
6	Genome Research	Biochemistry, Genetics and Molecular Biology	**10.8**	1
7	Developmental Cell	Biochemistry, Genetics and Molecular Biology	**9.2**	1
8	Nature Biotechnology	Biochemistry, Genetics and Molecular Biology	**9.2**	1
9	Trends in Ecology and Evolution	Agricultural and Biological Sciences	**8.7**	1
10	Annual Review of Microbiology	Immunology and Microbiology	**8.1**	1
11	Ecology Letters	Environmental Science	**7.9**	4
12	Cell Metabolism	Biochemistry, Genetics and Molecular Biology	**7.7**	1
13	Nature Reviews Microbiology	Biochemistry, Genetics and Molecular Biology	**7.2**	2
14	Trends in Biochemical Sciences	Biochemistry, Genetics and Molecular Biology	**7**	1
15	EMBO Journal	Biochemistry, Genetics and Molecular Biology	**6.6**	2
16	Trends in Genetics	Biochemistry, Genetics and Molecular Biology	**6.3**	2
17	Molecular Systems Biology	Biochemistry, Genetics and Molecular Biology	**5.9**	3
18	Nature Protocols	Biochemistry, Genetics and Molecular Biology	**5.8**	2
19	Advanced Materials	Materials Science	**5.7**	1
20	Proceedings of the National Academy of Sciences of the United States	Multidisciplinary	**5.4**	14
	Total			48

How did FP7 KBBE promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

An important number of KBBE projects included a clear training and career development component. For instance, the KBBE/OCEAN calls specifically offered academic and training courses for research participants. The coordinators of the 31 'The Ocean of Tomorrow' projects involved Ph.D. students who gained on-the-job experience, whilst exchange programmes between partners were also implemented. Projects such as VECTORS and COCONETs organised training activities, notably for PhD researchers (DEVOTES project).

In the area of food, the project KBBE-227220 TRACK_FAST aimed at the identification of training and career requirements for future European food scientists and technologists (e.g. skills required for the food job market, continuous professional training, etc.) destined to work for the food industry sector. Moreover, the project also supported the implementation of a European strategy to recruit the next generation of food scientists and technologist leaders.

Training activities and joint programmes with researchers in third countries were also implemented as part of the KBBE programme.

How did FP7 KBBE provide the knowledge-base needed to support key Community policies?

The projects funded under the Agriculture, Food, Fisheries, Biotechnology programme led to several types of policy impacts, as follows:

Development of scientific evidence to support policy and legislative actions: this was notably the case in agriculture, food and animal health and welfare related projects. By way of example, more than one third of the development and demonstration research in agriculture contributed to standardisation and legislation; Several biotechnology projects provided scientific data for supporting the development of guidelines and standards. For instance, projects such as KBBPPS and OPEN-BIO supported the creation of new markets for bioproducts through standardisation and labelling (KBBPPS, OPEN-BIO), Regulatory activities in the field of biotechnology, such as GMO risk assessment research, were also supported through the AMIGA, GRACE and G-Twyst projects. FP7-funded projects on organic farming provided research-based recommendations to the EC and national competent, such as the contribution to the Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.

Formulation of research and/or policy agendas: this is notably the case of fisheries projects (JAKEFISH and ECOFISHMAN projects). For instance, the JAKEFISH and ECOFISHMAN projects supported the Common Fisheries Policy, by involving stakeholders in jointly formulating the research and policy questions and identifying approaches to address the latter. A contribution to the reform of the CFP and to the development of the Ecosystem Based Fishery Management (EBFM) came also from the

MEFEPO project, whose main aim was to improve fisheries management with regards to sustainability of resources.

Fundamental research oriented projects supported practices and regulations within the pillar 'Better framework for aquaculture' of the reform of the Common Fisheries Policy with a focus on species selection (DIVERSIFY project), domestication (FISHBOOST project) and seed validation (REPROSEED project), disease prevention and safety regulations (AquaInnova and PROMICROBE project), management of natural resources by moving away from capture-based aquaculture (PRO-EEL, SELFDOTT, TRANSDOTT projects) and traceability of wild vs farmed individuals (SELFDOTT, AQUATRACE projects).

Development of tools and mechanisms for communicating to the public on health and well-being issues: this was the case in food related projects. Horizontal projects seeking the involvement of African and European organisations (CSOs), for example, contributed to the formulation and implementation of policies on agricultural research for development (ARD) in relation to the bioeconomy. The projects have provided an opportunity to enhance their capacity to influence the ARD by focusing on the coordination and communication with Europe.

There are other policy related outcomes. For example, the KBBE Conference witnessed Member States (such as Belgium, Germany, France and the Netherlands) adapting their transition plans with respect to the KBBE was a major success.
In terms of up-take of policy results, policy makers were involved in relevant projects as members of advisory groups. In some cases, researchers served as expert policy advisors and in others there was direct interaction with the policy-making process. Additionally, workshops with key policy-makers were organised and tools were provided over the internet, or as working documents for EU policy-development panels and ministerial conferences (such as the Standing Committee on the Food Chain and Animal Health (SCoFCAH), the Standing Committee on Organic Farming as well as Intergovernmental Panel on Climate Change (IPCC), the International Co-operative Programme (ICP) on forests).

How did FP7 KBBE increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

In the marine sector, access to marine infrastructure was funded under the Research Infrastructure programme (Capacity). The project AQUAEXCEL (Aquaculture Infrastructure for Excellence in European Fish Research) was particularly successful in integrating 27 top class aquaculture infrastructures and 17 key partners.
In the food sector, the EURO-DISH and FoodManufuture projects have resulted into a common infrastructure project in Horizon 2020, RICHFIELDS , whose objective is to design a world class research infrastructure on food and health consumer behaviour and lifestyle. For instance, the FoodManufuture project identified solutions to tackle the needs of the European research infrastructure of the food processing and manufacturing industries. It introduced the Food Factory of the Future (FFoF) concept, a novel research infrastructure which meets the current and future needs of the European food and manufacturing industries and accelerates their innovation potential. A Food Tech

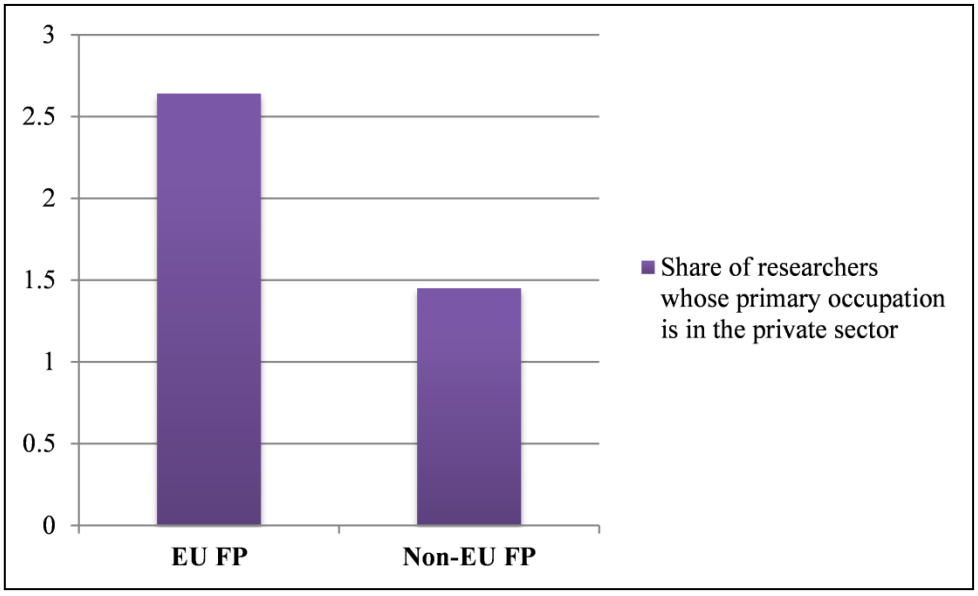
Innovation Portal was set up as part of the HighTech Europe project. The portal serves industry's needs and offers tools and information (e.g. 1,500 linked datasheets) to support the development of a innovative food industry.

A tangible example of an ERA impact is the project HIGHTECH EUROPE where a number of food research laboratories provided access to each other's unique food processing equipment, thereby facilitating the dissemination of novel technologies and providing the opportunity for more research and innovation to be done with these pieces of equipment.

How much did FP KBBE contribute to job creation?

82% of projects created temporary jobs during the project's implementation and 35% created new posts after the end of the project.

Moreover, the counter-factual analysis shows that organisations which participated in the EU FP7 tend on average to employ more researchers whose primary activity is in the private sector. As shown in figure below, on average, organisations taking part in the EU FP tend to hire more researchers whose primary occupation is in the private sector (+82%) than organisations not participating in the EU FP.



Share of researchers whose primary occupation is in the private sector, in EU FP participating and non EU FP participating research performing organisations (organisations active in the agricultural sciences field, 2013)

Source: DG RTD calculations, 2014 ERA Survey

To what extent the results of FP7 KBBE contribute to the achievements of the new Commission's priorities?

Sustainability is a central aspect of the programme. The overall aim of the programme has been to provide new, safer, affordable, eco-efficient and competitive products from European agriculture, fisheries, aquaculture, feed, food, health, forest based and related industries. FP7 reintroduced agricultural production research and includes projects that address clear tangible farming and agricultural system targets. 49% of FP funded project coordinators stated that their project had positive environmental impacts. The bio-based economy, addressing the key societal global challenges of limited resources, food security, health and climate change contributes to Europe 2020 on a broad front.

To what extent was FP7 KBBE coherent with other EU actions (CIP, ESF) and EU policy?

The general objectives of the KBBE programme were fully aligned with the objectives of the Common Agriculture Policy (CAP), the Common Fisheries Policy as well as the Marine Strategy Framework Directive (MSFD) and the EU Integrated Maritime Policy (IMP): improve agricultural productivity and sustainability and achieve sustainable production and management of biological resources from aquatic environments.

The specific activities of the KBBE programme in relation to agriculture, fisheries and marine supported risk-oriented research within a wider economic, social and environmental agenda. These activities reflect the CAP's activities (focusing on food security, climate change, sustainable management of natural resources and rural development) and Common Fisheries Policy' activities (focusing on ensuring a sustainable fishing industry and fair standard of living for fishing communities). FP7-funded projects on organic farming provided research-based recommendations to the EC and national competent, such as the contribution to the Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.

In the area of biotechnology, the rationale of the KBBE programme stemmed from the need to remove innovation barriers to emerging market segments such as industrial biotech and accelerate the market entry of innovative bioproducts and bioprocesses. This was fully aligned with the objectives of DG ENTR (now DG GROW) Lead Market Initiative for bio-based products (e.g. work on standardisation). Moreover, the biotech-related activities under the KBBE programme focused on the threats to the sustainability and security of primary non-food production (i.e. environmental and economic impact of an overreliance on dwindling fossil-based resources, degradation of ecosystems, soil and water resources, biomass supply for bioenergy/bioindustry sector) which is in line with the CAP's activities. The KBBE programme complemented DG SANCO policy in relation to GMO risk assessment and on biosafety of GMOs. As such, several FP7-funded projects (e.g. GRACE, G-Twyst) provided inputs for the European Food Safety Authority (EFSA) work.

In the area of food and nutrition, the general objective of the KBBE programme of ensuring safer, healthier and higher quality food was aligned with DG SANTE

(formerly DG SANCO) 2007 'Strategy on nutrition, overweight and obesity-related health issues' and the 'EU platform for action on diet, physical activity and health'. At the level of the specific objectives and activities implemented, the KBBE programme complements DG SANTE's policy in relation to nutrition, healthy lifestyles, food safety and development of new food products. As such, several FP7-funded projects (e.g. ASFRISK, CALLISTO) provided direct inputs for the European Food Safety Authority (EFSA) work. The results of the AFRISK project were used for EFSA scientific opinion forming the basis of the Commission Implementing Decision of 27 March 2014 concerning animal health control measures relating to African swine fever in certain Member States (notified under document C(2014) 1979).

What was the added value of FP7 KBBE when compared with national KBBE research and innovation programmes?

An important part of the added-value of the KBBE programme lies in its cross-cutting nature. The KBBE programme was the first programme which integrated all aspects of the bioeconomy (e.g. sustainable agriculture, biomass production, food and nutrition, industrial biotech and non-food products, fisheries). It is worth nothing that there was no similar national programme exhibiting this level of integration.

In the marine field, the majority of the 'Ocean for Tomorrow' projects facilitated the pooling of resources and achieving critical mass. This is illustrated by the fact that more than the half of the 'Ocean for Tomorrow' projects had a budget exceeding €10 million (the maximum being €17 million per project) and 15 projects included partners originating from more than 10 countries (with a maximum number of 39 partners from 23 countries per project). The reduction of research risk was achieved by the multi-disciplinary and cross-border consortia in all 'Ocean for Tomorrow' projects, whilst the reduction of commercial risk was achieved through the participation of one or more leading market players.

Many projects use extensive fieldwork using cohort studies, specifically designed questionnaires, etc. This kind of research is very expensive and time consuming, and could hardly be executed on the same scale outside of the setting of a FP7 project. As a way of example, bringing together national cohorts from many EU countries was done in the EFRAIM project, thereby providing a better foundation for the research results, has very clear European added value.

KBBE in H2020: continuity or evolution?

The new KBBE programme under Horizon2020, Societal Challenge 2 (SC2) will continue to support R&D activities covered under the KBBE programme. Overall, the key objective is to accelerate the transition to a sustainable European bioeconomy through sufficient supplies of safe and high quality food and bio-based products, productive and resource-efficient primary production systems and competitive and low carbon supply chains.

At the same time, greater emphasis is put on innovation and stakeholder involvement. This is illustrated by the newly launched Bio-Based Industries Joint Undertaking (BBI

JU), which is expected to leverage EUR 2.7 billion of private investments. The multi-actor approach underpinning the agricultural productivity and sustainability agendas will also be key for linking knowledge generation with dissemination, demonstration and innovation.

10.3. Information and Communication Technologies

Please note that ENIAC and ARTEMIS JTIs as well as PPPs are presented in a separate annex.

Objectives

Under FP7, the objective of Information and Communication Technologies (ICT) research was to improve the competitiveness of European industry as well as to enable Europe to master and shape the future developments of these technologies so that the demands of its society and economy could be met. FP7 funded research in ICT aimed at helping European leadership in generic and applied technologies, stimulating and driving innovation through ICT use, and aspired to transform ICT progress into benefits for all European stakeholders, including citizens, businesses, and governments.

After 2010 there has been an attempt in the framing the new calls and related expected impact to add emphasis to the realisation and commercialisation of innovative products. In fact, the Europe 2020 strategy recognised low investment in R&D and innovation and insufficient use of ICT as two structural weaknesses in European competitiveness. It is for this reason that the Digital Agenda for Europe and the Innovation Union were created with the aim of boosting research, development and deployment of ICT.

How did FP7 ICT contribute to the competitiveness of European ICT industry?

Based on a survey of project coordinators, over the period 2007-2013, FP7 ICT funded projects resulted in total 295 **patents**, with a very skewed distribution: in general, only a small proportion of projects reported patenting activity (only 139 projects resulted in at least one patent), and most of those reported applied for fewer than 5 patents for the whole period. Of this, about 6% of the projects filed applications for five or more patents, whereas majority of the projects applied for either one patent (52%), or two patents (27%). More than 90% of the patents were accounted for by two funding instruments, namely Strep and IP, accounting for 60% and 30% of patents respectively.

More than 50% of the focal patents were owned by corporations, with the remaining patents shared among universities and public research organisations. About one fifth of the patents resulted from projects with the Strategic Objective (SO) Future Networks and Internet, with 7% coming from Photonic components and subsystems, and 6% from Micro/nanosystems. The vast number of remaining SOs accounted for only small shares of the total focal patents.

Concerning other forms of **exploitable foregrounds**, information available from the projects final reports showed the following:
- 56% of projects within the SO ICT for the Enterprise and 44% of SO Photonics projects reported as results Commercial Exploitation of R&D. Conversely, less than

10% of exploitable foreground is related to Commercial exploitation of R&D results in FET, International Cooperation; Accompanying Measures; Language Technologies and ICT for Governance and Policy Modelling projects.

- General advancement of knowledge has the highest average (30%). This percentage is higher than 35% in case of ICT for Governance and Policy Modelling, ICT and Ageing, Embedded Systems, Intelligent Information Management, Accompanying Measures, Future Networks and Internet, FET, Nanoelectronics and Organic and large area Electronics.

- Exploitation of R&D results via standards has been quoted by more than 4% of the projects related to the SOs Photonics, Trustworthy ICT; Future Networks and Internet; ICT for Transport and ICT for Inclusion.

- Exploitation of results through (social) innovation has been selected by 22% of Language Technologies projects and 10% of eInfrastructures projects. However the average for this type of the result is just 3% for all topics

- Exploitation of results through EU policies has been quoted by 16% of the 16 ICT for Governance and Policy Modelling projects. The average of this type of result is just 1% for all topics.

Based on the information extracted from the 821 final reports, **125 spin-off companies** were created as a result of the FP7 ICT projects. There is also some evidence of SMEs that have been active in the Programme and have grown as a result both in terms of employees and turnover. Furthermore, evidence from projects reviewed[112] in the context of the Innovation Radar indicates that on average, there are nearly two new or substantially improved products or services developed within each ICT FP7/CIP project. However, further nurturing is needed to bring them to the market and exploit their commercial potential. This can be achieved by addressing the shortcomings of the innovations and/ or the needs of the innovators that are vital to deliver these innovations to the market.

[112] De Prato, G., Nepelski, D. and Piroli, G. (2015). Innovation Radar: Identifying Innovations and Innovators with High Potential in ICT FP7, CIP & H2020 Projects. JRC Scientific and Policy Reports – EUR 27314 EN. Seville: JRC-IPTS, available at https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/innovation-radar-identifying-innovations-and-innovators-high-potential-ict-fp7-cip-h2020

Examples of projects that delivered innovations and are being developed into products or commercial exploitation:

- New business models have emerged due to applications tackling challenges such as traffic management (SmartTaxi) and based on an open platform.

- In the area of computing systems, the Time Triggered Architecture (TTA) technology - a ground-breaking safety technology for aerospace, automotive, energy, railway and industrial domains in airplanes and cars has been validated thanks to EU funding and is being commercially exploited by leading innovative companies, such as TTTech, a spin-off of the Technical University of Vienna or ESTEREL Technology. The Airbus A380 for instance has already flown more than 5 million passengers across the world using EU-funded ICT technology that has developed a new control system for cabin pressure.

- In the field of electronics, many spin-offs have been created to commercialise products and technologies developed thanks to EU-funded projects: POC MicroSOLUTIONS in Spain works on smart diagnostics systems that can monitor colon cancer or identify bacteria in food. The French spin-off Primo1D deals with electronic textiles that can be used in various sectors such as healthcare, sports, transport and construction. ATLAS neuroengineering, a spin-off company of Imec (Belgium) and IMTEK (Germany), develops technologies to better understand the human brain. The spin-off Graphensic AB in Sweden is the first business in the world commercialising a specific and efficient type of graphene wafers. EU investment aslo helped companies, such as ARM to thrive. The company has been involved in ca. 30 EU projects, benefitting from €17 Mio. of EU investment. This support has been key for the start-up to become a world leader in the design of low power micro-processors. More than 95% of world mobile and smart phones are equipped with ARM microprocessors and ARM employs 1,500 people in Europe.

- Half the added value in the automotive sector today comes from the integration of new technologies within cars and the use of new technologies in the design and production of cars. Car electronics help reduce fuel consumption, increase safety and comfort. Several EU-funded projects prepare tomorrow's mobility, boosting electric vehicles, such as V-CHARGE (recent successful tests took place at Stuttgart airport) or OpEneR (led by Bosch). Car electronics needs to be extremely safe and the world standard in the field 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.

- In the area of ICT for Health, the achievements of the Virtual Physiological Human (VPH) were found to be significant and succeeded in placing the European research area firmly at the centre of S&T for personalised medicine. The main achievements of VPH programmes include successful demonstrator projects with particular practical impact on personalised cardiovascular care through the development of detailed computational models of biophysics, implemented with user-friendly workflow management. Another example already has practical impact for comparing antiretroviral HIV drugs. Moreover, a comprehensive set of infrastructure tools has also been built including powerful ontologies that are necessary for the integration of multi-scale, multi-disciplinary ICT models.

How did FP7 ICT contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

Several studies[113] found that the network generated by the FP7 ICT is very stable and resilient, indicating that a **critical mass** for a European Research Area is fairly consolidated. The network is scale-free (few hubs with hundreds of projects and a majority of organisations involved in only one project[114]) and has the characteristics of a small world ("*a friend of a friend is my friend*"), showing no difference with what observed for FP6 and FP5. Findings from a study[115] show that the organisations that were involved in FP6 acted as facilitators to bring in new organisations into FP7 projects and that most SMEs that had participated in FP6 experienced an increase of the number of projects they participated in, and the total number of partners they collaborated with in FP7.

Differently from FP6, large (private) organisations tend to dominate among organisations having participated in numerous projects. The networks are dominated by hubs representing about 5% of all the organisations, with the majority of these hubs being large public research and academic organisations, ranking in the top 20% organisations in terms of links both in FP6 and FP7 ICT. The hub role of public research and academic organisations is due to the fact that since its inception the Programme was considered an instrument to promote pre-competitive research.

It must be noticed that research organisations from new Member States have increased their participation and ranking. This is a positive fact from the perspective of cohesion policy goals. Furthermore, during the programme the network extension was particularly strong with around half of the participating organisations being new actors in EC-funded ICT research. The role of the 'core' partners in attracting such new actors is illustrated by the fact that most of the 'new' ICT research actors joined already pre-established partnerships.

The programme contributed to **strengthening the existing networks** of cooperation among projects participants. According to participants[116], the main benefits of participation in FP7 have been the networking effects, especially in terms of creation of new partnerships and improved R&D linkages with universities and research centres, confirming the results of the FP7 Interim Evaluation[117].

In terms of research outputs and their characteristics, it was noted that whereas most of the patents in the ICT industry (in general and EU based)[118] originate in a single

113 Breschi et al., 2012; Pwc and OpenEvidence, forthcoming

114 62% of the organisations participated to one project only, and 15% to two projects only, whereas a much more limited number of organisations participated to many projects (≥6), suggesting a scale-free participation pattern (many with one project and only a few with hundreds).

115 PwC and OpenEvidence, forthcoming

116 PwC and OpenEvidence, forthcoming

117 Bravo et al., 2010; Technopolis, 2010

118 In the study Jacob et al., (forthcoming), the patents resulted from ICT FP7 projects were compared to two randomly selected control samples—one representing the ICT industry in general, and the other the Europe-based ICT industry

organization[119], more than half of the patents from ICT FP7 projects were associated with **very high inter-organizational collaboration**, either with another organisation within an EU country, or between EU countries and between EU, Japan or the US. For most European organizations involved in patenting, the most important source of knowledge outside Europe was the US. Interestingly, the only two European countries that use inventors from BRICS countries are France (inventors from China) and Spain (inventors from India).The patents from ICT FP7 projects displayed a unique EU bias also in regard to the location of both applicants and inventors: although a couple of EU countries dominated in both of these dimensions, a broad spectrum of EU countries is represented among inventors and applicants. In general, in the focal sample (ICT FP7 projects) it was observed a dominant presence of the EU-28 countries with seven or eight leaders accounting for a majority of the focal patents. This is in sharp contrast to what is observed in the control sample, where only a few large EU economies such as Germany and France had a noticeable presence, while small EU economies were barely visible (e.g. Belgium accounts for 8% of patents in the focal sample but has only about 0.5% share in the control sample). These trends suggest a substantially higher involvement of EU organizations in ICT research due to the FP7 programme than what one observes in the industry as a whole[120].

How did FP7 ICT contribute to improve the coordination of European, national and regional research policies?

The programme has successfully contributed to setting national agendas on specific themes pioneered at EU level. Networks as cloud for instance had not appeared in national programmes until FP7 introduced it; this demonstrates the influence the Programme on national programmes for research. Another spill over effect is to have set the European Agenda, as for 5G, where for example Member States are following. Likewise, areas such as e-health, independent living and robotics were all pioneered by the European Commission before they were developed nationally. In the case of Ageing and Healthy Living, the AAL Programme programme has had a catalytic effect on national initiatives and activity, including leveraging of national funding and a strong commitment shown by Participating Countries, with financial contributions running at around 25-30% above the required minimum. A number of national programmes and initiatives on ambient assisted living have emerged as a direct result of, or stimulated by, the AAL JP60. One of the Programme's most visible impacts has been in building synergies with other European initiatives and programmes. Programme representatives have contributed actively to the EIP-AHA, ensuring that the AAL JP is better known within the policy community and that its calls are broadly aligned with the EIP-AHA's strategic priorities. The FIWARE platform in Horizon 2020 is also leveraging national efforts. The FET Flagships also influence national choices when defining research programmes; they have a continuous structuring effect of research communities at national and European levels around flagship themes, with national structures for each flagship appearing to act as information providers and points of access. Member States financing and private funding will also be leveraged (half of the budget is expected to be invested by MS and private funding into Partnering Projects).

[119] Outside of EU in the general industry sample and within EU in the EU-based sample.

[120] Jacob et al., forthcoming

How did FP7 ICT strengthen the scientific excellence of basic research in Europe?

Over the period 2007-2013, out of the 2,448 projects surveyed, 1,160 resulted in 18,169 publications[121], out of which 63% were conference proceedings and 37% journal articles (peer reviewed publications). The average number of publications per project was 15.7; however, the distribution was very skewed, with the majority of projects producing only few publications, while a few generated a large amount of publications[122]. In FP6, 927 projects had reported 5,681 articles (the number of articles only for FP7 was 6,687[123]).

As for the quality of research, 80% of the FP7 ICT scientific articles were cited at least once, whereas only 42% of the FP7 proceedings were cited at least once, with an average of 1.98 citations per proceeding paper and 11.18 citations per journal article.

By means of comparison to a control group, the study that examined publication output from FP7 ICT projects concluded that the FP7 ICT research published in the popular and high impact journals and conference proceedings received on average more citations than other research. This is also testament of the high scientific knowledge produced by EU funded research (collaboration at the EU level produces better quality research). As expected, academic organisations led in generating most of the scientific output (93.1%[124]), with total corporate research activity accounting for 6.9%.

International recognition is granted to European funded research in several fields. The EU robotics programme is the largest research civilian programme in the world. A similar programme, based on the European model, was launched in the US. Likewise, in the field of photonics, the US has been closely following the EU Programme. In the field of SmartCities the US looked at Europe to set up a similar grant scheme, and cooperation is ongoing with China.

In addition to the high quality of publications resulting from FP7 ICT projects, the experts and POs interviewed in the context of the support study[125] (PwC and OpenEvidence, forthcoming) also gave generally **positive reviews of the overall scientific/technological impact** of the complete portfolio of projects funded. Experts pointed out that the scientific impact is particularly strong, and that the programme was successful from a scientific point of view. With regard to advancing the state of the art of knowledge areas such as Artificial Intelligence, Internet of Things, Media, Quantum Computing were cited as best examples.

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121 The source of the figures on patents and publications is Jacob et al., (forthcoming). In total, 1,761 projects replied to the survey.
According to the data reported in the OpenAIRE website (https://www.openaire.eu/stats-fp7/statistics/fp7-stats#projects-with-publications-by-programme) the ICT FP7 produced 30,678 publications, of which 8,593 in open access (13 August 2015).

122 Although 59.6% of the projects produce between 1 and 10 publications, a respectable amount of projects produces between 11 and 50 publications, and only a small percentage (5.1%) produces more than 50 publications (one project produced 1036 publications).

123 Source: KITeS-CESPRI – Bocconi University (2010).

124 Aggregation of the Academic, Government/NGO, and Hospital generated output

125 PwC and OpenEvidence, forthcoming

- The European leadership in the field of eInfrastructures is shown by the fact that Cooperation in Latin America Research (CLARA, Cooperación Latino Americana de Redes Avanzadas - Latin American Cooperation of Advanced Networks) was developed on the basis of the European model of GEANT.

- FIWARE Platform is used in Brazil and Mexico and FIRE is well known in the US.

- Highlight of international collaboration are the coordinated calls with Japan and Brazil, and the targeted openings with Korea, South Africa and China. A collaborative project with the NSF (US) – GENI involving FIRE facilities and researchers from both sides has been launched. The international collaboration activities are aimed to achieve global impact. Currently Europe is leading in the field, one aim is to set standards and convince the international partners to use the same or similar tools, as well as expand activities more globally through federation of large scale facilities.

- Europe has been recognised as global leader in research targeting ICT for ageing well, with more than €1billion funding and the systemic approach from long-term research (FP7) to applied research (JPI – AAL, PCP) to pilot (CIP), deployment and large scale uptake (EIP and PPI). European researchers are leading in new scientific areas on AAL, which is supported by a large number of conferences and scientific papers accepted in journals world-wide. Cooperation is being established with Japan, Canada and US through OECD.

The Human Brain Project FET Flagship has also triggered or accelerated akin initiatives in US, China, Australia and Japan.

How did FP7 ICT provide the knowledge-base needed to support key Community policies?

Some developments resulting from FP7 ICT projects have either directly or indirectly contributed to **policy formation** and **supported policy objectives beyond research.**

In the field of radio spectrum, for instance, EU projects have pioneered the operational usability of TV white spaces, with the research results from FP7 ICT projects supporting actions in future spectrum regulations. 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..

Another example of research results feeding into policy is in the area of Future Internet, where the results of the project CREW, concentrating on the efficient use of spectrum and considering aspects of interference, have been shared with the Body of European Regulators for Electronic Communications (BEREC), to provide cross-fertilisation and policy learning

In the field of cloud computing, the link between research and policy-making is also evident. The research pogramme has been supporting the European industry in a key technology revolution that is transforming the way IT is developed and delivered, and that has a strong impact not only in the software sector but also in the productivity of most other sectors

which are highly dependent on software. In 2011 the Commission launched a policy initiative on cloud computing, which repositioned Europe on the world policy scene on cloud. Select industry groups were created for: a) service level agreements, b) contractual clauses, c) code of conduct, and d) research. The policy initiative fed then back into research.

The launch on the web-entrepreneurs initiative is another policy result. Web entrepreneurs have been recognised as crucial in creating new business opportunities in the digital age. This has resulted in developing specific actions which reinforce positive entrepreneurial culture, funding and incentives schemes, retaining talent and understanding the web entrepreneurs' ecosystem in Europe.

In general, the loop between policy and research has effectively worked in several domains, and it should be supported in the future, with proper dissemination activities.

Examples of Policy contributions

- The FET part of FP7 ICT has found wider acclaim and has been extended to all areas of the new Framework Programme – Horizon 2020, with a budget increase from 824m Euro in FP7 ICT to 2.6bn Euro in Horizon 2020. Innovation in instruments has also taken place by targeting part of the programme to young researchers and innovative SMEs. The original 2-step submission procedure was adopted by some parts of the new Horizon 2020 programme.

- The launch on the web-entrepreneurs initiative is another policy result. Web entrepreneurs have been recognised as crucial in creating new business opportunities in the digital age. This has resulted in developing specific actions which reinforce positive entrepreneurial culture, funding and incentives schemes, retaining talent and understanding the web entrepreneurs' ecosystem in Europe.

- Research result feed continuously into policy: e.g. in the area of Future Internet, the results of the project CREW, concentrating on the efficient use of spectrum, considering aspects of interference, have been shared with the Body of European Regulators for Electronic Communications (BEREC), to provide cross-fertilisation and policy learning.

- Operational usability of TV white spaces is a particular domain that EU projects have pioneered. 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 actions in future spectrum regulations, notably a Commission decision.

- The link between research and policy-making is evident in areas such as cloud computing. In 2011 the Commission launched a policy initiative on cloud computing, which repositioned Europe on the world policy scene on cloud. Select industry groups were created for: a) service level agreements, b) contractual clauses, c) code of conduct, and d) research. The policy initiative fed then back into research. The strategy also included ETSI action for identifying and mapping existing standards. Another project in this field is Cloud for Europe (C4E) – pre-commercial public procurement of cloud at national level with 12-13 countries.

How did FP7 ICT increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

The FP7 Research infrastructure programme has made a significant step forward in the efficiency and effectiveness of its support to the European research infrastructure compared to the programme in FP6. An important facilitator for this highly positive evolution was the more coordinated approach to the funding of existing and new

distributed research infrastructures or networks of research infrastructures in Europe, based on the ESFRI roadmap. The shift in focus towards the delivery of user-tailored e-Infrastructure services and the development of a multi-layer e-Infrastructure ecosystem resulted crucial for the creation of the globally connected European Research Area in Research Infrastructure. The Programme has brought e-Science into the European research system, helping researchers and engineers to stay at the forefront[126].

FP7 ICT contributed to increasing the top-level European scientific and technological infrastructure in the different areas of the Theme:

- GÉANT gives access to all-optical networks, guarantees interconnectedness with the US, China, Central Caucasus, Japan and South America. Thanks to the EU funding GÉANT remains the most advanced research network in the world and has become the mainstream infrastructure, conceptually and in practice. In the early days of GÉANT, average bandwidths were 155Mbps but with the advent of the hybrid GEANT architecture in 2004, GÉANT became able to transmit data at speeds of up to 10Gbps as standard. Today it 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 + 65 beyond).

- The expertise of different computing centres in Europe has allowed the creation of a network of high performance computing centres and to launch the race towards exascale. Consortia like PRACE have ensured access to facilities, where resource intensive simulations could be done by partners to whom these facilities were previously inaccessible.

- GÉANT, EGI and PRACE give access to innovative infrastructures that offer high capacity services not matched by any commercial or national offer. In the case of horizontal eInfrastructures and services, European collaboration has led to the development of new methodologies and tools, which make the management and provisioning of advanced services easier and more systematic. In addition, it has fostered a stronger and more integrated NREN community. For sub-areas such as High performance computing, collaboration across the EU has helped bring on board smaller and less resourced countries that otherwise could not afford these advanced systems, minimising internal disparities. Researchers in small, not so well resourced Member States profited from FP7 HPC and communication network funding the most, stressing the relevance of the programme for European cohesion. Coordinated procurement throughout Europe and transnational access has supported specialisation in architectures. As the HPC community is small, major hardware developments are based on activities at the European level. In addition, European collaboration in this area has helped establish a user and provider community, lowering the barriers of entry to access HPC resources and developing unified services that allow researchers to seamlessly switch between centres or relocate computing tasks (e.g. DEISA2 and PRACE). For grid and cloud activities, collaboration at the European level has allowed to train and build a user community of grid computing, to establish a production-quality grid infrastructure in Europe and to work towards the "gridificaction" of on-going research

[126] Source: Mahieu, B., et al. (2014); EPIRIA

initiatives. In areas such as climate sciences, these grid projects have fostered new global research (e.g. E-Science Grid Facility for Europe and Latin America).

- In the area of Future internet, novel approaches towards capacity increase (spatial diversity) have been started in the optical fibre context, whilst several technologies to increase bandwidth flexibility have been validated. The work towards 400G core network capacity has progressed significantly and these technologies are getting closer to the market. In the software defined optical networks there was strong progress, where cross carrier/cross domain software management of capacity has been modelled and partly made its way into the standardisation domain. On the radio side, multiple projects have demonstrated technologies to use spectrum more efficiently and also to share radio resource better, which is one of the core objectives of the radio spectrum policy pursued by the Union. Also in the 5G domain, projects have started to validate technological options for next generation radio access, whilst system oriented projects have defined the use cases and their requirements with international recognition.

- Energy efficiency solutions for wireless communication networks have been developed, optimising the energy use of 4G/LTE (Long-Term Evolution) base stations, which accounts for the highest energy consumption in the mobile network.

- The Internet of Things domain has delivered important results, for instance a fully specified IoT platform architecture which is now becoming a reference for standardisation.

- Over the Framework Programmes, FET has contributed to enable Europe to take the lead in such areas as nano-electronics, microsystems, new computing paradigms, dependable embedded systems, photonics, and new materials. It is also pioneering research in promising research fields such as quantum information processing, complex systems and bio-inspired ICT systems. Quantum technology has been funded in FP5 to FP6, for €200 million in total of funding, and now the first niche market products are appearing (sensors, metrology, cryptography), with enormous expectations.

- The two FET Flagships on Graphene and the Human Brain Project (HBP) have been launched after a four years selection process, bringing back Europe to address big scientific challenges through long-term support. The creation of FET Flagships at DG CONNECT was unique within a whole FP7 landscape and demonstrates an important ability of the programme management to reflect on present situation and come up with a funding method that can better address emerging challenges (e.g. a need for a more intensive and long-term co-operation between academia and industry in the research).

How much did FP ICT contribute to job creation?

From the workforce statistics extracted by the final reports of the completed FP ICT projects[127], it resulted that on aggregate, more than 52.000 people worked with these projects in different roles, with ~9,000 additional research jobs created by 821 projects.

[127] Extraction was possible only for 821 projects final reports, out of the 1,159 available

The employment effect in FP7 ICT projects was in line and possibly higher[128] than the one resulting from other research themes (10.9 additional researchers vs. 7.8). Researchers (including experienced researchers, PhD students and temporary researchers) were the most represented category with more than half of workforce.

To what extent the results of FP7 ICT contribute to the achievements of the new Commission's priorities?

FP7 ICT has contributed to strengthening competitiveness, with the objectives of supporting R&D for Industrial applications in key sectors, ICT application for the benefit of economy and society, research on long-term visionary research linked to ICT (FET) and eInfrastructures. The Programme has tried to support more strategic initiatives with future potential by identifying priorities in terms of roadmap based applied research, but also continued to support open and disruptive research and technologies. The emerging policy rationale behind this more strategic approach to research and development in ICT has been the realisation that there is an increasing need to share resources and expertise, to specialise in order to be able to compete with other global players in the years to come. This has been particularly evident, where Europe is lagging behind or at risk of losing its competitive position for instance in fields such as high performance computing, or embedded systems. FP7 ICT has also seen the rise of certain fields, such as photonics and robotics to prominence. In the areas where these fields open up new avenues for commercial exploitation closer links with industry have been established via Joint Technology Initiatives and Public-Private Partnerships.

The impact of the programme on community building is evident not only from the input side, but also in terms of outputs generated, such as patents and publications. SMEs participating in the programme showed higher productivity in terms of publications that those not participating. Moreover, research undertaken at the European level has been more-highly valued (in terms of citation of publications and further use) than research originating at the national level and has shown a higher degree of internationalization than their control sample counterparts, rather nationally focused. The programme has undoubtedly had high overall impact on knowledge creation, on the scientific and technological achievements.
Other impacts were in terms of policy transfer, as some policies and research have been pioneered at EU level and taken up by the national programmes, informing national policies in areas such as Future Internet, AAL, and in the areas defined as FET Flagships. FP7 ICT programme initiatives also provided examples to other countries and regions of the world e.g. the US and Latin America (robotics, photonics, Smart Cities, and GEANT). International collaborations are also paving the way for global standards and portraying Europe as leading technology hub. In this context need to be highlighted the coordinated calls with Brazil, Japan and targeted openings with China, Korea and South Africa.

[128] Taking also into account that the data include an extra year of reporting, compared to the data in DG RTD Annual Monitoring Report 2013.

Projects delivered valuable opportunities not only to the research community and direct beneficiaries of successful proposals but also enabled concrete solutions implemented in applicable cases for the benefits of European citizens.

To what extent was FP7 ICT coherent with other EU actions (CIP, ESF) and EU policy?

In relation to the synergies with CIP ICT PSP, it should be reminded that FP7 was more oriented towards research, whereas the former was providing specific support to innovation, but there was no clear link between the two programmes, i.e. CIP projects in general were not end of pipe projects relying on FP7 results. After four calls, about one fourth of the organisations participating in FP7 also participated to CIP ICT PSP. The second interim evaluation of CIP ICT PSP concluded that the programme "has not developed appropriate linkages with other EU programmes. In general there is a strong linkage to FP7, at least at the policy level, but when it comes to the EU Regional Programmes, national programmes and other CIP instruments and programmes (such as SME financing instruments) there is little evidence of such linkages[129]".

The tests carried out in CIP ICT PSP were mostly for public services and societal challenges, resulting in a good synergy. As pointed out by a DG CONNECT official, in the area of Active and Healthy Ageing there has been a systemic approach from long-term research to large scale uptake, with a shift across the innovation chain (FP7/AAL JP/CIP/European Innovation Partnership on Active and Healthy Ageing). In this area, returns on investment of the deployment of new products and services developed in FP7 and AAL have been measured in pilot projects financed by ICT PSP CIP with good results in relation to the quality and sustainability of the health and social care services for some of them. In the area of eHealth, large scale pilots have been funded aiming at facilitating cross border healthcare, with interoperable eHR and ePrescriptions (epSOS), citizens' access to their health records and deployment of telemedicine. In the future, further deployment of interoperable eHR and ePrescription services will be funded by the Connecting Europe Facility (CEF). Living Labs have been actively contributing to the Connected Smart Cities CIP pilot projects but the initiative reached a maturity that is providing them self-sufficiency. There existed a certain thematic overlap between CIP and FP7 as for Smart Cities, which is resolved by a clear situation in H2020, separated by research, innovation, take-up and policy.

The degree of synergy and coordination between funds for eInfrastructures from FP7 and Structural Funds is considered not very high, the main reason being the lack of alignment of objectives[130]. Overall, additional funding for eInfrastructures by means of the Structural Funds was 8% (7% for the overall research infrastructures).

Which was the added value of FP7 ICT when compared with national ICT research and innovation programmes?

[129] Vickery et al. , 2011

[130] Technopolis-Empirica, 2014

The greatest impact of FP7 ICT has been the knowledge effects for its participants, where the required competences, resources, scale and scope could not have been achieved to the same degree at the national level. The programme has led to the generation of critical mass in key sectors, and it has overall also been able to attract a balanced set of players across different sectors.

There are **pan-European challenges** that have to be tackled at European level. One case is eInfrastructures: according to the recently completed evaluation[131], the FP7 funded eInfrastructures GÉANT, EGI and PRACE give access to innovative infrastructures that offer high capacity services not matched by any commercial or national offer. In the case of horizontal eInfrastructures and services, European collaboration has led to the development of new methodologies and tools, which make the management and provisioning of advanced services easier and more systematic.
In areas, such as High performance computing, collaboration across the EU has helped bring on board smaller and less resourced countries that otherwise could not afford these advanced systems, minimising internal disparities.
Similarly, for the two FET Flagships, there was the need to create critical mass and to unify resources on a scale that no Member State alone could have afforded, both in terms of financial support and in cooperation among multi-disciplinary teams. The Flagships have been one of the main achievements of FP7 and have brought Europe back to the global context for research and innovation along with all the other industrialised countries.

The support study reported unanimous consensus that the scale of EU funding could not be reached by national and local funding. In particular, EU-level funding was considered unique with respect to eInfrastructures, FET flagships, JTIs. Furthermore, respondents confirmed that FP7 ICT funding has become more important due to the strong decrease in national funding, but because of the existence of specific research domains where EU-level intervention is able to make a difference by bringing together dispersed knowledge (e.g. quantum computing) and reducing costs (e.g. photonics).

In other areas, such as Future Internet, the EU has been having the role to set the agenda and help the industry coordinate the various streams of research. 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 part to the Programme, as they benefit from cooperation in order to maintain their global position. Core work on future generations of telecommunication networks is done in the FP projects, in order to give "breathing space" to these otherwise competitors for research and development work. In addition, this facilitates cooperation in standardisation.

131 PwC and OpenEvidence, forthcoming

In general telecom and Internet of Things are domains where standardisation is a very powerful incentive for collaboration among EU partners. 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. This observation found confirmation in the responses of participants interviewed (PwC and OpenEvidence, forthcoming), quoting the need for critical mass among the main reasons for seeking EU rather than national funding, and the fact that EU countries face largely similar challenges across Europe. For instance, in telecommunications, participants stated that "the technological challenges European incumbent operators are facing are quite similar (cost pressure and increasing traffic enabling the leading European Gigabit societies) […] Especially the collaboration on the transport network level allows to leverage on recently developed technology achieving improved network utilization at lower cost."

Interviewees also noted that identifying top-level expertise is crucial, especially in new domains. One researcher explained that: "The key problem for my research group is building critical mass and critical expertise in strategic topics. National funding fails on this level because the projects are too short (ca. 2 years) and too small (ca. 1 FTE) to achieve this. We need EU projects in order to achieve the necessary scale as well as the necessary contact to international experts". Fostering collaboration between universities and industry players from different Member States was also seen as a crucial benefit, and the increased interaction and synergies with different types of stakeholders (universities, SMEs, large companies). Some participants further explained how FP7 ICT participation encouraged longer-term thinking and riskier investment also by SMEs. At the project level no interviewee envisaged that a given project would have been carried out in the same way in the absence of EU funding. In most cases the project would have been cancelled or implemented at smaller level, or it would have been less sophisticated, postponed or slower. This demonstrates the importance of EU funding. However, it could also be interpreted as revealing the limited strategic importance of the projects. This seems to imply (quite reasonably) that companies use FP7 ICT as a useful complement for innovative activities, but not to develop core strategic activities (PwC and OpenEvidence, forthcoming).

There was a broad consensus among interviewed participants in the context of the support study that there is a need for EU-level intervention in research funding. Most of the interviewees were able to indicate a project whose results could only have been reached through EU-level research effort. For instance, "*with DOTFIVE Europe set the state-of-the-art in performances of Silicon-Germanium based semiconductors which was previously held by IBM (USA)*". With regard to research outcomes that would not have been achieved without FP7 ICT, interviewees mentioned some specific research topics such as higher fibre-optic broadband speeds, advances in Future Internet and open data. However, the value added appears to be greater in other more strategic aspects. Firstly, FP7 ICT is the main driver of European and international cooperation that is crucial to research across different fields. Secondly, some measures such as JTIs have changed the trade-offs between collaboration and competition, thereby

accelerating discovery. The interest of participants, including large companies lied indeed in the fact that the "*The aggregation of stakeholders with common goals generates benefits such as less competition and more money which enable them to develop solutions which otherwise would have been very expensive, deficient or hard to get done efficiently*.

Setting the vision has also been the case in areas such as networked media, so as to include the use of social networks by the creative industry. According to DG CONNECT officials, work is still needed in this area, but the programme has so far achieved the result reinforcing the need of putting together technology in the media sector to move to the new era of convergence and interaction.

In areas such as Cloud Computing, the European added value has been in supporting the European industry in a key technology revolution that is transforming the way IT is developed and delivered, and that has a strong impact not only in the software sector but also in the productivity of most other sectors which are highly dependent on software. This is particularly important in an area where Europe has a strong industry but is not driving the developments, so it becomes critical to invest in advanced research in order to keep pace with the competitors.

In areas such as robotics, the EU funding has promoted multidisciplinarity and large scale development, achieving the objective to involve more industrial actors in a sector traditionally dominated by academia. Also, as robots have had a large growth, passing from assembly lines to uses in environment, health, home, transport, the providers participate in the projects to see how to explore new markets. Therefore in this field where in the past the aim was to develop less costly robots, now industry is involved and needs to take risks.

In areas such as ICT for language technologies, the EU has made a difference in breaching the language barriers and in breaking the national fragmentation, as the extreme diversity of the European landscape makes it difficult for any single provider to cope with it. In areas that are typically a national endeavour, such as ICT for cultural heritage, the benefits come from collaborating at EU level and pulling resources together.

With regard to research outcomes that **would not have been achieved** without FP7 ICT, interviewees mentioned some specific research topics such as higher fibre-optic broadband speeds, advances in Future Internet and open data. However, the value added appears to be greater in other **more strategic aspects**. Firstly, FP7 ICT is the main driver of European and international cooperation that is crucial to research across different fields. Secondly, some measures such as JTIs have changed the trade-offs between collaboration and competition, thereby accelerating discovery. The interest of participants, including large companies lied indeed in the fact that the "*The aggregation of stakeholders with common goals generates benefits such as less competition and more money which enable them to develop solutions which otherwise would have been very expensive, deficient or hard to get done efficiently*.

ICT in H2020 : continuity or evolution?

The approach to ICT research and innovation in Horizon 2020 brings together elements of continuity as well as the seeds for more fundamental paradigm changes. In fact, the overall structure of Horizon 2020 as a matrix of horizontal technological areas and vertical application domains dealing with topics such as health, mobility, energy / climate, learning / culture was already a very distinctive aspect of the ICT thematic priority in the previous framework programme (FP7). On the other side the wide dissemination of ICT developments now reaching maturity is opening new frontiers in almost every domain of our daily life: examples are the widespread use of intelligent handheld communicating devices (e.g. smartphones, 5G, cloud computing), the ability to make every single object or even person a connected entity (cyber-physical systems and Internet of Things), the possibility of smarter decision making by processing large amounts of apparently unrelated data (big data). ICT is indeed evolving from being solely a tool for functional efficiency in the management of a hospital, a government agency or manufacturing process to support a radical redesign of the business processes and paradigm changes in these same areas. Examples such as the 24h patient doctor hospital relationship, mobile access to government services, smart logistics or the digitisation / customisation of manufacturing processes illustrate the disruptive potential of ICT. In this context it is increasingly critical to replace the "silo thinking" by a more holistic and cross-cutting perspective overcoming the barriers to adoption created by the conservatism of traditional players. The focus areas that are emerging in Horizon 2020 reflect this thinking but what we have in place is just the tip of the iceberg.

Another challenge addressed by Horizon 2020 - especially acute in the ICT sector - is the need to reach the levels of investment of leading countries in this area (eg US, Japan, Korea). The public private partnerships in place in Horizon 2020, several of which in the ICT area (ECSEL, photonics, robotics, 5G, high performance computing and big data value) are an important instrument to align priorities and pool (public and private) resources and investment capacity in strategic areas exploring opportunities for economies of scale. This involves not only research activities but also the innovation processes resulting from the massive adoption of technology by consumers and other actors in various application sectors. This approach reflects the economics of the Internet era where as a result of Metcalfe's law market adoption readiness levels are becoming as important as the more traditional concept of technology readiness level.

10.4. Nanosciences, Nanotechnologies, Materials and New Production (NMP)

Please note that PPPs are presented in a separate annex.

How did FP7 NMP contribute to the competitiveness of European NMP industry?

Although many FP7 NMP projects are still on-going and that results are reached after the end of the projects, there is evidence that FP7 NMP projects contributed to fostering the development of new products, processes and services, and to increasing the technology readiness level (TRL) during the implementation of the project.

Results from a survey of FP7 NMP participants whose projects are closed show that about 60% of these participants developed a **new or significantly improved product**[132]. Examples of new or significantly improved products are: new materials and products such as nanomedicine, adaptive components for machine tools, ceramics for Swatch watches, bioceramics for implants, textile for clothing and industrial applications and coatings for high temperature energy systems. Half of these participants reported the development of new or improved **manufacturing processes**, such as flexible production lines, additive manufacturing or high performance manufacturing, and 40% said they developed new services - such as Enterprise Resource Planning for high-tech manufacturing, demonstrated process guidelines or technological options for retrofitting of office buildings.

SME participants reported on a larger scale - compared to large firm participants - the development of new or significantly improved products and services reached during the project. Hence the FP7 NMP Theme succeeded in compensating the structural disadvantages of many SMEs compared to LE when it comes to the development of innovative solutions.

With regard to the **market introduction of the developed products and services**, one third of the respondents (34%) report that a new and improved product developed in the FP7 NMP closed projects is already introduced at the market. Another 13% expects that their product will be at the market in within two years after project end and 26% more than two years after the project end. When interpreting the figures it must be remembered that the technologies developed in NMP projects are often integrated in larger systems (e.g. complex manufacturing systems) and in this case the whole system has to be ready for market introduction. In those cases where market introduction has taken place, the median share of turnover reached with the new product innovation is 5% (n=103 companies).
There are also obviously differences between areas. The participants of Production projects are by far leaders in terms of market introduction (44% compared to only 23% in Materials projects and 26% in Nanotechnology projects). There seems to be a cut between limited economic impact areas (N, M, I) and more substantial or immediate economic impact areas (P).

On average more than half of the developed services from the FP7 NMP closed projects already reached market introduction. The median share of turnover reached with the new service is 3% (n=58 companies). Again, there are strong differences between the areas: services developed in projects in the Production area, are more marketed than for other area.

For the ongoing FP7 NMP projects, one fourth of product developments and half of new services that have been developed in these ongoing projects have already reached market introduction. Furthermore, half of the participants that have no market introduction yet of their finished or planned product innovation expect a market introduction within two years after project end.

[132] Source: Ex-post NMP study

Economic impact is more substantial and clearer for projects with **high TRL levels**. Survey results reveal that participant‘s self-estimated TRL at the beginning of their project was between 1-2 or 3-4 for over 88% of participants. Participant‘s TRL at end of project was between 5-6 or 7+ for 35% of participants. This means that overall the projects’ TRL clearly increased during the project.

SME participants are comparably more often active at TRL 5-6 or 7+, indicating that they are stronger involved in the later stages of the R&D process, and less in basic research activities as compared to large firms.

The analysis of FP7 NMP output in terms of **patent applications** reveals a total of 287 patents; EU28 contributed for 90% and non-EU28 the other 10%. The largest share of the different areas of NMP is contributed by Materials (31%).

More than half of participants of finished projects report in the survey a high or medium **increase in the quality of their products**. Relatively few improvements in productivity increases or cost savings could be realised, which is rather typical for early development stages of technology. The SME participants in the survey report higher improvements for improved flexibility, revenue growth and employment growth, than the large firms.

A small part of the participants (6%) reported that the NMP FP7 project led to the **creation of a spin-off**. For instance, a Tecnalia spin-off in the HARCO project (machine tools) and a Technical University of Vienna spin-off in the PHOCAM project (lithography-based 3D printing).

How did FP7 NMP contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

FP7 NMP contributed to increasing S&T collaboration **across European countries**. The analysis of the publications produced based on the results of the FP7 NMP projects shows that 75% are **co-publications**. Most of these were generated in a collaborative way (88% co-authored). Taking the areas together, a clear power network of knowledge transfer shows up between eight countries: Belgium, Denmark, Germany, France, Italy Spain, Switzerland and the UK. These countries can be regarded as NMP collaboration hubs because most co-publications originate from there.

The **co-publication** analysis reveals that most collaboration activities are between universities (HES) and research organisations (REC). However, nearly half of the co-authored publications involve an industrial partner: 205 industry-universities co-publications were counted, against 89 industry-research organisation co-publications. Large firms more often publish with universities (confirming other research that they are relatively more active in basic research), while SMEs publish more often with (application oriented) research organisations.

Surprisingly we found that here are even more project-external co-publications than project-internal co-publications in almost all areas, except for Production and that 37% of all co-patents were with an external partner organisation. This means that a much

larger community of research organisations and companies is involved in the FP7 NMP community than just the funded project participants and that knowledge diffusion from FP7 projects already takes place within the projects themselves.

The co-publication analysis shows that in the Materials area, LE are a central part of the network and SMEs play a smaller role. In the Nanotechnology area both LE and SME are strongly involved. Not surprisingly, in the New Production Technologies area, industry is hardy present as this is a more application-oriented field and - as was mentioned in the section on the patents output – the manufacturing industries are less tend to publish on their progress in process development.

Another indicator for collaboration and knowledge transfer across countries is **co-patents**. Our patent analysis reveals that from a total of 287 patents originating from the FP7 NMP Theme by October 2014, 38 have been applied by organisations from two different countries. Germany is the co-patenting hub with nine co-patent applications alone, but France, Spain and Italy also contribute strongly to this special technology transfer network. Interestingly, France, Spain and Ireland are countries in which the co-patenting partners are not from abroad but from the same country. However, these co-patenting partners are mainly external organisations, e.g. organisations which do not belong to the project consortium.

Collaboration in patenting is most intensive between universities and research organisations. Already existing, external research organisations networks profit from NMP projects as well: 37% of all co-patents were applied with an external partner, a research organisation that was not part of the project consortium of that NMP project.

Three main features regarding collaboration in FP7 NMP projects are:

Most new collaborations were made between SMEs and research organisations and between SMEs and large firms[133]. This concerned collaboration between actors from different countries but also from the same country.

Creating new consortia in FP7 NMP projects often means to continue existing consortia and collaborations (to follow-up FP6 and national projects). In fact, 79% of the project participants did cooperate in any form with their consortium partners already before the project[134]. Wherever new partners were asked to participate in the consortium, roughly 80% came from another country (20% from the same country. As such, nearly all consortia include ‘old friends’ and ‘new friends’.

Involving non-EU partners can provide a consortium with access to excellent knowledge, downstream partners or geographic markets. However, there have been reported delays and problems related to IPR negotiations and enforcement, inter-cultural collaboration and commitment. As such, collaboration with non-EU actors can be qualified as high risk, high gain.. Here, the case study analysis revealed a trade-off for project coordinators.

133 Source : case studies

134 Source: online survey

Therefore, it can be concluded that the diffusion of ideas, concepts and applications triggered by EU-projects outside the involved community works well. There are even more project-external co-publications than project-internal co-publications in almost all areas, except for New Production Technologies. This means first at all that a much larger community of research organisations and perhaps companies is involved in the FP7 NMP than just the funded project participants and secondly that project partners use existing (research) networks and that they build new connections to disseminate project results or to develop ideas further.

How did FP7 NMP contribute to improve the coordination of European, national and regional research policies?

FP7 NMP has a positive yet modest impact on coordination of national policies. To some extent, this reflects that there are other coordination mechanisms at work. For example, European Technology Platforms (ETPs), leading universities and multinationals influence European and national policies. This increases coordination or alignment of national policies.

The case studies indicate that FP7 NMP is complementary to national policies and programmes (in most countries) rather than leads to increased coordination of national policies (e.g. in terms of technologies and application areas). For instance, several interviewees stressed that FP7 NMP has an emphasis on applied research, development and pilots ('the heart of the research and innovation process'), whereas national programmes in several EU Member States have an emphasis on basic research ('the source') and on demonstrators, commercialisation and enablers such as cluster organisations and incubators ('the final steps'). In these countries, EU funding is very complementary to national programmes. There are many exceptions. For example, Germany and the Netherlands were mentioned as countries that support the entire innovation process, whereas Spain, Hungary, Italy and EU accession countries were mentioned as countries with small budgets for supporting development and pilots but also demonstrators and commercialisation.

The analysis of national NMP policies in the five countries indicates that, at least in some countries, FP7 NMP has a direct and positive impact on coordination of national policies. However, this mostly means that national policies (and programmes) address also the technologies and application areas of FP7 NMP.
For instance, the priorities, timing and procedures of national programmes in Italy were adapted to better match FP7 NMP (and other parts of FP7). This approach should stimulate Italian actors to participate in FP7. In Ireland, one of the FP7 NMP effects mentioned was diversification of the technology base (not just nanotech), international collaboration partners (less emphasis on non-EU partners) and the industrial structure (adding manufacturing activities to service activities). In the Netherlands, FP7 NMP is perceived as an opportunity to share Dutch experiences with public-private collaboration and ethical aspects of new technologies. In addition, FP7 NMP allows for scaling up technology development and pilots.
For large countries that are among the leaders in the field of NMP, such as Germany and France, the impact of FP7 NMP on national policy is small. Both Germany and France already addressed, and will continue to address, a broad range of NMP topics at various TRL levels. In Germany, FP7 NMP is perceived as an opportunity to further increase collaboration between research organisations and industry, and to share knowledge with other countries. In France, FP7 NMP is considered as a mechanism to increase international collaboration.

How did FP7 NMP strengthen the scientific excellence of basic research in Europe?

About 75% of FP7 NMP funded projects produced peer reviewed publications. The bibliometric analysis of data in the SESAM database showed that 3,936 publications generated by the FP7 NMP funded projects until October 2014 could be identified also in the Web of Science (WoS). Most of these publications can be assigned to the Materials area (1,816), followed by Nanotechnology (1,211), Integration (455), and New Production (328).

The level of **excellence of the scientific output** was measured using highly cited papers as an indicator for excellence. In the Web of Science 0.36% of all NMP publications since 2008 obtained more than 100 citations and are considered as "highly cited". Within this group of in total about 4,758 publications 22 publications emerged from FP7 NMP funded projects. These correspond to 0.56% of all FP7 NMP publications. This comparison indicates that the level of excellence of FP7 NMP publications as measured by the share of highly cited publications is at least as high as the average level in the whole NMP landscape.

How did FP7 NMP promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

The FP7 NMP projects stimulate the **mobility** of project team members between countries and their organisations. It showed that 41% of survey respondents state that the project has led to a temporal exchange of personnel with one or more project partners. While 53% of research organisations participants had a temporal exchange of personnel (where this is rather common), also 19% of SME participants had. Also the project contributed to improving the career prospects for young researchers (e.g. PhD programmes in research or talents promotion in industry), as 66% of the survey participants stated. This mostly applies for research participants (77%) but also for SME participants (44%).

The projects also contributed to the **improvements of several competences** of the participants. Improving scientific and technological capabilities by participating in top trans-national teams doing high-level research and benefiting from learning is one of the reasons for participating in FP7 NMP (compared to national programmes). When asked for what are specific R&D objectives to participate, 75% of the survey respondents of participants considered exploration of new S&T knowledge to be relevant; 35% of participants considered exploitation of new knowledge to be relevant[135]. This is of special relevance for actors from small countries and countries that are not leading in high-tech research and sectors.

[135] Ex post NMP study.

How did FP7 NMP increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

The analysis of scientific impact based on results of the survey and the case studies indicates that building up thematic research databases or research platforms for improved networking as well as developing new instrumentation and new research methods are main impact dimensions generated by FP7 NMP funded projects. For example about one third of the participants in the FP7 NMP programme developed thematic research databases. About 46% of the participants and in particular CSA projects were involved in building up a research platform for improved networking of stakeholders. On the other hand contributions to setting up large-scale infrastructures were rather low. Almost 50% of participants indicate that development or substantial improvement of facilities or infrastructures was not at all achieved. In summary, most of the impact achievements were in line with the objectives set by the different projects.

To what extent the results of FP7 NMP contribute to the achievements of the new Commission's priorities?

FP7 NMP contributes to strengthening the knowledge base in Europe, fostering innovation, and supports EU growth and competitiveness. In addition, FP7 NMP addresses European societal and environmental challenges.

A considerable part of the survey participants being asked about their project contributions to societal and environmental goals, says they contribute to energy and resources efficiency (63%, resp. 66%) and development of tools for sustainable development (56%). Contributing to better nanosafety is also considerable: almost 45% participants mention this (N = ca 1800).

Taking into account the different areas, the participants in the three PPPs and Nanosciences and Nanotechnologies contributed above-average on specific indicators.

- Participants in the PPPs contributed above-average to the four most addressed environmental effects. For energy efficiency PPP’s scored 39% versus all the other areas 17%; for resource efficiency this was 29% versus 16%; for the development of tools for supporting or monitoring sustainable developments this was 23% versus 13% and for the development of renewable and non-polluting energy sources: 22% versus 12%.

- Participants in Nanosciences and Nanotechnologies contributed above-average to ensuring safety of nanotechnology by 24% versus 10% and to ensuring safety of new/advanced materials, including industrial safety by 20% versus 14%.

We conclude that social and environmental impacts of FP7 NMP projects are considered as an intended side-effect of economic success (rather than the other way around).

What was the added value of FP7 NMP when compared with national NMP research and innovation programmes?

Most supporting evidence for the added value of FP7 NMP is that only 8% of the survey participants indicate the they would have undertaken the activities anyway.

An overall assessment by participants is that **46% of them would not have undertaken the research and innovation activities without FP7 NMP funding** and another 46% would have looked for other funding, e.g. national programmes. Only 8% indicates that the respondent would have undertaken the activities anyway, e.g. by using private funding (this figure is much higher in evaluations of national programmes). No reportable differences between the areas were found, except for participants in PPPs as 37% of the participants in PPP project teams would not have undertaken the R&D activities. This percentage is lower than for all NMP projects (46%); this can be explained by the relatively higher TRL level of most PPP projects. The immediate economic relevance is higher which increases the chance that projects would also start without FP7 NMP funding.

EAV effectiveness

The FP7 NMP Theme addresses **pan-European challenges**. Although the scientific, technological and economic objectives of FP7 NMP are dominant, they are linked to social and environmental challenges such as renewable energy resources, energy efficiency, food safety, health, etc. Social and environmental challenges are an important background rationale for the development of projects.

A significant number of projects address truly pan-European challenges such as standards, energy efficiency of European sectors, the building of value chains with partners in different EU countries and, to some extent, international research infrastructures and European legislation. For example: 42% of the participants reported a major or medium contribution of the project to energy efficiency; also 42% to resources efficiency.

EU scale dissemination of research results is common practice in FP7 NMP projects. The scientific results are published in international journals, presented at international conferences and business events, shared via the project website, summarised in brochures, etc. Moreover, 46% of the participants is involved in building-up a research platform for improved networking (community of interest, online forum, social media, workshop series, etc.). This percentage is slightly higher for participants of CSA projects than for participants of various types of Integrated Projects.

EAV efficiency

The concept of **critical mass** reflects that some research activities require the scale, complexity and combination of different types of knowledge and skills (from different disciplines and sectors) that cannot be provided by an individual country.

Survey results indicate that several aspects of critical mass are considered relevant as a motivation for participating in FP7 NMP. Most specifically, this concerns access to

additional funding (54%), to external knowledge (44%), the opportunity to work with strategically relevant research units/enterprises and access to networks (36%) and access to R&D networks or research organisations (35%).

The importance of critical mass also emerged from the response to the survey question on the reasons for participation in FP7 NMP as compared to national alternatives. Participants mentioned international networks, big consortia, high scientific levels (cf. excellence) and possibilities to work with all relevant stakeholders.

The case study results provide a similar yet richer picture with respect to critical mass, partly overlapping the survey results. In addition to the points listed above, case study interviewees mentioned:

- FP7 and Horizon 2020 provide more continuity than national or regional governmental programmes that respond to the economic crisis by means of budget cuts in science, innovation and other policy areas.

- FP7 NMP supports inter/trans-disciplinary research and cross-sectoral innovation. In national programmes, there are more 'stove pipes' and less options to include an entire value chain.

- A related point is that value chains often are international or even global, which implies that only a European or international programme can support research and innovation that involves the entire value chain.

- FP7 NMP allows actors from small countries and countries that are not leading in high-tech research and sectors, to collaborate with leading countries and actors. There are less barriers for getting into a good consortium than for developing a one-on-one partnership with leading actors. As such, FP7-NMP contributes to a level playing field.

- FP7 NMP consortia provide access to missing expertise that is available in other countries.

EAV synergy

The EAV of **leverage on private investment** refers to the attractiveness of EU research and innovation programmes (international collaboration, excellence, etc.) and the extent to which this induces firms to invest more of their own funds compared to their investments under national programmes. As such, this aspect of EAV builds on the aspects of EAV discussed above. Examples are the possibility to work in big consortia, in multi-disciplinary teams, with excellent researchers, different types of actors, from different parts of the value chain and from different countries.

The importance of commercialisation within FP7 NMP is most relevant for firms. The survey revealed that for firms specifically, three commercialisation objectives are highly or moderately important: opening-up new markets or new groups of customers (54% of the 822 industry participants that answered this question), improved market position in our existing market (49%) and establishment of a new business area (28%).

This was confirmed by the case studies. Because the size of specific downstream sectors and markets (such as automotive, semiconductors and energy production) differs between countries, and because many sectors and markets are spread across Europe, participation in FP7 NMP consortia provides upstream firms from one country with access to downstream markets in other countries. As such, actors can target a larger geographic market. Case studies also revealed that from the perspective of firms (and research organisations) FP7 NMP, in between FP6 and Horizon 2020, provided the continuity and predictability that is needed for securing private investments. In many EU Member States, the financial and economic crisis led to reduced public investments in research and innovation. Again, this is a mechanism via which FP7 NMP increased private investments in research and innovation activities.

Improving scientific and technological capabilities by participating in top trans-national teams doing high-level research and benefiting from learning is one of the reasons for participating in FP7 NMP (compared to national programmes). This is of special relevance for actors from small countries and countries that are not leading in high-tech research and sectors. Finally FP7 NMP facilitates the **mobility of researchers** between countries and their organisations.

NMP in H2020 : continuity or evolution?

The new 'Leadership in Enabling and Industrial Technologies' (LEIT) part of Horizon 2020 will have an even stronger focus on developing European industrial technologies, with also industrial biotechnology next to nanotechnology, advanced materials and advanced manufacturing and processing technologies. The activities in the LEIT part will be based – as for the PPPs in FP7 NMP - on research and innovation agendas defined by industry together with the research community.

The balance within the new H2020 programme will even be more towards the higher TRL levels, with dedicated support for larger-scale pilot lines and demonstrator projects to facilitate industrial take-up and commercialisation. Also there is – extrapolating the trend already set in FP7 NMP – more involvement of industrial participants, and of SMEs in particular, in order to maximise the expected impact of the programme. Industry will take the lead and build the consortia.

The decision of the EC to have industry as the lead organisation in H2020 projects is very well justified from the perspective of funding projects that are oriented towards new and improved projects, processes and services. In case our preliminary results about the productiveness of PPPs will continue to be proven, H2020 is expected to gain more direct economic relevant results.

However, based on our findings we see a number of weaknesses in a system in which 'the usual suspects' (the larger European manufacturing companies) have the lead. This is not to say that this should not be done, as they are both in the forefront of technological development in the manufacturing industry as that they contribute to a large extent to Europe's economic growth perspectives.

10.5. Energy

Please note that FCH JU is presented in a separate annex.

Objectives

FP7 Energy Theme objectives were threefold:

- Adapting the current energy system into a more sustainable one, less dependent on imported fuels and based on a diverse mix of energy sources, in particular renewables, energy carriers and non-polluting sources;

- Enhancing energy efficiency, including by rationalising use and storage of energy;

- Addressing the pressing challenges of security of supply and climate change, whilst increasing the competitiveness of Europe's industries.

During the course of the programme, new policy objectives have been integrated into the rationale of the FP7 Energy Theme: Building on the Innovation Union Flagship Initiative and taking into account the crucial role of innovations in bringing down the costs of low-carbon energy technologies, more emphasis has been given to supporting the translation of research results into innovations. In addition, based on the Strategic Energy Technology Plan (SET-Plan) launched in 2007, the FP7 Energy Theme concentrated its support on a fewer number of topics and stimulated joint actions between the EU and national programmes in order to increase leverage of EU funding and bringing coherence to the fragmented European RD&D landscape.

How did FP7 Energy contribute to the competitiveness of European energy industry?

FP7 Energy theme contributed to fostering innovations by achieving technological breakthroughs and developing new products, processes or services.

The great majority of project participants (73%) reported a concrete **marketable outcome** as a result of the project (around 20% a new product or process or service, 7% a new business model). Interestingly, demonstration projects show relatively less new processes, but more new services and business models. For more than half of the concrete outcomes (55%), participants expect that they enter the market **within five years.**

As regards the number of **patents** generated in FP7 Energy projects, the FP6/FP7 impact study estimates that one in ten participants (11%) applied for at least one patent or has been granted at least one patent[136].
According to RESPIR data, almost one third of all processed projects reported at least one IPR (almost exclusively patents). The average number of IPRs for projects reporting IPRs was two.

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136 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.

The majority of projects funded under the FP7 Energy Theme targeted **technology development**. By using the concept of Technology Readiness Levels (TRLs), it is possible to estimate the technological impacts and outcomes of funded projects. The FP6/FP7 impact study[137] found that 75% of participants in technology-oriented projects could improve the TRL during the project. Typical research projects have started at TRL 3-4 (experimental proof of concept - technology validated in lab) and finished at TRL 6 (technology demonstrated in relevant environment) – bringing a technology from the validation phase to a model/prototype being tested in a relevant environment. Demonstration projects started at a higher TRL (typically TRL 6 (technology demonstrated in relevant environment) and finished at TRL 7-8 (system prototype demonstration in operational environment - system complete and qualified). On average, projects improved the TRL level of the technology by 2.5 steps. Half of the participants indicated that they expect to reach TRL9 (application phase) within the next 12 months.

	9	0	0	0	1	0	0	0	0	4
	8	0	0	0	0	0	1	1	2	16
	7	0	0	0	0	0	0	1	13	10
	6	0	0	0	0	0	0	22	28	13
TRL before	**5**	0	0	0	0	0	11	12	15	4
	4	0	1	1	3	10	21	10	16	3
	3	0	0	2	16	34	37	19	17	7
	2	1	1	12	5	10	19	4	10	2
	1	1	5	16	7	3	11	4	7	2
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
				TRL after						

Shift of Technological Readiness Level (TRL) due to participation in FP7 Energy project

Source: Technopolis, 2014

Compared to FP6, where most projects finished at TRL6, projects supported under FP7 have finished at higher TRL levels. Also, the number of projects that start at higher TRL levels (7 or higher) has increased significantly in FP7 underlining the increased focus on demonstration activities.

The investigation of the **economic impact** of supported FP7 projects can only be preliminary at this stage because many FP7 projects are still on-going and economic impacts normally need some time to materialise. Nevertheless, the FP6/FP7 impact study[138] has estimated the economic impacts of FP funded energy projects based on a survey. One important finding was that the potential impacts are very unevenly distributed, i.e. a few projects have a very high potential impact dominating the overall estimations while the potential impact of most projects is rather small (10% of the participants account for 90% of the expected turnover). The survey showed that projects

137 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

138 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

have, on average, an expected future annual turnover of between EUR 4.5 – EUR 28 million (mean value; due to the huge heterogeneity of projects, the median value is only between EUR 1 500 – 4000).

In terms of **economic organisational impact** so far, around 20-25% of participating companies see a substantial improvement of more than 5% for turnover and profit. The large majority (76%) of companies indicate that there has been an increase in their general competiveness. However, for only around 2% of participants their participation has had very large effects of more than 25% increase in turnover profit, FTE or market share.

The Framework Programme results in a large number of concrete outcomes in terms of **potential innovations**. Two-thirds of participants see a concrete marketable outcome, now or in the future. These innovations are roughly equally divided across products, services and processes (each around 20%), with business models only around 6%.

Concrete economic and energy impacts are at this moment still limited, but not absent. The aggregate expected annual turnover by participants related to these innovations, taking into account the probability of market entry, amounts to €18 billion - €75 billion by 2020. Note that these impacts will only take place under the condition of substantial additional private and/or public investment and no major negative shifts in policy and market conditions.

How did FP7 Energy contributed to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

Participants indicate that their participation has led to substantial organisational impacts, especially in terms of improved networks and knowledge position. For all these measures more than 50% of participants indicate that there is more than a small effect on their organisation for these two aspects.

Participants from 68 countries have been participating in the FP7 Energy Theme. The vast majority of participants have however been coming from EU Member States (86% in terms of participants, 89% in terms EU contribution) and countries associated to the FP (9% in terms of participants and EU contribution). Since the level of EU contribution to organisations from a specific country correlates closely with the country's economic performance and overall national research support, countries hosting the highest number of participants are mostly the big Member States. However, taking however into account the number of inhabitants (participants per million inhabitants) some middle-sized and smaller countries are heading the list.

Fostering international cooperation on the basis of mutual benefit was an important element of the FP7 Energy Theme. Thanks to openness to third countries, the Energy Theme contributed 1.4% of its budget to participants from third countries (If the EU contribution to the 4 coordinated calls funded by the FP7 Energy Theme is taken into account, the budget share for international cooperation reaches 2.3%). International

cooperation was most prominent in the areas of bioenergy, solar energy and Carbon Capture and Storage (CCS).

How did FP7 Energy contribute to improve the coordination of European, national and regional Energy research policies?

The FP7 Energy Theme has supported the creation of area-specific Technology Platforms and, in the context of the SET-Plan, European Industrial Initiatives. At the end of FP7, stakeholder groupings exist in all areas of energy. The structuring of stakeholder at European level has facilitated the definition of common objectives and Strategic Research Agendas that have become the basis for European priority setting and also influence national R&I agendas.

Fostering cooperation between national programme owners and developing trans-national research activities has been supported by the FP7 Energy Theme through five ERA-NET projects (in the area of smartgrids, ocean energy, solar energy, geothermal energy and wind energy) with a total of EUR 13.5 million. In addition, 2 ERA-NET Plus actions in the area of bioenergy with a total budget of EUR 22 million brought together national programmes and leveraged national resources.

The integration of research programs was fostered through a pilot action in 2013 aiming at bringing together and integrate on a European Scale, programmes of a critical mass of research performers from different Member States, Associated Countries, and, if appropriate other third countries, to advance the longer term research agenda of the SET Plan. As a result of this pilot activity, 4 projects have been supported with a total EU contribution of EUR 39.5 million.

How did FP7 Energy strengthen the scientific excellence of basic research in Europe?

Scientific outputs of FP7 Energy participants have been substantial. Scientific organisations reported on average around 8 scientific (peer reviewed) publications per participation, half of which were published in high impact journals. A (rough) extrapolation for (almost) finished projects shows that in total around 18,000 articles and 8000 articles in high impact journals.

In terms of scientific publications, the mid-term evaluation survey indicated that, on average, each public/private research institute or higher education institution published around 6.5 articles per participation of which 3 were in high-impact journals. The figure for FP6 was higher (9 publications of which 4.9 in high-impact journals) which could be due to fact that publications continue to be written also after the project, that Networks of Excellence (FP6) were particularly successful in publishing and that demonstration projects (increase in FP7) result in less scientific publications in general compared to the more basic research projects. Data from RESPIR points to lower figures – according to information provided by project coordinators, finished FP7 Energy projects resulted on average in around 6.6 scientific publications of which 2.8 were in high-impact

journals (or 24 publications per EUR 10 million EU contribution of which 10 in high-impact journals).
Comparison with other programmes shows the **excellence of FP7 Energy theme**.
An average project funded under the FP7 Energy Theme resulted in some 24 scientific papers (of which half in high-impact journals), around 7.5 PhD students, one patent, and almost four expected new innovations. To put these figures into perspective, we can compare them to reference values of national programmes like the UK Engineering and Physical Sciences Research Council which covers similar research areas but misses of course the 'European Research Area'-Dimension of the FP. Figures for the FP7 Energy Theme and the EPSRC (in terms of output per million EUR) are very close together, with the FP performing slightly better than the EPSRC. We can therefore conclude that the FP7 Energy Theme can compete with national programmes in terms of scientific outputs.

How did FP7 Energy promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

Research-oriented organisations trained, on average, one PhD student per participation resulting in around 2500 PhD students trained in FP7 Energy projects (the average figure is lower for industrial participants and demonstration projects)[139]. Data of RESPIR indicates around 6 PhD students per research project (of which one third was female) which supports the findings of the mid-term evaluation.

How did FP7 Energy provide the knowledge-base needed to support key Community policies?

Activities supported under the FP7 Theme have reinforced **EU energy policy** by contributing to the triangle of EU energy and climate policy objectives: sustainability, security of supply and competitiveness (through low prices for energy consumers and by supporting a strong EU industry in low-carbon energy). It underpins the EU "20-20-20-10 targets" for 2020, the new set of targets for 2030 and the EU Energy Roadmap 2050 which calls for an almost decarbonised European energy system. European action is urgently needed – even within a 2050 time horizon – because investments now will define the nature of the energy system for typically 30 to 50 years.

During the course of FP7, 9 projects with a total budget of EUR 17.7 million have been supported aiming at providing knowledge for policy making, especially as regards energy security, foresight and transition planning. In addition the FP7 Energy Theme supported structuring of stakeholder at European level and facilitating the definition of common objectives and Strategic Research Agendas that have become the basis for European priority setting and also influence national R&I agendas.

Policy impact is difficult to estimate for participants, as it is often only an indirect consequence of the project activities and it is not easily traceable unless a proper follow up is made (which is often not the case). According to the survey carried out in the

[139] 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

frame of the FP6/FP7 impact study[140], 17% of the participants reported that their project impacted policy making at national level (15% on local level). The figure was slightly higher for FP6 participants, probably due to the more significant support for socio-economic projects which aim at providing knowledge for policy making.

How did FP7 Energy increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

Coordination and access to top-level European scientific and technological infrastructure has been fostered through a pilot action in 2013 aiming at bringing together and integrate on a European Scale, programmes of a critical mass of research performers from different Member States, Associated Countries, and, if appropriate other third countries, to advance the longer term research agenda of the SET Plan. As a result of this pilot activity, 4 projects have been supported with a total EU contribution of EUR 39.5 million.

At the level of individual participants, there is clear evidence (as stated above) that projects had a strong positive effect on the participants' capacity for trans-national cooperation and creation of a network of partners.

How much did FP Energy contribute to job creation?

Projects supported by the FP7 Energy Theme have been contributing to job creation within the participating organisations directly by offering job opportunities for researchers and (more indirectly) as a result of technological advancement and improved products/services.

Research-oriented organisations trained, on average, one PhD student per participation resulting in around 2500 PhD students trained in FP7 Energy projects (the average figure is lower for industrial participants and demonstration projects)[141] . Data of RESPIR indicates around 6 PhD students per research project (of which one third was female) which supports the findings of the mid-term evaluation.

According to the FP6/FP7 impact study, around 20% of all participants increased their staff as a result of participating in an FP7 project (for around 10% of organisations, the increase was between 10%-50%).

[140] 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

[141] 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

To what extent the results of FP7 Energy contribute to the achievements of the new Commission's priorities?

Establishing a Resilient Energy Union with a Forward-Looking Climate Change Policy, including strong ambitions as regards renewable energies, energy efficiency and industrial competitiveness, is among the top priorities of the new Commission.

FP7 Energy projects have been contributing to these priorities by supporting the technological advancement of renewable energy technologies with almost EUR 1 billion and boosting R&D for energy efficiency with more than EUR 280 million. This support will translate into improved technologies which contribute to a cleaner, more secure and cost-competitive energy system.

To what extent was FP7 Energy coherent with other EU actions (CIP, ESF) and EU policy?

FP7 Energy was the main instrument for implementing the technology pillar of the EU's energy and climate policy – the Strategic Energy Technology (SET) Plan. By addressing key technological bottlenecks for the transition to a low-carbon economy, FP7 Energy contributed directly to the EU's energy and climate targets (for 2030: at least 40% domestic reduction in greenhouse gas emissions compared to 1990, at least 27% for the share of renewable energy consumed in the EU, at least 27% improvement of energy efficiency and an electricity interconnection target of 10%).
Actions supported under FP7 Energy have been complemented by the Intelligent Energy Europe part of the CIP Programme which focussed on improving market uptake of existing technologies by removing non-technological barriers.

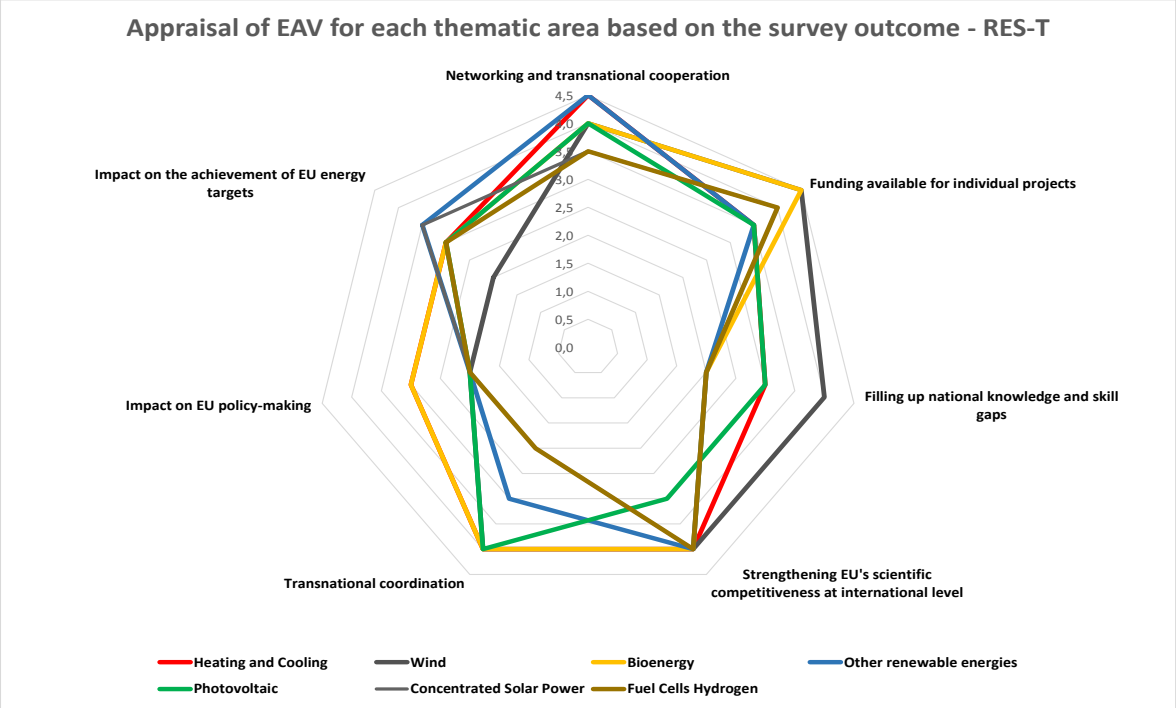
What was the added value of FP7 Energy when compared with national Energy research and innovation programmes?

The European Added Value of the FP was confirmed by the participant survey of the FP6/FP7 impact study[142]: 70% of survey participants indicated that their project would not have been carried out without funding from the EU. Unsuccessful participants reported that in more than 40% of cases, even unsuccessful proposal led to the establishment of business contacts leading to another FP proposal or cooperation activities. Since the percentage of unsuccessful participants seeking other forms of financing was not very high (21%), it can be assumed that project participants tend to develop research projects and ideas that are strictly pertinent to FP programmes rather than seeking financing for own research activities only.

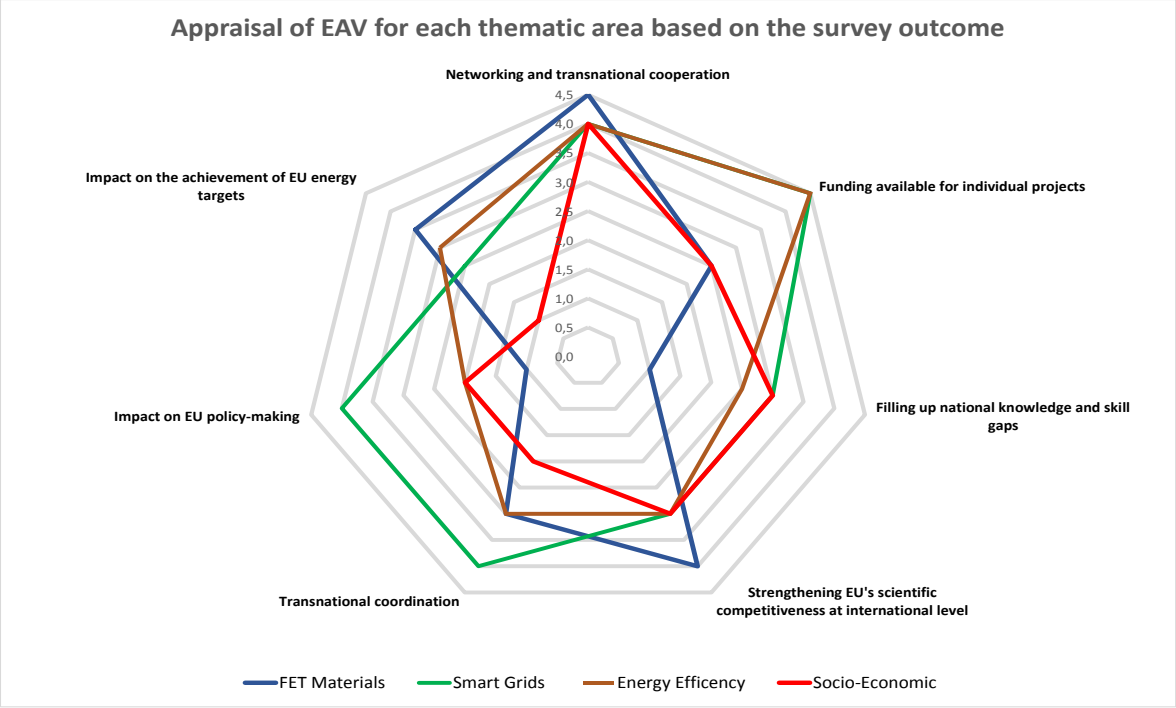
Survey participants reported a high impact of the FP7 Energy Theme in terms of network development, supporting the development of transnational partnerships, providing funding on a large scale, particularly for infrastructures development missing at the national level and strengthening competitiveness of the Union. As regards the achievement of renewable energy, energy efficiency and emissions reduction targets, participants indicate a moderate impact. The impact on filling knowledge gaps between

[142] 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

Member States and avoiding overlaps between research at the national and European level has been rated rather low.



Source: Technopolis, 2014



Appraisal of European Added Value (EAV)

Source: Technopolis, 2014

Energy theme in H2020: continuity or evolution?

Activities supported under FP7 Energy continue to be supported in H2020 mainly under the Societal Challenge 'Secure, clean and efficient Energy'. To fully exploit the synergies between technological development and market uptake of innovative technologies, the previous Intelligent Energy for Europe (IEE) and FP7 Energy have been under Horizon 2020. In addition, H2020 has put stronger emphasis on a holistic system approach that aims at integrating the various components into an efficient and smart energy system.

10.6. Environment (including Climate Change)

The information provided in this chapter comes from the ex-post evaluation of FP7-Environment[143].

Objectives

The objective of the theme Environment (including Climate Change) is defined in the Council Decision 2006/971/EC:

> *"Sustainable management of the environment and its resources through advancing our knowledge of the interactions between the climate, biosphere, ecosystems and human activities, and developing new technologies, tools and services, in order to address in an integrated way global environmental issues. Emphasis will be put on prediction of climate, ecological, earth and ocean systems changes, on tools and on technologies for monitoring, prevention, mitigation of and adaptation to environmental pressures and risks including on health, as well as for the sustainability of the natural and man-made environment."*

The Decision also specified the areas where FP7 Environment activities had to be conducted:

- Climate change, pollution and risks

- Sustainable management of resources

- Environmental technologies

- Earth observation and assessment tools for sustainable development

As the whole FP7, after the global economic crisis, the Environment theme underwent a re-orientation of its priorities in response to the economic crisis. The Europe 2020 Strategy establishes quantitative targets, which include for R&D and environment that *the "20/20/20" climate/energy targets should be met (including an increase to 30% of emissions reduction if the conditions are right)*[144] and raises environment, climate change and resource efficiency as key issues[145]

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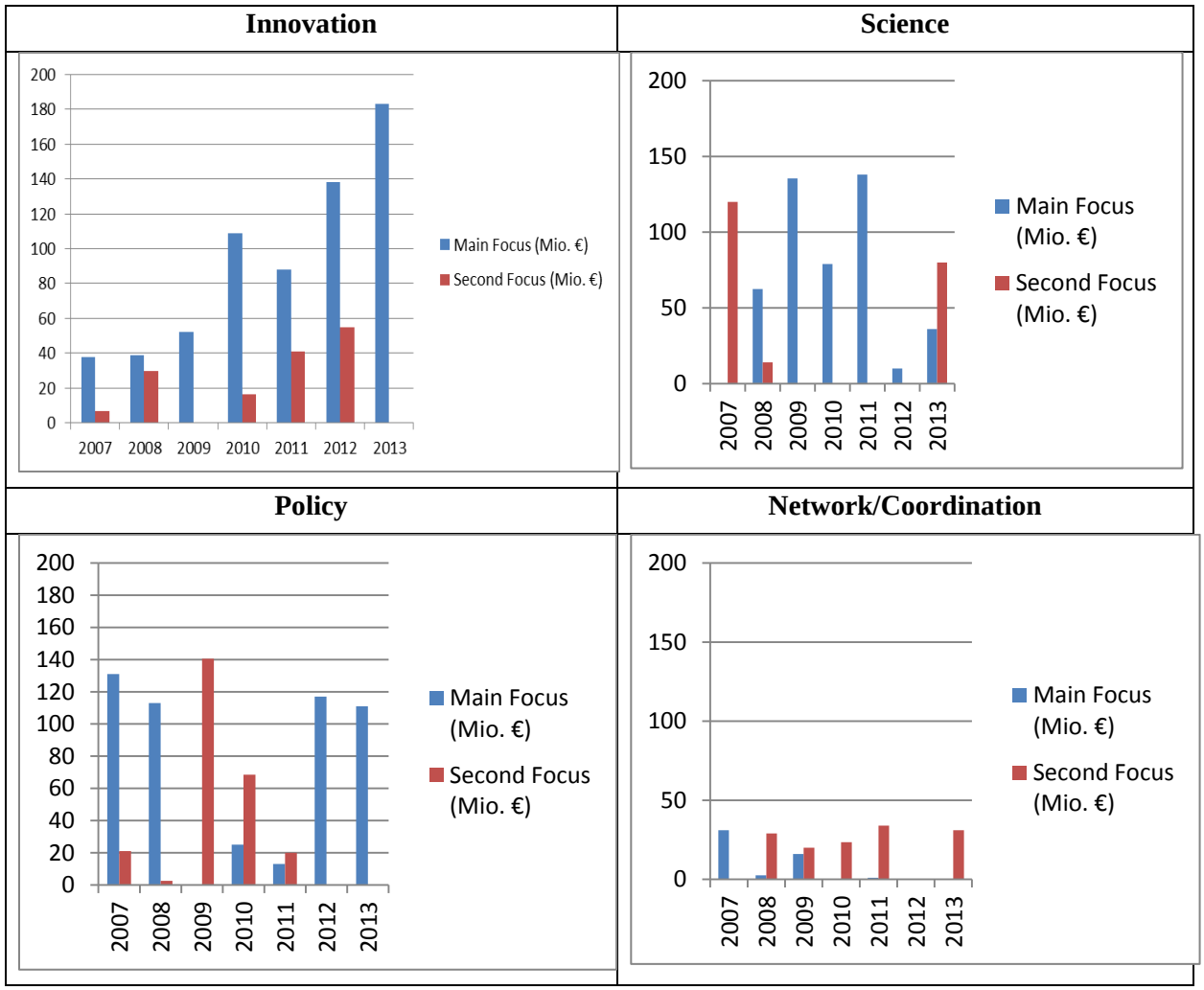
143 *Research on climate change funded by the Seventh Framework Programme*, 2014.

144 Communication from the Commission (2010) Europe 2020: A strategy for smart, sustainable and inclusive growth, COM (2010) 2020 final; p. 11: "*Reduce greenhouse gas emissions by at least 20% compared to 1990 levels or by 30%, if the conditions are right; increase the share of renewable energy sources in our final energy consumption to 20%; and a 20% increase in energy efficiency*".

145 "*Climate and resource challenges require drastic action. Strong dependence on fossil fuels such as oil and inefficient use of raw materials expose our consumers and businesses to harmful and costly price shocks, threatening our economic security and contributing to climate change. The expansion of the world population from 6 to 9 billion will intensify global competition for natural resources, and put pressure on the environment. The EU must continue its outreach to*

With regard to FP7, a strategic decision was made to *integrate the research and innovation dimensions*, strengthening the support to *the whole chain of research and innovation, from blue sky research to market uptake*, and also boosting the contribution to *nurturing fast-growing SMEs*. The evolution of the FP7 priorities has affected the Work Programmes for the Cooperation Theme "Environment (including Climate Change)". Figure below shows the evolution of each call orientation, in million euros. The main conclusion is the constant increase of investments on innovation-oriented projects, especially after 2009.



Historical evolution of the main and second focus of Work Programme calls, in € Mio.

other parts of the world in pursuit of a worldwide solution to the problems of climate change at the same time as we implement our agreed climate and energy strategy across the territory of the Union".op cit, p.8.

How did FP7 Environment contribute to the competitiveness of European industry?

FP7 Environment has contributed to developing innovations, and fostering the development of new products, processes and services.

According to projects' report (Respir database), the 195 finalised projects produced 16 **Intellectual Property Rights** (IPR, including patents, trademarks, registered designs) applications: 12 patents, 2 utility models and 2 "others". The figure (0.08 IPR per project) is below the Cooperation average (0.5). Probably, the late orientation of the FP7-Environment programme towards innovation influenced this score. Most IPR applications (13) came from projects funded by the sub-programme ENV.3 (Environmental technologies): W2PLASTICS, MUSECORR, MIDTAL, MODELPROBE, SOILCAM, AQUAFIT4USE, FIRESENSE, CLEARWATER, UPSOIL and NAMETEC. The three other IPR were produced by a single Earth Observation project, EUROSITES.

Furthermore, the innovation survey shows that between 32.4% and 48.6% of FP7-Environment projects should produce innovative outputs. Non-commercial innovation, like methods, processes or databases in public domain are rather widespread within FP7-Environment.

Survey	Percentage of reported innovations	Exploited innovations (%):			Total exploited (%)
		Commercialised	Internal to the firm	Other (e.g. public domain)	
A	80%	40%*	6.7%	6.7%	53.3%
B	40.5%	3.4%*	0.6%	10.2%	14.2%

(*) Includes an innovation commercialised and internal to the firm.

Innovation results from FP7 Environment projects

If we take the 19 innovations declared in both samples A and B[146], we observe that 42.1% are processes, 36.8% are products, 10.5% are services, 5.3% are the three of them and an additional 5.3% are organisational methods. Some examples of innovations (exploited or not yet) are presented in the box below.

Half of the respondents involved in innovations considered they worked on an **adjacent** innovation[147], while 33.3% said they dealt with **transformational innovations**. Similar

[146] Definition of the two samples

[147] Respondents were asked to define if the innovations on which they spent most of their budget belong to one of the following categories:

- *Core innovation*: low-risk, short-term, not creating new social behaviour, new markets or using new technology
- *Adjacent innovation*: medium-risk, medium term, new market, largely applying existing technology base or based on existing behaviour of citizens
- *Transformational innovation*: game-changing, breakthrough, disruptive: high-risk, long-term, creating entirely new products or services, based on new technology or new social behaviour

proportions apply amongst exploited (commercially, internal to the firm or other) innovations.

Projects that already commercialised their innovation stated that they have obtained a **turnover** between 50,000 and 90 million €, with a median between one and 3.5 million €. There are however very few projects that were able to provide such data, so the numbers are merely illustrative. These examples show that FP7-Environment projects can implement commercial innovations during their lifetime or short time after the end of the project, obtaining a significant income.

All innovations in the market are already **exporting outside the EU**. Export represents between 40% and 100% of their revenues, meaning that those new products, services or methods are competitive in global markets.

However projects dealing with innovations consider they will need 4.6 years in average to reach a relevant **market share**, which varies between 1% and 50% depending on the project[148], with most of them under 10%. With the data provided, we can make a rough estimate of the economic impact of FP7-Environment supported innovations. The (few) projects surveyed that were able to give such information could reach, all together, an income of nearly € 700 million. The whole FP7-Environment could therefore produce revenues around an order of **magnitude of € 1.9 billion** which corresponds approximately to the budget of the whole FP7-Environment programme. In terms of cost-savings of raw materials and energy, innovations supported by FP7-Environment could reach € 2.6 billion[149].

All projects that exploited an innovation carried-out a technical assessment from the environmental point of view (e.g. a life-cycle assessment). This sort of analysis is very common in projects that are in advanced stages to implement a commercial innovation: 83% of such projects did it. A life-cycle assessment or similar constitutes a commercial asset, since it demonstrates the benefits of the new technology or method, especially in terms of energy or resource efficiency. The data given through the survey show that commercially exploited innovations are already dealing to costs savings equivalent around 9 million € in raw materials and 13 million in energy.

Continuity of funding is key to fully implement the innovation on which projects were working. Around 57% of surveyed projects dealing with innovations said that there were already commitments to ensure such continuity. However, only 29% of such commitments come from industry – in principle the main player to go to the market.

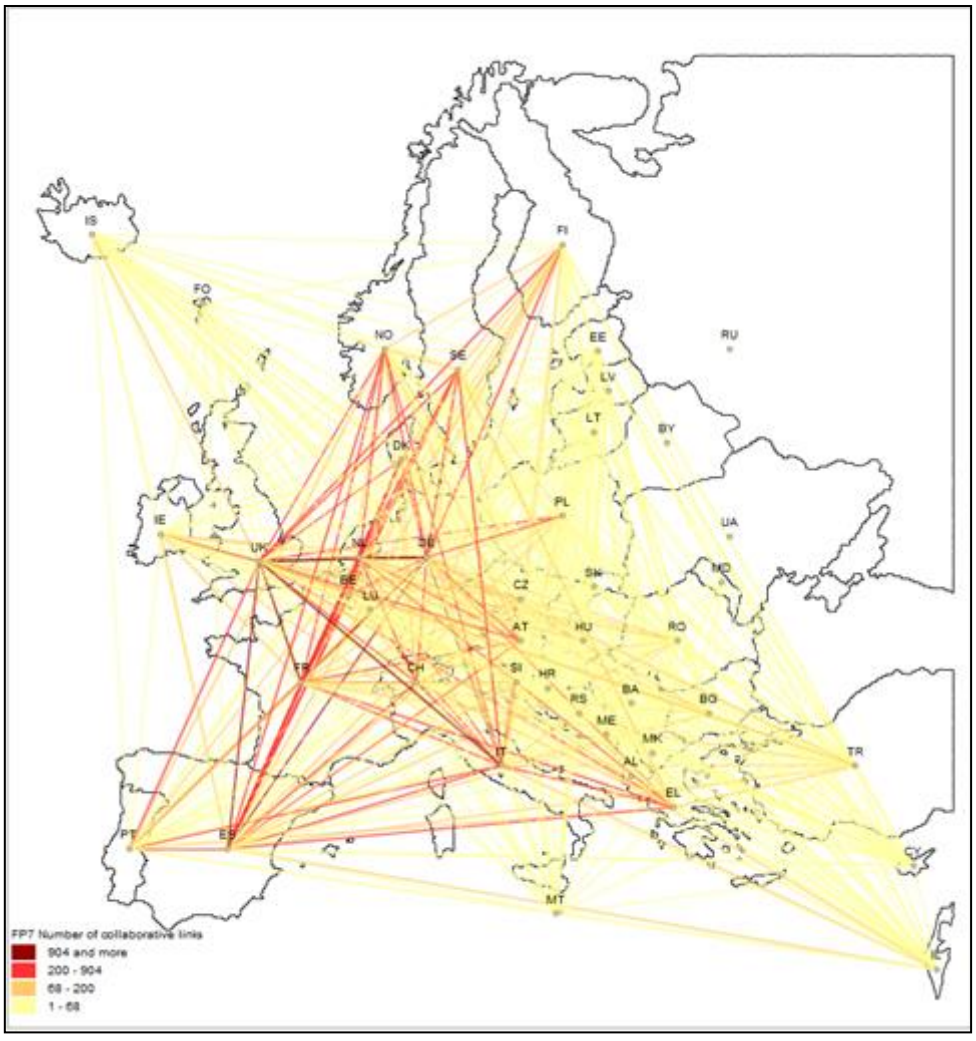
How did FP7 Environment contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

FP7-Environment contributed to promoting **transnational collaboration**, contributing to the creation of the ERA. The programme supported 96,362 inter-institutional collaborations, of which 91,557 (94.75%) trans-national. Unsurprisingly, most links were established between Member States (80,775), but Switzerland and Norway,

148 Non-commercial (i.e. open domain) innovations are not taken into account here.

149 These estimates are just orders of magnitude based on the (few) data collected through the survey.

associated countries, had also a critical importance. A group of countries have created some critical axis for international networking: Germany, Spain, France, Italy, the Netherlands and the UK; to a lesser extent, Switzerland and Norway. Their rows and columns in the matrix are the darkest. As expected, the more one country participates in FP7, the more it collaborates with organisations from abroad.
Amongst the post-2004 Member States, Poland appears as the one more linked with other countries, especially with Germany and the UK. The above-mentioned collaborative axis appears very clearly in Figure below. We clearly distinguish central and peripheral countries.



FP7-Environment collaborative links. Member States, Associates and Candidate countries

Benefits from international collaboration were significantly pronounced in the projects' review reports. In the vast majority reviewers agreed that participation in the projects **enlarged the international networks of the participants**. There were also several cases where this collaboration extended beyond the EU borders.

The international European and Asian cooperation has been fundamental in ISSOWAMA connecting European partners with counterparts from Bangladesh, India,

Cambodia, Thailand, China, Vietnam, Indonesia and the Philippines. In ORCHESTRA the cooperation across European countries was important as they face the same legislation (REACH). Nevertheless, the project has collected the experience of countries such as the US and Canada as they have a broad experience in using in silico methods to evaluate the toxicity of chemicals.

In addition, developing countries have shown interest in the research conducted and contacts were made with scientists in India, Thailand, Korea, Brazil and Argentina. The international collaboration under ICE2SEA enabled the conduct of research in Antarctica, the Arctic and Greenland, and in Chile. The CLUVA project facilitated collaboration between EU and African Universities, while POEM reached out to Chinese and Indian institutions. LIVEDIVERSE worked with societal organisations, NGOs and local residents in target communities in India, South Africa, Viet Nam and Costa Rica. SAFELAND included international collaborators and advisers from China, India, USA, Japan and Hong Kong. Based on the partners' networks MARCOM+[150] extended collaboration beyond the European Union with the US and Canada as well as Croatia, Montenegro, Turkey, Maghreb and Middle East.

How did FP7 Environment strengthen the scientific excellence of basic research in Europe?

Improving scientific excellence was one of the key objectives in FP7-Environment in order to build the evidence base for sustainable management of the environment.

For the purposes of this analysis a distinction is made between outcomes and impacts. At the level of outcomes the most common approach to scientific excellence is the number, quality and citations of scientific publications. The European Commission maintains a database on publications which made it possible to conduct a quantitative, bibliometric analysis. The analysis of scientific excellence at the impact level is not yet supported by quantitative indicators. Therefore, the review of the 90 projects was used for the analysis of impact[151].

- Scientific excellence at the level of outcomes

The FP7-Environment programme produced **2,154 papers**, of which **44.3%** were in high ranked journals[152]. On average, each project made **13.1 publications.** The number of publications by projects is just above the Cooperation average (12.6, all projects included), while the percentage of paper in high ranked journals is below the Cooperation Specific Programme average (50.3%).

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150 Towards an Integrated Marine and Maritime Science Community

151 This combination of quantitative and qualitative methods is the commonest trend to assess research. See: Thwaites, T. (2014) "Calling science into account", in *Nature*, Vol. 511, July, pp. S57-S60.

152 High impact journals are defined to be the top 10% (in terms of SJR index) of all journals within a given scientific category. For a complete list of scientific categories please visit: http://www.scimagojr.com/journalrank.php
The SJR - Journal Rank Indicator, it is a measure of journal's impact, influence or prestige. It expresses the average number of weighted citations received in the selected year by the documents published in the journal in the three previous years.

No. of processed projects	Percentage without reported publications	Number of publications	Publications by project	Pub. in High-Impact Journals	%
164	**35%**	**2154**	**13,13**	**955**	**44,34%**

Publications in FP7 Environment (including Climate Change) Theme

Source: SESAM RESPIR

Analysis of publications by areas shows that two main groups can be distinguished: at the forefront, the first group includes the areas 'Climate change, pollution and risks' (ENV. 1), 'Natural Hazards' and 'Sustainable Management of Natural Resources' (ENV. 2). The average number of publications per project is above 20 with about 70 publications per 10 M euro funding. Those scientific fields can be seen as mature, having a long tradition of international cooperation and a solid infrastructure of international scientific organisations, conference series and targeted scientific journals. Projects in this field are embedded in this infrastructure, which keeps the setup time to a minimum and allows immediate production of scientific outcome. Examples are the projects Carbo-Extreme, COMBINE, EPOCA, ICE2SEA, REDD-Alter (ENV 1), FUME, MICORE, MOTIVE, WISER (ENV 2).

The second group includes the areas 'Environmental technologies' and 'earth observation and assessment tools for sustainable development'. The average number of publications per project is above 5-6 with about 30 publications per 10 M euro funding. Those scientific fields are less mature and are characterized by a much higher degree of interdisciplinary and even transdisciplinary cooperation. Setup time for research is longer because it first requires the joint elaboration of a common analytical framework that is acceptable from multiple disciplinary standpoints.

For all fields, the average number of publications per 10M Euro FP7 funding is 55, which is higher than the numbers for the FP6 environment program, which were reported to be 25 for STREPs and 52 for IPs/NoEs (reference stock taking results of FP6, 2011).

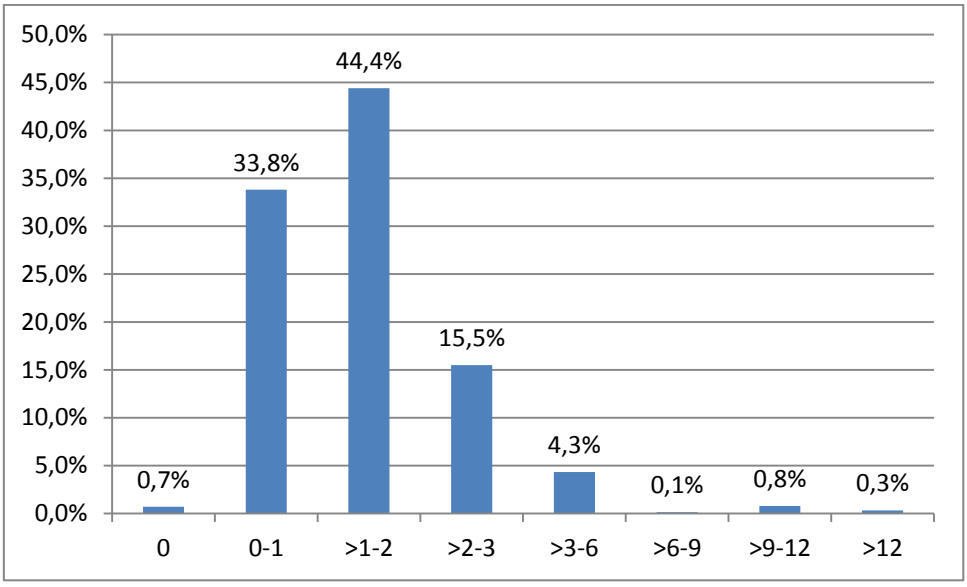
	Projects with a Processed Final Report	No. of projects with at least one publication	Total No. of pubs.	No. of pubs. in High Impact Peer Reviewed Journals	%	Average No. of pubs. per project	No. of pubs. by 10M euro	No. of pubs. in High Impact Peer Reviewed Journals by 10M euro
Climate change, pollution, and risks - ENV.1	47	40	1112	570	51%	23,66	76	39
Sustainable management of resources - ENV.2.	26	18	573	225	39%	22,04	69	27
Environmental technologies - ENV.3.	44	27	282	78	28%	6,41	30	8
Earth observation and assessment tools for sustainable development - ENV.4.	37	18	182	80	44%	4,92	31	13
Horizontal activities - ENV.5.	10	3	5	2	40%	0,50	6	2
TOTAL ENV	**164**	**106**	**2154**	**955**	**44%**	**13,13**	**55**	**24**

Publications by FP7-Environment priority area

At the top of the list, there were 22 papers published in Nature and Science, with respectively SJR indexes 14.5 and 11.2. Those papers were produced by the projects HERMIONE, RECONCILE, CARBOEXTREME, THOR, EELIAD, MEECE, COMBINE, EUROSITES, MEGALOPOLI, COCOS, EPOCA and DEER.

The average journal rank indicator of all FP7-Environment publications is **1.58**, which would correspond to the position 1,508 in the SJR classification (over 20,554 in the list). However, the variation is huge (coefficient of variation = 91.7%). Figure below shows this distribution. Most papers had a SJR index between 1 and 2, and 21% went above SJR index 2 (which corresponds to rank 963).

The information indicates that few projects reached a top level of scientific excellence, measured in terms of the ranking of the journal where they publish. Only 5.6% of all papers are in the top 450 journals (SJR index 3 or more). Only 1.1% reach a SJR higher than 9. This means that the programme was more successful on supporting the creation of critical mass of good research than on creating the top worldwide excellence.



Percentage of FP7-Environment projects by SJR index

The impacts of research on scientific excellence are more difficult to measure. Until today there are neither commonly accepted indicators neither a monitoring system and databases available to answer this question. A qualitative analysis with help of the 90 project reviews was conducted to address this shortcoming[153].

Impact on scientific excellence of individual participants[154]

Among the 90 projects reviewed, approximately 20% reported an increase in the number of publications and journal impact factor through project collaboration. In most cases this was due to the pull effect of excellent key partners towards the other, less high ranking participants in the project. Examples are ATP and COMBINE, two projects of the priority area ENV.1 (Climate change, pollution and risk). The pull effect was made possible through the recruitment of early career researchers combined with a system of staff exchanges and joint training efforts. This finding substantiates the statistical analysis of the factors affecting publication outcomes of the projects, which identified the number of additional researchers hired by the project as a significant independent variable. Clearly, this impact is a valuable example for the implementation of the European Research Area, improving excellence through European cooperation.

153 The impacts on scientific excellence at the level of individual participants and at the level the scientific community within a certain scientific field were analysed.

154 From the perspective of scientific excellence, a research project was considered successful when most excellent participants could be attracted for participation and when researchers' excellence improved through the collaboration in the project. Scientific excellence at individual level is usually measured by the h-factor and with the impact factor of the journal the researcher publishes in. However, average h-factors and journal impact factors vary with the scientific disciplines. The typical range of h-factors and journal impact factors for the particular research fields therefore need to be acknowledged.

HERMIONE, example of improving partners' excellence through participation

HERMIONE (Hotspot Ecosystem Research and Man's Impact On European Seas) has involved a multi-disciplinary team of biologists, ecologists, microbiologists, biogeochemists, sedimentologists, physical oceanographers, modellers and socio-economists to make the nexus between the deep-sea assemblages and ecosystem services provided to humankind. The majority of the core scientists participating within the project are authorities in their respective academic fields, eminently established within the field of deep-sea research. HERMIONE has certainly caused a stir within the scientific community through its pro-active approach, with a remarkable total of 761 conference participations and numerous other workshop ones. The project provided a lot of fodder for thought for policy-makers who must contend with the designation of revised policy instruments to address newly-discovered human impacts on deep-sea assemblages, such as the fact that cold-water coral communities are already under stress due to bottom trawling in many areas.

Impact on scientific excellence and maturity of the scientific community of a certain research area

Approximately 20% of the reviewed projects reported active interaction with and impact on international communities. Among those, IPCC interaction was most frequently reported. As noted above, climate change is the priority area with best performance in scientific outcome. Obviously, the maturity of this community in terms of international scientific self-organisation is a factor of success in scientific excellence; European researchers play a dominant role in this.

Active interaction in international platforms can be seen as one measure of impact of FP7 environment research on excellence and leadership at international level. Indeed, it is about implementing '*European schools of thought*' in coping with societal challenges. Thereby, the key element of maturity lies in the integration of scientific excellence with societal relevance.

Carbo-EXTREME, example of excellent impact on international research agenda

Carbo-EXTREME (The terrestrial Carbon cycle under Climate Variability and Extremes – a Pan-European synthesis) had the objective to obtain a better and more predictive understanding of the European terrestrial carbon cycle responses to climate variability and extreme weather events. The consortium consisted of 82 researchers from 26 organisations. The most excellent researchers have h-factor of 55. Many of the other researchers' h-factor varies around 40. The consortium contributed to the IPCC and IGBP activities. CARBO-Extreme researchers in many high-level policy relevant boards and contribution to the IPCC reports as lead authors. Significant interactions were developed between the CARBO-Extreme EME sites and the infrastructure Project EXPEER (FP7).

Some projects managed to interact with numerous international research organisations. Examples are CLIMSAVE and KNOWSEAS. A few projects reported active interaction with international organisations acting at the science-policy interface such as UNEP, UNDP, FAO. In those cases, influence on the international environmental policy debate and a combined impact of the research cooperation on scientific excellence and policy support is likely to be expected.

LiveDiverse, example of excellent impact on international organisations acting at the science-policy interface

LiveDiverse (Sustainable Livelihoods and Biodiversity in Riparian Areas in Developing Countries) focused on producing knowledge that would contribute to improving strategies to promote sustainable livelihoods and the protection and preservation of ecosystems. The partners involved in LiveDiverse collectively had well-established long-term linkages with UNEP, UNESCO, UNDP, FAO, GEF, Global Water Partnership, World Bank, Secretariats of Biodiversity Convention, Ramsar, Climate Change Convention, WWF, Birdlife International, Conservation International, Flora and Fauna International, Nature Conservancy, Wildlife Conservation Society. Informally, when possible the lessons and results of the project have been communicated in the events or interactions with these fora. During the project implementation stronger links have been established with the following international for a: IUCN, IASC, OECD Water Governance initiative, UNWC.

How did FP7 Environment promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

Most of the FP7 Environment projects reviewed stated that a number of PhD students were involved. This number ranged from five PhD theses and two BSc theses in the case of IMPRINTS, to more than 20 PhD researchers in the case of HITEA and CONGRESS or around 30 PhD students (SECOA, WISER or AQUAFIT4USE).

Inclusion of senior researchers was also of interest to the Expert Group. In absence of any relevant data[155] however, this was mainly based on the expertise level and age in case the CVs were available. In many cases seniority of expertise prevailed while there were some projects where the number of senior researchers was around the same as that of junior researchers. Given the scarcity of cases where this information was available however, no sound conclusions can be drawn.

Mobility was not among the main aims of the projects per se. However, there have been cases worth noting that organised study visits and exchange programmes across the different participating institutions (COPHES, LIVEDIVERSE, W2PLASTICS, ENNAH). In addition, training events or summer schools were organised (ORCHESTRA, ICE2SEA) while there have also been cases of switch of researchers between consortium partners (CCTAME, MOTIVE) with relevant benefits in their careers.

How did FP7 Environment provide the knowledge-base needed to support key Community policies?

In line with its objectives (to *Improve the science-based understanding of the challenges in the environment-climate change system* and to provide the *policy support*

[155] The workforce reports do not include any data on senior researchers.

to the Union and Member States[156], the FP7-Environment work programme was designed so that the insights and knowledge derived from the research findings would inform the development of new policies, which would then become more effective, efficient and equitable, as well as sustainable from an economic, environmental and ethical perspective. FP7- Environment represented a regular investment on policy actions, between €100 million and €140 million per annum, (except in 2010 and 2011), with an increase (from FP6) in the number of CSAs supported.

The FP7-Environment Work Programme calls for proposals were developed around the specific need to address and support EU adherence to international and EU policies, including international policy commitments[157] and EU policy commitments[158].

Furthermore, environmental technologies have been chosen as one of Europe's key tools for leading the green revolution and moving towards a low-carbon economy. The area of protection, conservation and enhancement of cultural heritage is also considered an integral part of this domain. Environmental and cultural heritage preservation technologies research in FP7 use a system approach aiming to integrate all components of the process while taking into account external factors, thus helping to decouple growth from resource depletion.

The review of 90 FP7 Environment projects shows that activities funded through the FP7 Environment theme contributed strongly to **addressing the increasingly global scale environmental challenges**. Research projects were implemented on major and urgent social, scientific and economic issues. Successes include:

- Multi-scale analysis of biological diversity and development of economic activities from ecosystem services.

- Promotion of European excellence in key domains to foster the implementation of GEOSS.

- Support to the development of environmental technologies in the area of water treatment and water and soil rehabilitation and protection with clear economic, environmental and social potential impacts.

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[156] Council Decision of 19 November 2006 concerning the Specific Programme "Cooperation" implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013). No. 2006/971/EC.

[157] UN FCCC, Kyoto Protocol, Montreal Protocols, UN Convention on Biological Diversity, UN Strategy for Disaster Reduction, World Summit on Sustainable Development, Intergovernmental Panel for Climate Change (IPCC), Group on Earth Observations

[158] European Climate Change Programme II; 6th Environmental Action Plan and associated Thematic Strategies (air, waste, marine protection, biodiversity, soil, pesticides, urban); Action Plans on Environmental Technologies, and Environment and Health; European Directives:
Water Directive; REACH (chemicals); CAFÉ (air quality); INSPIRE (environmental data),
Marine Strategy Framework Directive (environmental pillar of the EU Maritime Policy); Integrated Maritime Policy for the Union (the Blue Book), EU Strategy for Marine and Maritime Research (science pillar of the Maritime Policy), Europe 2020 Strategy and related flag ship initiatives e.g. the Innovation Union, A Resource Efficient Europe.

- Enhanced links with the UN IPCC to foster EU contribution to future Assessment Reports, including strong advocacy for timely publication of results of FP7 projects.

Examples of FP7 Environment policy contributions

- Strong contribution to the 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 Sustainable Industrial Action Plan.

- The Commission Communication on *A European Strategy for Marine and Maritime Research* (2008) highlights the importance of integration between established marine and maritime research disciplines in order to reinforce excellence in science and to boost our knowledge of the oceans and our ability to manage sea-related activities in a sustainable manner. As a key pillar of the European Maritime Policy, this strategy was welcomed by the Competitiveness Council (2 December 2008) and recognised as a significant progress towards the development of the ERA. The 2009 Work Programme, with 11 marine and maritime topics under "Sustainable use of seas and oceans" represented a major step towards a more integrated approach to marine and maritime research within FP7.

- Strong support to international initiatives, including the International Panel on Climate Change (IPCC), the Global Earth Observation System of Systems (GEOSS)[159], and the Biological Diversity Convention (BDC).

In most cases, the impact of FP7-Environement projects on policy development (e.g. Directives) is indirect due to the different timing of research and policy. Research projects take much longer. An example of this process is the recent European Commission's public consultation on policy options to maximise water reuse in the EU, managed by DG Environment. The background document is based on two reports drafted by a consultancy (TYPSA), which makes extensive use of the information and analysis done by the FP5 project AQUAREC, finalised in 2006. This example shows how the policy impact of a project can appear after a long time lapse.

How did FP7 Environment increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

The majority of FP7 environment projects followed open access principles in relation to publication of papers, reports, etc. However, not all the papers were published in open access journals, the main reasons being inhibiting publishers' licensing agreements, high costs of open access publishing, or commercialization purposes.

There have been fewer cases for open access to data, databases, tools, etc. For instance, the Adaptive Forest Management toolbox produced in MOTIVE is open source while the also chose to publish some of its medium impact research in open access journals such as PLoS ONE and Ecology and Society. In COMBINE the lead partner established institutional repositories with all COMBINE publications being open access within six months from their publications. A large fraction of the model-data produced by COMBINE simulations are also on the public CMIP5 archive, thus available to the international scientific community for analysis. MARINETT has provided open access

[159] Addressed in separate report

to all deliverables including information contained in the project's database and knowledge transfer methodologies. EUCHIC has contributed to open access and transfer of scientific knowledge by producing the EU CHIC guidelines into 13 languages, which can be utilised to apply the developed CHICEBERG protocol on a wider scale. In addition the project developing a standardised documentation methodology for Cultural Heritage monitoring and preservation which is openly accessible.

There is no precise information about the actual impact of open access actions. However the review showed that some projects preferred not to follow an open access policy, in order to do not challenge the possibility of exploiting commercially their results[160].

How much did FP Environment contribute to job creation?

Young researchers represented most of the new recruited staff and as mentioned above in this staff category women presented larger shares. Based on the overall workforce statistics for FP7-Environment, the additional researchers recruited formed 11.80% of the total reported workforce not different from the total average for the total Cooperation Programme (12.64%). Out of the 1,284 additional researchers recruited, 603 were women (47%).

To what extent was FP7 Environment coherent with other EU actions (CIP, ESF) and EU policy?

The coordination between F7 Environment and other EU actions such as the Structural Funds, LIFE+, CIP or ESF was rather weak. The integration of FP7 and CIP was important when FP7 was re-orientated towards innovation. FP7 Environment and the CIP actions focused on environmental issues, with similar objectives but different constituencies. Synergies were not the most common situation.

Which was the added value of FP7 Environment when compared with Environment research and innovation programmes?

The ex post evaluation of FP7-Environment documented European added value of environmental research projects in a number of different occasions, i.e. in relation to:

- *Infrastructures*: Access to infrastructures and databases is important in environmental research. However this is sometimes hampered by different national rules and settings, or incompatibility and lack of interoperability of systems. Projects may lead to harmonising or enabling inter-connectedness of national infrastructures or contribute to creating (new) joint European infrastructures.

- *Dealing with environmental challenges*: Calling for bringing together resources and coordinating national policies. Although bound by context and natural specificities, environmental problems usually cross national borders. This coupled with shrinking public research budgets makes international collaboration imperative. Some projects

[160] The review shows that some projects see open access and (commercial) innovation as contradictory concepts. Indeed sometimes open access is considered as a major objective of the project, and (commercial) exploitation is not even seen as an option.

may have been explicitly organised in partnerships including actors from several regions or countries facing similar environmental problems and jointly looking for possible solutions. In this regard coordination of national policies is also important to avoid duplication.

- *Capacity building and development of critical mass*: Projects may target geographical regions or research areas that need gathering of input data from a variety of (geographical) settings or call for a combination of various fields of expertise under a multidisciplinary research approach. This dimension of European added value also relates to building / increasing research capacity in specific countries in certain fields and by pooling of resources to attain the critical mass needed to deal with environmental issues.

- *The potential for leveraging additional resources*: Publicly funded research projects can leverage additional funds from the private sector. This is possible especially in the cases where exploitation of the research results can lead to market developments.

- *Obtaining better results than National/sub-national R&D financing programmes*: R&D and innovation activities carried-out through EU or international cooperation are supposed to bring better results: more ambitious projects, larger combination of skills and research traditions, complementarity of R&D systems, bigger markets for innovation, etc. However this hypothesis should be tested, comparing outputs and outcomes from different systems.

On an 1-5 Likert scale, around 40% of the projects that were eventually graded for European added value (32/81) scored equal or above 4, while the majority (61/81) scored 3 or above.[161] The projects that scored 4 or above presented high added value in more than one of the above dimensions. The dimensions of added value usually documented in the projects' justifications and results referred to the need for international collaboration in dealing with environmental challenges, for capacity building and development of the critical mass as well as for harmonising databases, procedures, measurements, models, etc.

Some intervention areas of FP7-Environment are perfect examples of European added value, in the sense that research would be inefficient if not coordinated at European and/or international level. This is clearly the case of Earth Observation. The FP7-Environment programme played an active role on implementing the Global Earth Observation System of Systems (GEOSS); while the European Commission is one of the four co-chairs of the Group on Earth Observation (GEO). GEO/GEOSS involves 90 governments and around 80 international organisations, which develop together projects and coordinate their strategies on earth observation. GEO is evaluated in a separate report[162] that demonstrates the relevance to the EU of these actions: opening up of access to essential global, regional and national datasets; adoption of compatible data policies in EU Member States and pan-European organisations; direct and indirect contribution to the Europe 2020 Strategy and related policies (including capacity building in developing countries); mobilisation of the research community; or potential

[161] Scorings made by expert based on projects' review reports.

[162] Connolly, N. et all. (2014) *Assessment of the Achievements of the Group on Earth Observations (GEO): A European Union Perspective.* Report requested by the European Commission.

to foster and stimulate growth and innovation for industry (especialky SMEs). GEOSS is critical to tackle global challenges such as climate change, energy and food security, and health.

FP7-Environment played also a key role in the development and aggregation of climate change models, with a strong impact at the International Panel on Climate Change (IPCC). Models could be developed at national level, but FP7-Environment is unique because of its coordination role. It puts and run them together, ensuring the completeness of the systems. FP7-Environment allows an international co-development of climate change models, creating a process of mutual learning and an efficient knowledge creation. With its funding activities in this field, the Commission contributes to the creation of international standards that avoid fragmentation of research and funding. Something similar happens in other areas, like greenhouse gases (GHG) measurement or carbon in the sea, where the EU is leader thanks to its coordination and standardisation role – not to mention the impact of research in these field on policy (e.g. Directives).

Examples of European added value in FP7 Environment projects

LIVEDIVERSE: The project provided an important added value in strengthening the capacities of international partners (in India, Viet Nam, South Africa and Costa Rica) by enabling them to access the state-of-the-art knowledge in the field. At the same time the EU funding allowed to push the knowledge boundaries in the field for the European partners and afford doing field research in developing countries. The project was implemented at such a big scale that it enabled the conduct of comparative parallel studies in four countries and three continents. Such research, while being important, cannot always acquire funding from national governments (European and developing countries).

FUME presents a great potential of European added value as it can lead to significantly greater harmonisation, provided that the database created continues to be expanded and data format/type is harmonised. The environmental challenge that the project was designed to investigate is very much a pan-European one, as well as being relevant in many areas throughout Europe. FUME could lead to greater coordination of national policies, as relevant countries will have access to harmonised information upon which to base their policies. The project is also likely to have enhanced research capacity by benefiting less well-funded areas, and it was successful in achieving a critical mass, as it was successful as a large-scale integrating project.

W2PLASTICS also reflects several dimensions of the European added value including dealing with cross border environmental challenges, pooling resources to attain a critical mass and leveraging additional resources from the private sector. W2PLASTICS deals with environmental burden from complex industrial and household waste which is a serious problem common for many if not all European countries. Joint efforts to develop a breakthrough recycling technology is imperative in this case. The project demonstrates successful pooling of resources for research, innovations and exploitation especially investments from the private sector to establish spin-offs.

MESMA is a good example of all the different dimensions of European added value. MESMA provided access to a new open access database that is available through the MESMA Geoportal. The database has been built in harmony with existing and emerging EU and international standards for interoperability, data delivery, data visualization, and data integration (the INSPIRE directive). Second, the environmental challenges tackled in the project relate to the continuous nature of the marine environment and the variability in marine habitats, which may shift and change over time and be influenced by external factors that originate in one

jurisdiction and have an effect on another. In this regard international co-operation was essential for developing a generic and not case-specific framework for marine Spatially Managed Areas. Third, MESMA may have an impact on developing policies such as the proposed EC Directive on Maritime Spatial Planning and Integrated Coastal Zone Management. Fourth, because of the potential commercial exploitation of the MESMA framework, associated web-based application and developed or modified tools the project also has the potential to leveraging some funds from the private sector, either to support the development of a more mature application or through expert consulting services provided by the academic partners.

Environment in H2020: continuity or evolution?

The successor of the FP7's Cooperation Theme Environment (including Climate Change) is the Horizon 2020's Societal Challenge 5, "Climate Action, Environment, Resource Efficiency and Raw Materials", which includes the following broad areas of activity:

- Fighting and adapting to climate change;

- Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems;

- Ensuring the sustainable supply of non-energy and non-agricultural raw materials;

- Enabling the transition towards a green economy and society through eco-innovation;

- Developing comprehensive and sustained global environmental observation and information systems; and

- Cultural heritage.

Compared with the activities covered by FP7-Environment we can observe that marine has been moved to Societal Challenge 2 ("Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy"), while raw materials have been added.

The main changes are, however:

- Administrative: Under Horizon 2020, Societal Challenge 5's projects are managed by the Executive Agency for Small and Medium Enterprises (EASME). DG RTD focuses in policy, including the preparation of the bi-annual Strategic Programme.

- Stronger focus on delivering solutions: Horizon 2020 follows and deepens the trend initiated during FP7, when innovation became the main priority. Horizon 2020's SC5 calls aim at promoting large-scale demonstrations instead of single, often fragmented technological innovations. The goal is to increase the societal impact of Horizon 2020 action, which requires (i) more ambitious projects, (ii) a systemic innovation approach , and (iii) calls and topics structured along promising innovative areas such as Nature-Based Solutions, Re-Naturing Cities or Climate Services. In addition, due to the cross-cutting nature of environment, a higher number of calls are launched together with other

Horizon 2020 parts (e.g. Leadership in Enabling and Industrial Technologies and other Societal Challenges like "Bioeconomy").

10.7. Transport (including Aeronautics)

Please note that Clean Sky will be presented in a separate annex.

Objectives

Original objectives

The successive Work Programmes of theme 7 "Transport (including Aeronautics)" in the Cooperation programme defined the objective of transport research as follows:

Based on technological and operational advances and on the European transport policy, developing integrated, safer, "greener" and "smarter" pan-European transport systems for the benefit of all citizens and society and climate policy, respecting the environment and natural resources; and securing and further developing the competitiveness attained by the European industries in the global market

Consequently, the results from work programmes and projects are intended to serve a broad spectrum of European policies. At the same time transport research and innovation is an area of application for many of the results from curiosity driven research into future and emerging technologies to key enabling technologies and application-oriented solutions for industry.

Evolution of objectives to respond to the crisis

The economic recovery package, presented by the Commission in 2008, aimed at boosting growth and the creation of jobs. The development and market uptake of new and more environmentally friendly technologies in new vehicles was stimulated by financial support to research into the green technologies.

Beyond the European Green Cars Initiative (EGCI) as such, growing emphasis was put on innovation and deployable results over time. In 2011, as the economic crisis moved jobs and growth to the top of the political agenda, the focus of FP7 shifted from "Research and Development" to innovation, deeper attention was paid to the market orientation of activities. The 2011 call was strongly marked by the Europe 2020 strategy, placing a strong emphasis on Innovation and particularly on the uptake of EU research results. In 2012, the Work Programme was influenced by the issuing of the 2011 Transport White Paper and its medium and long-term targets. In 2013, the last work programme of FP7 built a bridge towards the new Horizon 2020, with particular care being put on balancing all the components of the innovation cycle.

How did FP7 Transport contribute to the competitiveness of European Transport industry?

Through the European Technology Platforms (ETPs), the Transport industry was involved as from the early stages. ETPs were actively engaged in providing input

towards the setting of priorities. Via Strategic Research Agendas (SRAs), the ETPs provided strategic orientations to the work programme design by establishing research objectives and development priorities, timeframes and action plans (Roadmaps) tackling the challenges of the respective industrial sectors. Thereby, the industry needs in terms of competitiveness were well reflected in the design of the successive work programmes.

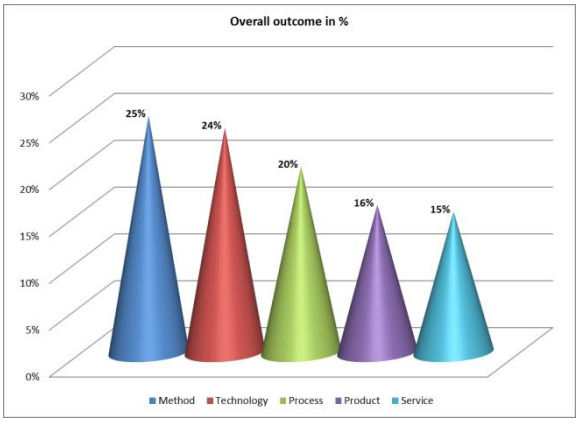
At project level, data from the Tri-Value programme assessment study shows that approximately half of project coordinators have engaged with developing a business plan and analysed markets (54% during the project and 34% after the project). About 40% of the respondents undertook technology transfer activities during the project period, increasing to almost 50% after the project conclusion. Three quarters made contact with potential clients during the project period. About 4% have succeeded in signing up agreements with private investors.

FP7 Transport contributed to supporting the development of new methods and applications. More than half of the FP7 Transport projects (>60%) delivered testing activities (validations and verifications) often linked to activities related to development of new products or services. Development of software, tools, models and applications (not marketed) is also very common (i.e. occurs in more than half of the projects).
A small proportion of projects (<20%) delivered new services, new products, new norms and standards or patents, which may reflect the fact that transport research and innovation in FP7 focused much more on early stage development rather than closer to market applications.

On average, one in five projects reported filing an application for a patent. Patent applications accounted for three in four reported Intellectual Property Rights (IPR). However, these figures only reflect IPR and patent applications filed during the lifetime of the project.

To assess the competitiveness needs and innovation propensity of European Transport research beneficiaries, a survey reviewed – amongst other things – the indicators of Intellectual Property Rights (IPR). The 1.477 respondents reported a total of 440 commercial IPRs. These consist of 236 patents, 108 copyrights, 26 trade rights, and 70 trade secrets. 27% of all IPRs are already granted and 35% are submitted. Half of the patents and copyrights belong to commercial enterprises PRC (148) and SMEs (74).

Within the Galileo sub-theme under the "Transport" theme, EU funded projects have produced commercial products or services, realised and tested prototypes, and registered patents/ trademarks.



According to the responses of the Transport Survey 2015,
60% of the outcomes of R&I activities led to incremental improvements of innovative solutions

"Disruptive" results were indicated by 40% of the respondents

47% of the outcomes belong to Private Commercial organisations (incl. SMEs), which reflects the industrial/ application oriented nature of Transport research

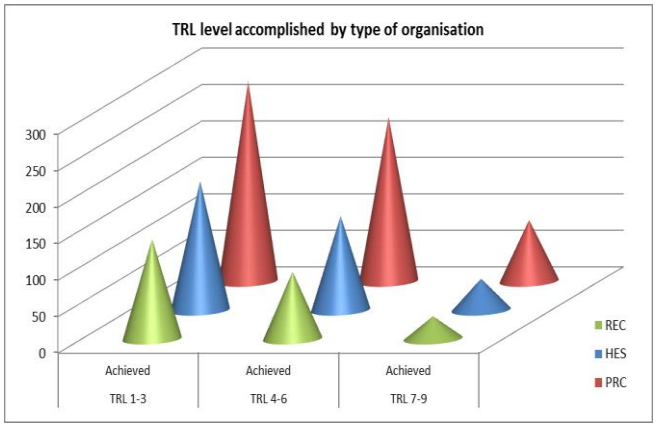
The respondents indicated that the outcomes of their R&I activities led to:
Innovative Methods (25%)
Innovative Technologies (24%)
Innovative Solutions such as Processes (20%), Products (16%), Services (15%).

Technology Readiness Levels (TRLs) indicate the maturity of the outcomes in terms of their exploitation potential. The level relevant for a commercial exploitation of project results starts from TRL 4-6. Several respondents gave multiple indications on Technology Readiness Levels reached:
- 49% of the respondents declared TRL 1-3
- 37% related to TRL 4-6
- 14% to TRL 7-9

When analysing the overall distribution of Technology Readiness Levels, higher TRLs are reached in the following areas:
AAT - Aeronautics and air transport - AAT:
- The greening of air transport (Green Aircraft)
- Improving cost efficiency (Aircraft Operational Cost)

Sustainable surface transport (rail, road and waterborne) - SST areas:
- The greening of products and operations
- Integrated safety and security for surface transport systems
- Competitive surface transport products and services

The highest TRL 7-9 is reached by 104 participants, mostly in the SST areas (81%).

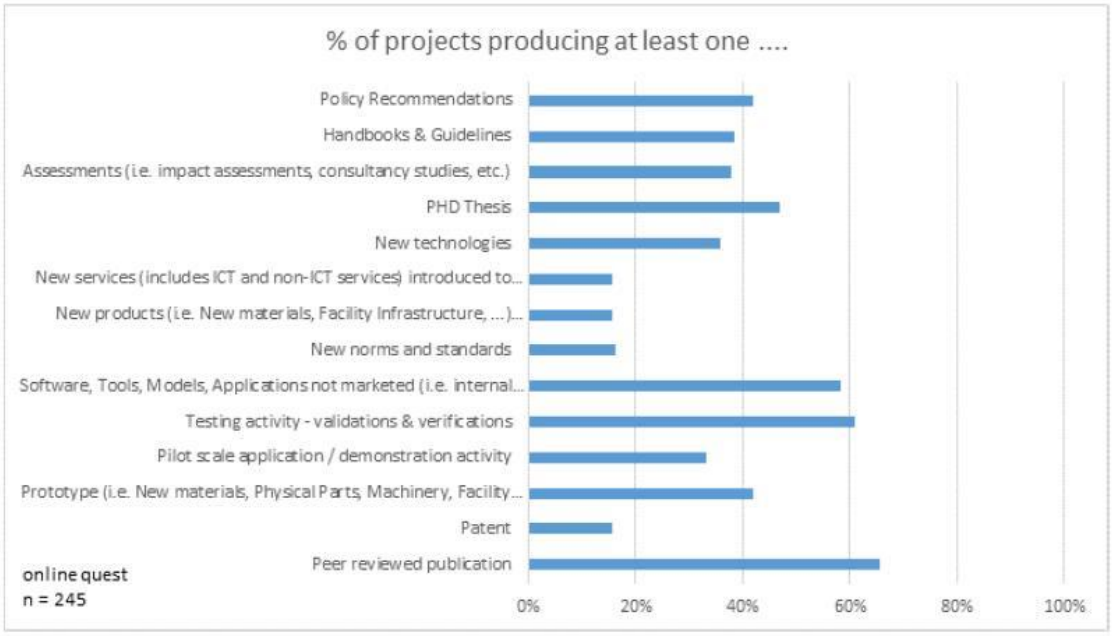


Concerning Market Readiness, 34% of the respondents carried out demonstration and testing activities, of which 46% are PRC, 28% are HES, and 23% are REC. The highest incidence of demonstration and testing activities is found in the areas: Green Aircraft, and Aircraft Development Cost (AAT); The greening of products and operations, New transport and mobility concepts, Integrated safety and security for surface transport systems, and Competitive surface transport products and services (SST).

Further activities relate to prototyping (23%), technology transfer (18%), and feasibility & market studies (16%). Activities to develop business plans relate in particular to areas on "Improving safety and security" in SST.

The Transport Survey 2015 gave also evidence that project participants undertake efforts on both an individual level and also within the project consortium to valorise the research results and inventions. From 1.280 survey participants that provided an answer, 48% respondents stated that results are exploited internally by the organisation itself. Further 32% of the respondents stated that the results were used within the consortium (vertical exploitation). 20% of the respondents declared to target third parties outside the consortium to valorise the use of their results.

The project AdMap-GAS illustrates well the contribution of FP7 transport towards fostering the competitiveness of the European Transport industry. The main impact of this project was to show how a critical bottleneck in aero engine production could be overcome by developing an alternative process which would potentially give EU manufacturers an international competitive advantage. Furthermore, processes developed within the process can also be transferred into other industries, such as the motorsport sector. Along with high-level scientific publications and the application for patents as an output, the peculiarity of this project resides within the coordinating institution setting up a new department to promote further development of this manufacturing technology.



How did FP7 Transport contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

As reported by beneficiaries interviewed in the framework of the TRI-VALUE evaluation, more than a third of FP7 Transport projects have been successful in creating a formal network within the scope of the project. Nearly 75% of the respondents also developed contacts with external organisations as a result of the project.

The access to complementary expertise and "network" effect from FP7 projects is one of the most intangible but important assets generated by the transport research. The TRI-VALUE analysis showed that more than a third of projects have been successful in creating a formal network within the scope of the project, and an overwhelming majority of participants (>86%) continued to cooperate even after completing the project for which they originally formed a consortium. Nearly 75% of the respondents also developed contacts with external organisations as a result of a project. This reflects a great support and considerable success by FP7 in building skills and knowledge networks for transport research across Europe.

The collaborative follow-up with members of the consortium or with external organisations is also not influenced by mode or project orientation. However, transport mode and policy orientation seem to exert some influence in relation to establishment of formal networks, compared with technological oriented projects. This seems to be a particularly relevant result in waterborne transport related projects, with nearly 75% of projects in that category referring to this type of networking. On the contrary, for aviation/aeronautics projects, formal networks look to be a relevant result in technological projects, but none of the air policy project coordinators reported such a type of collaborative effect. The difference may be due to the fact that networking was already a standing practice in aviation/aeronautics and relatively a new phenomenon in the waterborne sector. For the other modes (road and rail), no significant differences relative to their orientation were noticed.

Examples of networks originating from FP7 projects include the following:

- An End Users' Platform working as a pool of accessibility experts from EU networks representing the elderly and people with different types of disabilities, with the aim of providing advice on the accessibility of public transport within European projects and beyond was established in the context of the MEDIATE project

- EDINNA, an educational network of inland waterway navigation schools and training institutes founded within the PLATINA project

- ITxPT, an initiative aiming to further cooperate on the implementation of standards for plug-and-play IT-systems applied to public transport, formed from the X-NOISE EV project

- DELTA Network of Regions, originated in the framework of the DELTA project

- LivingRAIL extended panel of experts including professionals, researchers and customers

ERANETs

As one of the tools of the Seventh Framework Programme, the ERA-NET scheme performed a pivotal role in enhancing coherence and scale in the European research landscape via the improved coordination and cooperation of national and regional research programmes.

Between 2007 and 2013, one project a year was financed under the Transport ERA-NET calls. Broad in scope, the ERA-NET scheme covered all transport modes, with six projects financed in Surface Transport and one in Aviation. The cumulated EC contribution over the whole period amounted to about EUR 20,7 MIO for a total project value of about EUR 43,6 MIO. ERA-NET projects entailed a higher-than-average number of beneficiaries: about 20, compared to an overall average of 13,6 participants / project for Transport projects in FP7.

ELECTROMOBILITY+ and INFRAVATION were "ERA-NET Plus" projects. Under such scheme, national research programmes were “topped-up” with EC funding in order to support R&I projects in the fields covered in such ERA-NET Plus. With the INFRAVATION ERA-NET Plus there was also a contribution from the USA, amounting to 1 million euro.

International cooperation

International cooperation in Transport research is primarily aimed at facing global challenges while strengthening the European transport research area.

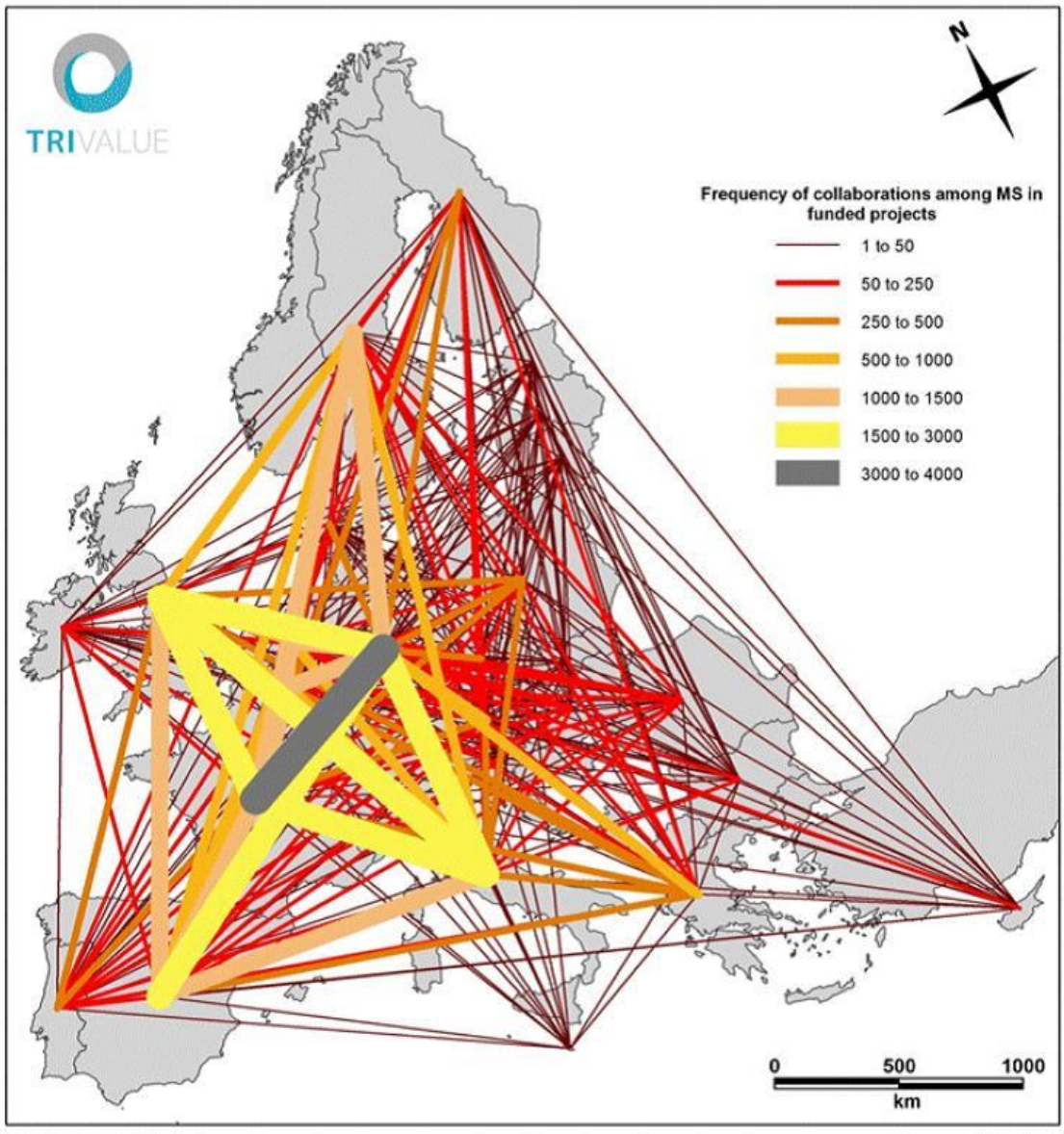
The added value in terms of helping the European transport industry lead at international level is particularly noticeable in major maritime and air projects with partners such as Korea, China and USA. Furthermore, given the complex and global nature of air transport, European funding plays a key role in supporting this kind of research.

International cooperation focussed on cross-cutting issues (HERMES - 2014, EU-TRAIN - 2013, ENABLE - 2011 and TRANSBONUS - 2010) and mode-specific cooperation in aviation/aeronautics (CANNAPE - 2013, AERA-PRO - 2013, AEROAFRICA-EU - 2011, AERO-UKRAINE - 2011, COPAIR-LA - 2010 and AEROCHINA2 - 2009), road (SIMBA II - 2010, TRANSAFRICA - 2010, EAGAR - 2010), rail (NEAR2 - 2014) and waterborne (-).

Examples of international cooperation with a thematic focus are greening in aviation (GRAIN - 2012, SUNJET - 2012), sustainable urban road transport (SOLUTIONS - 2016, VIAJEO PLUS - 2016 and STADIUM - 2013), improved mobility of people and freight (Enhanced WISETRIP -2014), safety in aviation (COOPERATEUS - 2012) and road safety (SAFERBRAIN - 2012). There are many more projects to be mentioned if we take the participation of international cooperation partners in regular research and innovation projects into account.

The number of international cooperation actions supported throughout the programme has increased. More than 200 international participants were involved and 118 projects that included international participants were funded. Four "coordinated calls" resulted in 12 funded projects. The evaluation showed that challenges remain in this area, notably concerning the assessment of the added-value of the engagement of international partners and the extent to which this allows, for example, the establishment of networks at global level similar to those that are being established at European level. The Interim Report on FP7 noted that participation of the strategically important BRICS countries in

FP7 is still weak, despite efforts to increase collaboration and raise awareness about FP7 in these countries. In addition to direct funding of participants in projects, the instruments with strong potential for further development are the coordinated calls and the synchronised calls.



Collaborations in FP7 Transport projects

How did FP7 Transport contribute to improve the coordination of European, national and regional Transport research policies?

Coordination of European, national and regional Transport research policies was reinforced through:

- ETPs, that provided a good basis for interaction between the Commission and the national and regional levels through the operations of the mirror groups and the National Platforms
- The ERA-NET scheme, enhancing coordination and cooperation of national and regional research programmes
- The convergence and complementarity in national priority setting, involving both Transport and Research authorities

The FP7 Transport programme strengthened the existing well-structured research community. Pre-existing partnerships form the core of the projects, which were completed by new partners with complementary competences according to specific project needs. For two thirds of the projects, the level of cooperation between the partners was strong and effective. The FP7 Transport programme also had a broadening effect: the programme involved participants beyond the pattern of national specialisation in R&D. FP7 funded projects that were too complex and risky to be funded without public support, although these projects were normally related to the core business of the companies involved.

FP7 transport successfully complemented national funding schemes for research. A number of FP7 project coordinators reported that the activities they were involved in would simply not have been performed without funding from the European Commission. This is reported to be particularly true for aviation and shipping, which are by nature trans-national.

Annual work programmes were adopted by the European Commission with the assistance of the Programme Committee, thereby ensuring the coordination with MS activities and implementing ERA in terms of optimal co-operation and competition, optimal circulation and transfer of scientific knowledge, and more effective national research systems.

All in all, FP7 Transport had a positive leverage effect in promoting national research efforts. EU funding catalysed national funders to join and co-invest towards common objectives.

How did FP7 Transport strengthen the scientific excellence of basic research in Europe?

While strongly geared towards application, FP7 transport activities showed a high degree of scientific excellence and have had a significant impact on knowledge generation, measurable in terms of number of publications and patents. Within the reference population of the projects included in the Commission's SESAM – RESPIR database, the number of peer-reviewed publications per project totalled 324 – or an average of about 1,9 publications per project (about 2 publications per project in Aviation projects and about 1,7 in Surface Transport projects[163]).

[163] It should be noted that these figures only refer to publications produced during the lifetime of the project as reported by the project beneficiaries.

Open access was granted for about one in two publications. Most publications occurred in Surface Transport projects:

	% of projects with at least one publication	Number of publications
Aviation	28%	124
Surface Transport	33%	187
Cross-cutting	16%	13
Overall	29%	324

However, based on the Transport Survey 2015 carried out amongst participants in FP7 Transport projects, these figures need to be revised upwards. Considering a reply rate of 25%, the numbers are considerably higher. Indeed, publications included in the Commission's databases are only those occurring during the lifetime of the projects. Later publications can hardly be tracked.

Almost 3.250 scientific publications were reported from the survey, i.e. an average of 6,5 publications per project (out of the 501 projects represented in the survey). About 40% of the publications are declared by HES, and 31% are from industries.

There is a balanced share for the published and submitted publications between Aeronautics (55%) and Surface Transport (42%):

From the AAT publications 3/4 relate to the areas
- The greening of air transport (Green Aircraft)
- Improving cost efficiency (Aircraft Operational Cost)
- Pioneering the air transport of the future

From the SST publications 3/4 relate to the areas:
- The 'European Green Cars Initiative'
- The greening of surface transport
- Improving safety and security
- Strengthening competitiveness (Competitive surface transport products and services)

	Commercial IPRs				
IPR by entity	*Patents*	*Copyrights*	*Trademarks*	*Trade secrets*	*Publications*
SME	***35***	***17***	***8***	***14***	*339*
PRC (no-SME)	***82***	***30***	***5***	***31***	*694*
HES	*68*	*44*	*4*	*7*	***1387***
REC	*46*	*16*	*9*	*18*	*796*
PUB	*5*	*1*	*0*	*0*	*31*
Total	***236***	***108***	***26***	***70***	***3.247***
	440				

Concerning patents, figures were comparable in both Aeronautics and air transport (AAT) and Sustainable surface transport (rail, road and waterborne) (SST)

The highest number of patents in Aviation were declared under two areas:

- Green Aircraft

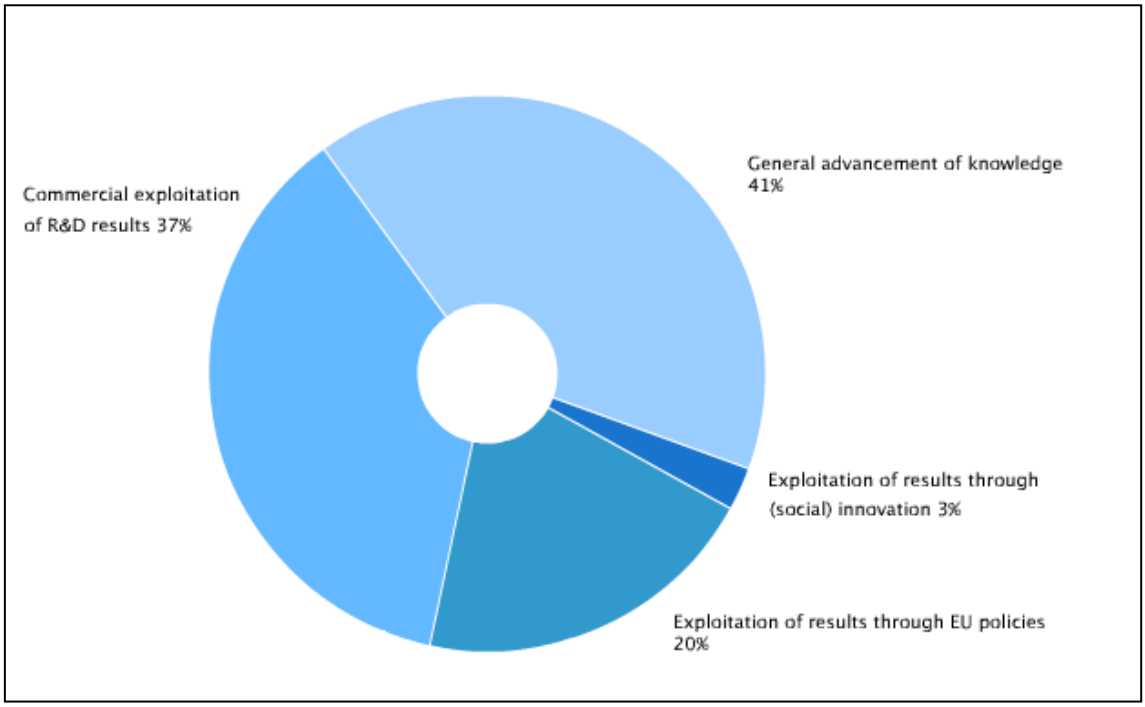
- Promising Pioneering Ideas in Air Transport

One quarter of the patents in Surface transport were declared under the areas:

- Optimised thermal engine development and integration

- The greening of products and operations

- Competitive surface transport products and services



Outputs from FP7 Transport projects

How did FP7 Transport promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

In FP7 transport, education and technology transfer in the area of transport focussed on the innovations and improvements in the systems for education and research themselves for transport in general (-) and more specifically aviation/aeronautics (E-CAERO - 2013), road (-), rail (SKILLRAIL - 2011, CETRRA - 2010) and waterborne (EUROVIP - 2014, KNOW-ME - 2014).

PhD and post-doctoral fellowships were generated through participation in collaborative research projects of the Transport Programme. Extrapolation indicates that about 2300 additional positions – including Scientific managers, Experienced researchers (i.e. PhD holders) and PhD students – were created specifically under FP7 Transport projects, ensuring the education and advanced training of tomorrow's high potential innovators.

Efforts to make Europe more attractive to the best researchers included, at the international level, International Cooperation activities carried out under the FP7 Transport theme, with all calls open to researchers and research institutions from third countries. For areas of mutual interest, enhanced participation of certain third countries was emphasized, namely with Eastern Europe and Central Asia (including Russia) and large emerging economies such as China, India, Brazil and South Africa. Industrialised countries such as USA and Japan were targeted for collaboration in a number of topics.

How did FP7 Transport provide the knowledge-base needed to support key Community policies?

Transport Research in FP7 was geared towards contributing to key policy areas. In this sense, the Transport Research and Innovation Achievements Report[164] identifies three high level objectives on which FP7 funded transport projects focused on:

- Resource efficient transport that respects the environment. Important intended effects of projects in this area were: (a) reducing or eliminating impacts on climate and health, (b) reducing the consumption of fossil fuels and (c) reducing weight and lowering resistance of the aircraft/vehicle/vessel.;

- Better mobility, less congestion, more safety and security. In FP7 projects, focus was put on the idea of co-modality and enhanced intermodality, on safety of aircraft/vehicles/vessels, on avoidance of deliberate attacks and illegal acts to improve security to improve security are taken into account. Some research and innovation in this field was done on a system level and in a generic way, whereas the practical implementation took place in the remit of the modes.

- Global leadership for the European transport industry, implemented by projects in a number of focus areas: entirely new transport concepts, next generation of transport means (including on board smart control systems) and advanced production processes.

Within the TRI-VALUE evaluation, project coordinators were asked to state whether policy recommendations were produced as an output of the projects. a substantial majority (>60%) of FP7 Transport policy oriented projects and a large share (>40%) of technology oriented projects reported producing policy recommendations. With more than a quarter of policy related projects and close to one fifth of the technology related projects producing outputs to be used by the European Institutions, with the indication that 60% of all projects delivered policy recommendations and with project coordinators estimating that 15 to 30% of projects already produced outputs that were “used to date”

164 Transport Research and Innovation Achievements Report (first edition, March 2015), covering the achievements from projects that were completed up to December 2014 (excluding Clean Sky).

by the EU Institutions, the TRI-VALUE evaluation concluded that FP7 activities have a substantial contribution to the European transport policy making process.

Hence, the TRI-VALUE evaluation concluded that there is good alignment between the work conducted under FP7 and the transport policy objectives. In particular, GHG reduction and safety were key areas of focus for transport research, followed by pollutants reduction and energy efficiency. Across all modes there is a large number of projects contributing directly or indirectly to those objectives. The use by EU institutions of policy projects is mostly noticed for rail and water projects, namely its use in policy papers and implementation (i.e. via a Directive or Regulation). For technology projects, the use of results is noticed mostly as "reference in documents", namely for rail and urban projects.

However, probably associated with the long timeframe of the decision-making processes, a relatively small share of projects (<20%) referred to Norms and Standards as an actual project output.

European, national and local authorities are users of results from policy projects. Public authorities can take a role as participants in projects (i.e. local authorities in CIVITAS). The use in policies and strategies is also noticeable in aviation, road and waterborne projects. As to rail projects, the use of results by public authorities, was only reported for a few projects, mainly of technology nature.

How did FP7 Transport increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

A meaningful example of how FP7 Transport favoured coordination and access to technological infrastructure is wind tunnel testing.

Wind tunnel testing has evolved a great deal since the 1950s. Today wind tunnels are highly sophisticated machines used for high-productivity testing of compressibility effects, flow physics and noise emissions in aviation/aeronautics.

For European research infrastructures the issue is if each wind tunnel should be able to offer the full spectrum of expertise and capacities or if the better option is to develop smart specialisation. Such specialisation has been spurred on by increasingly strict aerodynamic requirements and larger and larger scale models as well as the fact that physical constraints of simulation parameters are limiting. To boost European research in wind tunnels, it is imperative that the main facilities work together, combining their respective specialisations: the ONERA-S1MA transonic wind tunnel in France, the DNW-LLF subsonic wind tunnel in the Netherlands and the pressurised cryogenic facility ETW in Germany. This development was supported by a workshop and two European projects:

- A workshop organised in Brussels in February 2013, on Aviation Research Infrastructures in Europe brought together all the relevant aviation stakeholders, such as national and European authorities, agencies, industry, research institutions and academics.

- The 'European strategic wind tunnels improved research potential' (ESWIRP) project reinforced wind tunnel research through the development of generic and specific mathematical models for improving flow quality in the three partner wind tunnels.

- Under the OPENAIR project, new measurement techniques and testing facilities were used e.g. for an integrated approach to lowering aircraft external noise by noise reduction technologies (total of 15) for both engine- and airframe related noise sources validated to TRL 4/5 through large scale testing on fan rigs, jet noise facilities and wind tunnels.

How much did FP Transport contribute to job creation?

As for economic aspects, the project impacts on key economic priorities (i.e. job creation, stabilizing consumer prices, stabilising public authorities' budget and general macroeconomic increasing) were not easily detectable in many transport projects. Around 30% of the project coordinators interviewed reported to have contributed to job creation. There seemed to be, however, difficulties associated with the ex-post assessment of some key impacts. That suggests that there might be a need to improve the measurement and quantification of project benefits and impacts and a new mechanism for following the impacts of projects after the official completion date.

Various projects focussed on the uptake of skilled labour in the transport market and the raising awareness of potential job opportunities in (surface) transport in general (TECH-CLINIC SST - 2009) and mode-specific in aviation/aeronautics (FLY HIGHER - 2014, EDUCAIR - 2013, RESTARTS - 2012), road (-), rail (FUTURAIL - 2010) and waterborne (PROMARC - 2010).

To what extent do the results of FP7 Transport contribute to the achievements of the new Commission's priorities?

FP7 Transport contributed to achieving several Commission's priorities:

To boost jobs, growth and investment. Uptake of research results in the transport market focussed on analysis of pathways and best conditions for innovation (TIPS - 2014, T-TRANS - 2014 and AIMS - 2010) and the role of actors and regions (MARKET-UP - 2012). Participation by small and medium sized enterprises (SMEs) in transport research and innovation was stimulated and supported in general (INTRASME - 2014, STAR-NET TRANSPORT - 2011), through regional clusters (B2B LOCO - 2011, SMART - 2011), mode-specific/aviation (SME-AERO-POWER - 2013, MONITOR - 2011 and AEROPORTAL - 2010) and surface transport modes (STAR-NET TRANSPORT - 2011). In the European green Cars initiative (PPP), the Commission works closely with industry to design work programmes which are fully in line with industry's priorities. There is a long-term commitment on both sides which is vital in pursuing industrial technologies in a strategic way, being more effective in the translation of the research into the marketplace. In addition, the significant innovation-linked activities (pilots, demonstrators, prototypes) and strong industrial drive help bridge the so-called valley of death between technology development and applications.

To implement a resilient Energy Union with a forward looking climate change policy. The achievements of the FP7 funded projects largely covered the FP7 policy objectives and contribute to its goals by revealing innovative CO2 reduction solutions and policy strategies, by reducing the vulnerability of the transport systems facing extreme weather events, and by promoting means to enhance energy efficiency.

The economic recovery package, presented by the Commission in 2008, was already referred to here before. The European Green Cars Initiative (EGCI) was a public private partnership, focussing on electrification of cars and vans, increasing energy efficiency In particular, in passenger road transport energy efficiency of vehicles is expected to improve by 21% in 2020 and 35% in 2030 relative to 2005, leading to a decline in energy demand in passenger road transport by 2030. Beyond 2030, energy demand of passenger road transport is expected to stabilize . Research and innovation to enable these improvements not only took place in EGCI, but was also echoed in the regular Work Programmes and together had an impact that was traceable towards the end of FP7.

The Clean Sky (CS) Joint Technology Initiative (JTI), was also a Public Private Partnership (PPP) between the European Commission and the aeronautical industry, set up to bring significant step changes regarding the environmental impact of aviation, by speeding up technological breakthrough developments, shortening the time to market for new and cleaner solutions tested on full scale demonstrators including test flights and contributing significantly to reducing the environmental footprint of aviation (i.e. emissions and noise reduction but also green life cycle) for future generations and to ensure the highest level of European competitiveness in this area.

To achieve A Connected Digital Single MarketResearch and Innovation in FP7 transport contributed to enhancing the use of digital technologies and online services.

Examples of activities on smart equipment include an open platform to support the transport operations, planning and a wide range of traveller information services, cross-modal journey planning, dynamic route guidance, effective payment access and improved personal mobility (VIAJEO – 2012), specifications and standardisation for a new generation of interlocking systems for train signalling system (INESS - 2012), a reduction of maintenance costs (up to 25%) for commercial vehicles due to an optimised maintenance strategy (MODE - 2012) and preparatory work for the use of European satellite navigation programmes (EGNOS, Galileo) for different transport modes.

To make Europe a stronger global actor. Transport research and innovation in FP7 concentrated on the next generation of transport means, on board, smart control systems, advanced production processes and the exploration of entirely new transport concepts. European leadership in enabling and industrial technologies (LEITs, e.g. ICT and micro-electronics, nanotechnologies, new materials, biotechnology, advanced manufacturing, space) boosted the application in transport and spurred innovation for next generation issues in all transport means. On the next generation of transport means (the way to secure market share in the future) cross-cutting R&I efforts focussed on breakthrough solutions from multi-disciplinary collaborations, sometimes on a more

general level for competitive product development (EXCITING - 2012, MID-MOD - 2011, COMPAIR - 2011), encouraging radical technology changes (YEAR in 2008 and 2010). The main achievements from completed FP7 projects in relation to on board smart control systems are to be found at programme level the "i2010 Intelligent Car Initiative" to remove bottlenecks in rolling out intelligent systems and to speed the development of smarter, safer and cleaner transport for Europe and the on board systems to enable drivers, pilots and others that are responsible for the speed and direction of a vehicle to link with traffic management systems.. In 2008, the Public-Private Partnership (PPP) for Factories of the Future (FoF) was launched under the European Economic Recovery Plan. PPP activities comprised in total 150 high level projects involving top industrial companies and research institutions in Europe, including the transport modes. The exploration of entirely new transport concepts was nearly exclusively the domain in the aviation sector.

To what extent was FP7 Transport coherent with other EU actions (CIP, ESF) and EU policy?

Firstly, coherence was ensured overtime by FP7 transport adapting to developments in the overall community policies. In 2011, as the new Barroso II Commission took over and the economic crisis moved jobs and growth to the top of the political agenda, the focus of FP7 shifted from "Research and Development" to innovation, i.e. to a deeper attention to the market orientation of activities. This had an impact on transport policy, for instance in the main transport policy background provided by the White Paper on Transport: while the first calls were marked by the objectives of the 2001 White Paper and its midterm review of 2006, the final calls took as reference the 2011 Transport White Paper. Consequently, the scope of the different topics has been aligned and influenced by the main policy papers issued along the period.

Coherence was also sought in relation to exploring synergies between FP7 and other EU funding sources. Cohesion Policy funds' investments in transport and research infrastructure led to increased national and regional capacities, paving the way to excellence by supporting actors' participation (in particular SMEs but not only) to the EU research programme, or by enabling market deployment of EU funded research results. In parallel, research results provided solid scientific basis for the Cohesion Policy to invest where added value for its objectives could be achieved by deploying innovative solutions into the market.
The FP7 Transport Programme Committee reflected on the synergies that existed between the framework programme for research and innovation and the structural funds and on how they could be enhanced within the next framework programme H2020. The TPC expert group produced a guide aiming, on one hand, at raising awareness of the transport sector main actors managing both policies over the possibilities of synergies, supporting their thesis with concrete FP7 examples, and on the other hand, at identifying the transport areas where synergies could be best exploited

Which was the added value of FP7 Transport when compared with national transport research and innovation programmes?

According to the Tri-Value programme assessment study, one half of projects of FP7 Transport would not have been launched if it was not under FP7 Transport programme, or it would have been launched in a more reduced scale and scope. This is reported to be particularly true for aviation and shipping, which are by nature trans-national, and which would be disadvantaged if they had to rely exclusively on national funding for R&D activities.

The FP7 Transport programme has brought together the complementary competencies of the best European R&D actors in the field (and occasionally further afar) and assembled consortia with partners from a range of countries so as to provide a truly pan-European view or foundation, e.g. for regulatory purposes. It has also provided the necessary scale and scope to address key transport challenges. This is especially required for costly applied research.

High EU added value stems from activities within FP7 transport according to the coordinators interviewed, who attribute this value to aspects such as the "network effect" access to complementary expertise, or to overcoming barriers for uptake of results. In general, results are consistent across modes.

In the aviation sector, access to trans-national complementary expertise and overcoming lack of funding at the national level were important in 80% of the projects surveyed. This shows the critical importance of EU funding in aeronautics and air transport research and technology development.

In intermodal, rail, road and urban projects the elements mentioned in the assessment of added value included

- Access to complementary expertise

- Understanding the needs of a wider market

- Capitalising on previous EU experience

Overcoming the lack of national funding.It can be concluded that European funding is playing a critical role in providing funding for issues of importance at EU level, as most projects would find it impossible to gather funding for research in the covered topics elsewhere, regardless of the fact most coordinators do work simultaneously in EU and National research programmes.

In conclusion, evidence reviewed in TRI-VALUE demonstrates considerable added value from European research, as it contributes to promoting excellent science in transport at the European level. Firstly, it shows that the trans-national consortium work enables researchers to verify and think in conceptually broadened terms.

Whilst added value comes from the collaboration across borders and experiences and skills which contribute to a more comprehensive piece of research, national research funding rules often do not permit funding of international projects.

Transport in H2020: continuity or evolution?

The transport component of FP7 was already strongly geared towards applications and innovation. The further boosting of these dimensions can be considered as the main novelty in H2020 compared to FP7, together with the increasing importance of policy objectives.

The main element of continuity between transport in FP7 and H2020, on the other hand, are the competitiveness and the sustainability components, which are at the heart of both programmes.

In detail, during FP7 EU research activities have undergone significant changes and have witnessed a shift from mere project funding to research policy making, with an increased emphasis on the innovation potential of research and its impact on society in general and the economy in particular. This evolution calls for greater attention to be paid to the output and impact of EU funded R&I, for strengthening the feedback loop from R&I activities into policy making at EU level and beyond, and for increased efforts to assess the cumulative achievements of the research programmes. Therefore, the transport research and innovation achievements report looks into the continuity at the level of the major policy objectives as overarching two or more programming periods (both FP7 and H2020). This 'achievements report' should in fact be seen as a component of a dissemination and exploitation strategy aimed at reinforcing the relevance, the usefulness and the effectiveness of EU Transport R&I. In parallel to the reinforcement of the feedback loop into policy there is the development of tracking project participants for their innovation potential and tracing of project results for how to speed up their way to market uptake. So, there is continuity and evolution at the same time.

10.8. Socioeconomic Sciences and Humanities (SSH)

How did FP7 SSH contribute to the competitiveness of European industry?

The specific case of SSH research should be acknowledged in the analysis of the different types of exploitation of the results. Patents, prototypes, demonstrators, and other commercial exploitation uses of the knowledge are not usual among SSH[165]. However, five projects (INFOCON, IKNOW, MEDPRO, SUSTAINCITY, and SELUSI) have self-reported to have created spin offs companies.

> The IKNOW project aimed at identifying events and developments potentially shaking or shaping (Wild Cards and Weak Signals) the future of science, technology and innovation (STI) in the European Research Area (ERA). One main result has been the creation of Futures Diamonds, a spin-off company. Future Diamonds designs and develops systems and technological solutions supporting innovation processes for government, business, research and education actors at local, national and international levels, and offers job to a whole team of programmers, web-coders and designers. The company provides its services and solutions to 2.100 users worldwide (members) from 112 countries of the 5 continents. One of the solutions and services offered and created is the Horizon Scanning Platform, a horizon scanning system on key issues affecting the future of the health and social care workforce in the United Kingdom. This platform is managed by the Centre for Workforce Intelligence (CfWI) that is an independent agency working on specific projects for the Department of Health (UK).[166]

How did FP7 SSH contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

Most of projects (237, that is, 95,3% regarding the total number of FP7 SSH projects) are coordinated by EU member states; 3,8% of projects are coordinated by associated countries (8 Switzerland and 5 Norway) and 0,9% by candidate countries (1 Turkey and 1 Iceland). Coordination is concentrated in the group of EU-15 states led by the UK (50), Germany (30), Italy (24), and the Netherlands (23). The same patterns are observed in the FP5 and FP6 data. Among the recently integrated Member States, only 3 countries (Hungary, Poland, and Lithuania) have coordinated SSH projects in FP7.

It is also important to remark the link between the amount of projects coordination and the participation as partner: those countries with higher amount of coordinated projects are also those with a highest participation as partners. However, it is important to point that all countries took part in the FP7. The overall EC average contribution per project is around 2.280.000€ and the average of project participants is around 11, meaning a high rate of cross-country links per project.

Based on the IMPACT-EV questionnaire, FP7 researchers reported to have collaborated with other European projects and research organisations in relation to their research.

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165 *Report on Societal implications*

166 HORIZON SCANNING PLATFORM Website, http://www.horizonscanning.org.uk/

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 (i.e. FINESS project). 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).

In general, collaborations among research projects and organisations include a number of different initiatives: joint conferences, being part of the advisory board, co-writing a policy brief, cross-invitation at project seminars, workshops and conferences, joint meetings, presentations, dissemination of findings among networks, interviews with researchers, exchange and comparison of results.

How did FP7 SSH contribute to improve the coordination of European, national and regional research policies?

The analysis of FP7 projects' Final Reports reveals that 95% of the projects have engaged with citizens or civil society organisations and 92% have done so with governments or public bodies or policy makers in their efforts to enhance their potential for social and political impact. Among them, the 33% involved specific actors whose role was mainly to organise the dialogue with citizens and civil society organisations (e.g. professional mediators, communication, companies, and science museums). In the majority of the cases this engagement involved forms of communication and dissemination of the project results, and in some of them it also involved collaboration in implementing the research results or in framing the research agenda.

FARHORIZON project (Use of foresight to align research with longer term policy needs in Europe)

The main objective of the project was to explore the long term challenges which face different sectors (or which cut across sectors) and to build a shared vision that could guide the development of the relevant European research agenda. For this purpose, the methodology included the use of "Success Scenario Workshop". The participants to these workshops included representatives from national governments (up to vice-minister level), European Commission (up to Director and Cabinet level), industry (up to Vice-President of an MNE and Chairman of an ETP) and scientific experts of high standing. One of the project's ending remarks was the fact that the themes analysed in the project coincided with main elements of the Europe 2020 and Innovation Union agendas, which were published later.

Beyond the collaborative research projects, the Coordination and Support Actions implemented in FP7 have promoted the alliance between different stakeholders, policy makers and civil society. The Support Action FLASH-IT has provided a forum for debate and it has developed new mechanisms to engage researchers, policy-makers, industry and CSO in order to transfer and enhance the existing knowledge of a wide range of topics. Furthermore, the four Social Platforms funded by the European Union's research (between 2007 and 2013) are also a good example of the establishment of synergies among different stakeholders. In the report "EU Social Platforms: A review on an experiment in collaborative research design " in which the effectiveness of these platforms is evaluated (SOCIAL POLIS, FAMILYPLATFORM, SPREAD and INNOSERV), highlighted the creation, in all these platforms, of a space for constructive dialogue between academics and civil society. Moreover, the four platforms had or are having an active interaction with policy makers, at local, national and European level.

How did FP7 SSH strengthen the scientific excellence of basic research in Europe?

The reviewed FP7 SSH projects have relative significant scientific impact, not only producing a considerable number of publications (mainly article, and books) but also through their citations, conference presentations and leading to subsequent research opportunities.

Almost 80% of the FP7 SSH projects[167] (78%) have published articles in peer reviewed journals, leading to an average of 16 articles per project. Nearly two thirds of the articles (72%) are published by one third of the projects, which indicates the existence of a group of highly productive research teams.

According to the data collected in the IMPACT-EV questionnaire, scientific publications tend to be the most common procedure to disseminate new knowledge within the scientific community. By analysing the researchers' responses to the question about their 10 most representative publications, most of the publications are in peer reviewed journal articles (68%), followed by book chapters (11,4%) and books (9,8%). Publicly available Full reports (3,3%) are also present in various projects while non-peer-reviewed journal articles (2,4%), journal editorials (2,5%) newsletters (0,8%) are less common. Different to other scientific areas, the specific importance for SSH research of books is important to be highlighted here, as if it is ignored, it does not fully reflect the disciplinary tradition.

In terms of citation patterns, data from the IMPACT-EV questionnaire indicates that when the Journal Citation Report (JCR) quartile is reported, articles tend to be published in the first quartile. Thus, drawing from other impact factor sources, the number of citations in Scopus and Google Scholar reveals that the 39% of the projects have been cited at least once.

Furthermore, FP7 SSH Cooperation projects have involved research consortiums of excellent researchers. Scientific productivity among these scholars is a clear indicator of

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this excellence. An analysis of the consortium's productivity -of a sample of 134 FP7 collaborative projects (including a total amount of 3.540 researchers)- reveals that in 98 of those (73%) at least one of the researchers has more than 10 JCR publications. The analysis also shows an average of 98 JCR publications per consortium. This indicates how FP7 was able to attract and promote excellent research teams across Europe. This data is highly relevant considering that in the field of SSH the average of JCR publications is lower than in other fields of research.

The average of JCR publications per researcher is 3,71 taking into account that this figure includes a significant amount of young researchers with no publications. Excluding those with 1 or 0 publications, the average goes up to 8,5 per researcher. It is a proof of the high level of scientific publication of the researchers and the importance of the training of early career researchers.

Another proof of the excellence criteria is the presence of many top researchers in the projects awarded with different prizes and distinctions. At the international level, we find highly recognised researchers, such as the Nobel Prize in economy Jean Tirole, who has been involved in three projects. Other international awards are the annual distinction of the International Social Science Council (ISSC), the Schumpeter Prize Competition, or the recognition of being among the top 5% economists in the RePEc (Research Papers in Economics) worldwide ranking. At the European level, we find awards such as the one from the European Science Foundation on pioneering demographic research, and an Yrjo Jahnsson medal awarded by the European Economic Association. Finally, national prizes include for instance a National Natural Science Prize, an Honorary Fellow of the Royal Society of New Zealand, a Certificate of Merit for Pre-Eminent Contribution to Creative Legal Scholarship by American Society of International Law, or a Fellow of the British Academy.

FP7 SSH projects: scientific impact

	Publications (weight 5)[1]						Scientific dissemination (weight 3)								Subsequent research (weight 5)								Scientific Impact Value	Scientific Impact Score[7]
	Peer-reviewed journal article (weight 20)		Books/chapters (weight 10)		Others (weight 5)		Conferences Invited (weight 20)		Conferences Submitted & Accepted (weight 15)		Seminars Organization (weight 10)		Seminars Attendance (weight 5)		International (weight 20)		European (weight 15)		National (weight 10)		Local (weight 5)			
ACRONYM	N	Score[2]	N	Score[3]	N	Score[3]	N	Score[4]	N	Score[4]	N	Score[4]	N	Score[4]	N	Score[5]	N	Score[5]	N	Score[5]	N	Score[5]		
ASPA (FP7 CP-FP)	47	21	5	2	--	--	--	--	29	3	--	--	12	3	--	--	--	--	--	--	--	--	2380[6]	10
ASPRO CEE 2007 (FP7 CP-FP)	41	17	--	--	--	--	--	--	19	3	5	1	2	1	--	--	--	--	--	--	--	--	1880	10
CHANGING BEHAVIOUR (FP7 ENERGY)	8	9	--	--	1	1	--	--	--	--	--	--	--	--	1	1	1	1	1	1	--	--	1150	8
GINI (FP7 CP-FP)	36	16	7	4	7	2	11	3	19	3	--	--	24	3	--	--	1	1	--	--	--	--	2285	10
GUSTO (FP7 CP-FP)	24	11	8	4	--	--	--	--	6	2	--	--	6	2	--	--	--	--	--	--	--	--	1420	9
INCLUD-ED (FP6 IP)	73	20	4	2	--	--	1	1	18	3	--	--	8	2	--	--		--	3	1	--	--	2375	10
MERCURY (FP7 CP-FP)	11	5	13	5	1	1	--	--	58	3	6	2	51	3	--	--	3	1	--	--	--	--	1090	8

[1] Each type of scientific impact has a different weight assigned.
[2] A score is assigned according to: a) the number of articles published: for 1-5 articles=1; 6-10=2; 11-15=3; 16-20=4; 21-25=5; 26-30=6; 31-35=7; 36-40=8; 41-45=9; >45=10; b) the sum of all the individual impacts: each article has an individual score depending on the journal quartile of JCR (Q1=1; Q2=0,75; Q3=0,5; Q4=0,25, no JCR quartile =0) plus the cites achieved (for cites in WOS and Scopus, 1 to 5 cites= 0,25; 6 to 10= 0,5; 11 to 20 = 0,75; more than 20 = 1. For cites in Google scholar, 1 to 25 cites = 0,25; 26 to 50 = 0,5; 51 to 100 = 0,75; more than 100 = 1). Final score for Project articles is the sum of a) and b).
[3] A score is assigned according to: a) the number of books or chapters published: for 1-5 books/chapters=1; 6-10=2; 11-15=3;16-20=4; 21-25=5;26-30=6; 31-35=7; 36-40=8; 41-45=9; >45=10; b) the sum of all the individual impacts: each book/chapter has an individual score depending on the publisher prestige based on whether they are indexed in the Book Citation Index – Web of Science (http://wokinfo.com/products_tools/multidisciplinary/bookcitationindex): 1 if it is included, 0 if it is not.
[4] Score is assigned according to the number of conferences (invited / submitted & accepted) / seminars (organized / attended): 1 to 5 = 1; 6 to 10 = 2; more than 10 = 3.
[5] Score is assigned according to the number of subsequent projects developed: 1 to 3 = 1; 4 to 5 = 2; more than 5 = 3.
[6] 5x20x21 + 5x10x2 + 3x15x3 + 3x5x3 = 2380
[7] 10 (>1500), 9 (1251-1500), 8 (1001-1250), 7 (801-1000), 6 (601-800), 5 (401-600), 4 (301-400), 3 (201-300), 2 (101-200), 1 (0-100)

How did FP7 SSH promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

FP7 SSH supported training through activities such as summer schools, study visits, teacher training programmes or PhD students' meetings engaged in the projects' development. Beyond that, projects have had a relevant commitment with science education. According to the available final reports (a sample of 119 projects), 45% have generated science education materials like kits, websites, explanatory booklets, DVDs, among others. Moreover, 31% of these projects (37 projects) have reported working with students and/or school pupils in activities such as: open days, participation in science festivals and events, prizes/competitions or joint projects.

FP7 SSH also contributes to mobility of researchers: 33% of the FP7 SSH projects that reported impacts on ERA specified they promoted mobility opportunities for the researchers in their teams. The answer varies significantly across projects, from 5% of the researchers having mobility opportunities to 100%. Besides, 37.5% of the projects reported that the participation in the project has led to career advancement for staff of their team.

FP7 SSH projects: impacts on collaborations, employment and career advancement

	Collaborations (weight 3)[1]										Employment (weight 3)				Career Advancement (weight 3)				ERA Impact Value	ERA Impact Score[7]
	FP projects (weight 20)		Other Projects (weight 15)		Eu/Int Org (weight 15)		Nat Org (weight 10)		Eu Infr (weight 5)		Researchers employed (weight 10)		Junior researchers (weight 5)		% Mobility (Weight 5)		% Position promotion (weight 10)[4]			
ACRONYM	Num	Score[2]	Num	Score	Num	Score	N	Score	N	Score	N	Score[3]	N	Score	%	Score[5]	%	Score		
EUMARGINS (FP7 CP-FP)	5	2	--	--	--	--	--	--	--	--	5	1	--	--	--	--	58	3	240[6]	9
FINESS (FP7 CP-FP)	2	1	2	1	--	--	--	--	--	--	15	2	13	2	--	--	--	--	195	8
HOLY AND LAY (ERC)	--	--	4	2	--	--	--	--	--	--	2	1	--	--	100	3	25	1	195	8
INSPIRES (FP7 CP-FP)	7	2	--	--	1	1	--	--	--	--	10	1	--	--	--	--	--	--	195	8
LOCALISE (FP7 CP-FP)	5	2	--	--	--	--	--	--	--	--	46	2	--	--	7	1	--	--	195	8
POLHIA (FP7 CP-FP)	5	2	--	--	--	--	--	--	--	--	14	2	1	1	--	--	1,29	1	225	9
SAWS (FP7 HERA)	--	--	16	3	--	--	--	--	1	1	17	2	--	--	60	3	14,26	1	285	9
TAP (FP7 HERA)	--	--	4	2	9	2	--	--	--	--	11	2	3	1	--	..	75	3	345	10

[1] Each type of impact has a different weigh assigned.
[2] This score is assigned according to intervals of the number of collaborations: 1 to 3 =1; 4 to 10= 2; more than 10 = 3.
[3] This score is assigned according to intervals of the number of senior or junior researchers employed: 1 to 10 =1; 11 to 50 = 2; more than 50 =3.
[4] Percentage of researchers promoted in relation to the size of the consortium.
[5] This score is assigned according to intervals of the percentage of mobility among researchers and the percentage of position promotion: 1 to 25% = 1; 26 to 50% = 2; more than 50% = 3.
[6] Example: 3x20x2+3x10x1+3x10x3= 240
[7] This score is assigned according to intervals of the ERA Impact Value: 10 (>300), 9 (201-300), 8 (101-200), 7 (81-100), 6 (61-80) , 5 (41-60), 4 (31-40), 3 (21-30), 2 (11-20), 1 (0-10)

How did FP7 SSH provide the knowledge-base needed to support key Community policies?

Several projects' results have been used for policy development at the local, regional, national, European and/or International level. On the other hand, evidence is found in the development of strategic plans and/or programmes by organisations using the results of these projects. Many local, regional, national or European and/or International organisations and Institutions have elaborated their plans and/or programmes tacking into account the projects' results.

Examples of political impact achieved by FP7 SSH projects

- The results of CAP-IRE project have been used as the basis to develop the post 2013 Common Agricultural Policy (CAP),[168] clearly influencing on the development of this policy framework;[169]

- The data and methods of the COINVEST project have been integrated in the Innovation Strategy *"Getting a Head Start on Tomorrow"* of the Organisation for Economic Co-operation and Development (OECD);[170] Besides, the COINVEST policy recommendations to UK Government about investment in intangible have influenced in the UK knowledge investment growing[171].

- The results of FINNOV project have been taken into account to elaborate the UK *Innovation and Research Strategy for Growth;*[172]

- Some of the project recommendations of PRIV-WAR have been included in the European Resolution about the development of the common security and defence policy after the entry into force of the Lisbon Treaty;[173]

- The results of EURO-JUSTIS project have been included by the UK Ministry of Justice and the National Audit Office (NAO) in their Briefing for the House of Commons Justice Committee.[174] The project results of EURO-JUSTIS have contributed also to the elaboration of a module (set of questions) to the fifth European Social Survey (ESS) which has been replicated by an EU/UNDP project;[175]

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168 CAP-IRE Final Report

1. [169] EUROPEAN COMMISSION, *THE COMMON AGRICULTURAL POLICY AFTER 2013* (BRUSSELS: EC, 2013),

2. [170] OECD, *THE OECD INNOVATION STRATEGY: GETTING A HEAD START ON TOMORROW* (WASHINGTON: OECD, 2013)

171 UK Government, *UK knowledge investment continues to grow* (London: GOV.UK, 2013),

172 Department of Business Innovation and Skills of UK, *Innovation and Research Strategy for* Growth (London: GOV.UK, 2011)

173 European Parliament, *REPORT on the development of the common security and defence policy following the entry into force of the Lisbon Treaty (2010/2299(INI))* (Brussels: European Parliament, 2011)

174 UK Ministry of Justice, *Comparing International Criminal Justice Systems* (London: National Audit Office, 2012)

175 Research Excellence Framework, *Impact Case Study (REF 3b) (*London: REF, 2013)

- The SELUSI Project has advised the Flemish Government on its strategy to stimulate social entrepreneurship and co-authored a guidebook on how EU's regions can stimulate social innovation at the request of DG Region; [176]

- MONFISPOL project developed *DYNARE* that is a software platform for handling a wide class of economic models, in particular dynamic stochastic general equilibrium (DSGE) and overlapping generations (OLG) models. Various public bodies (central banks, ministries of economy and finance, international organisations) and some private financial institutions use *DYNARE* for performing policy analysis exercises and as a support tool for forecasting exercises. It has strong political impact in banks.[177]

Other evidence of the political impact achieved by FP7 SSH projects is the presentation of projects' results in political forums at international, European and national/local levels[178]. There is an intensive work from FP7 SSH projects in order to disseminate the projects' results among policy-makers, stakeholders and/or among other professionals related with politic issues.

FP7 SSH DOMAC project: an example of productive interaction[179]

The interaction during the negotiation process of the Kampala Declaration between some project team members and stake-holders and policy makers from World Health Organisation (WHO), direct and coordinate authority for health within the United Nations (UN), have been crucial to achieve the outputs of the project, and also to influence the final declaration document.[180]

176 SELUSI Project Summary

177 The DSG-NET (international research network for modelling, monetary and fiscal policy) used DYNARE software. Members of the DSG-NET: Bank of Finland; European Central Bank, Bank of France, Worgel Bank, Swiss National Bank; Federal Reserve Bank of Atlanta; Bank of Sweden and The capital Group Companies.

178 Among these political forums, the main ones being: meetings with representatives from the European institutions (for instance, the PRIV-WAR, FIDUCIA and COUNTER projects); meetings with National Delegations, Agencies or Ministries (for instance, the PRIV-WAR and FINNOV projects); European or/and International Workshops and Seminars organised in collaboration with political representatives (for instance, the FLOWS or COPE projects); and European /International Conferences also organised in collaboration with political representatives and mainly addressed to stakeholders, policy makers and/or other professionals related with politic issues (for instance, the COINVEST, POINT, WWWforEUROPE, CAP-IRE and MERCURY projects).

179 Productive interactions are defined as exchanges between researchers and stake holders in which knowledge is produced and valued that is both scientifically robust and socially relevant. Spaapen, Jack, and Leonie van Drooge. "Introducing 'productive interactions' in social impact assessment." *Research Evaluation*, 20.3.2011, pp. 211-218.

180 World Health Organisation. WHO, *The Kampala declaration and agenda for global action* (Geneva: WHO Press, 2008); DOMAC Final Report, http://www.domac.is/media/domac-skjol/DOMAC-18-Uganda.pdf; Coalition for the International Criminal Court (ICC), *Report on the first REVIEW CONFERENCE ON THE ROME STATUTE 31 May-11 June 2010 Kampala, Uganda* (New York, ICC, 2010)

FP7 SSH: policy impacts

		Policies (weight 5) [2,3]								Programmes (weight 3)[4]								Forums (weight 1)[5]								Political Impact Value	Political Impact Score[10]
		Int / European (weight 20)[6,7]		National (weight 15)		Regional (weight 10)		Local (weight 5)		Int / European (weight 20)		National (weight 15)		Regional (weight 10)		Local (weight 5)		Int / European (weight 20)		National (weight 15)		Regional (weight 10)		Local (weight 5)			
ACRONYM	Pillar[1]	N	Score[8]	N	Score	N	S	N	Score	N	Score	N	Score	N	Score	N	Score	N	Score	N	Score	N	Score	N	Score	N	Score		
CAP-IRE (FP7)	Growth	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	1	--	--	--	--	--	--	120[9]	9
COINVEST (FP7)	Growth	1	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	1	1	2	1	--	--	--	--	210	10
DOMAC (FP7)	Fairness	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	100	8
ENACT (FP7)	Democratic Change	--	--	--	--	--	--	--	--	1	1	--	--	--	--	--	--	3	1	--	--	--	--	--	--	80	7
EURO-JUSTIS (FP7)	Fairness	--	--	--	--	--	--	1	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	85	8
FINNOV (FP7)	Growth	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--	2	1	--	--	--	--	--	--	95	8
INCLUD-ED (FP6)	Jobs	1	1	--	--	1	1	2	1	1	1	1	1	1	1	--	--	5	2	2	1	--	--	--	--	365	10
MONFISPOL (FP7)	Growth	--	--	--	--	--	--	--	--	1	1	1	1	--	--	--	--	--	--	--	--	--	--	--	--	105	9
PRIV-WAR (FP7)	Fairness	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	1	3	1	--	--	--	--	135	9

[1] Based on Jean Claude Juncker agenda for Jobs, Growth, Fairness and Democratic change
[2] Each type of impact has a different weigh assigned.
[3] Policies adopted by governments and supranational institutions. Political impact is considered if there are evidences of the relationship between the research project and the policy.
[4] Programmes implemented by civil society organisations (NGOs, companies, unions, trusts, professional bodies and other stakeholders) that have used the findings of the research. Political impact is considered if there are evidences of the relationship between the research project and the policy.
[5] Political forums (with policy makers) in which the findings of the research have been presented.
[6] Policies at the European level include Regulations, Directives, Decisions, Recommendations, Resolutions, Opinions, Conclusions and Recommendations adopted by the European Parliament, the Council of the European Union or the European Commission. Also are included in this category resolutions, declarations, treaties, protocols, global plans of actions, conventions, agreements, conferences and summits, consultative opinions, etc. adopted or promoted by the United Nations, as well as agreements, guidelines, recommendations and declarations adopted by OECD.
[7] For each type of impact, the weight varies according to the scope of the impact.
[8] Score is assigned according to intervals of the number of policies / programmes / forums: 1 to 3 = 1; 4 to 5 = 2; more than 5 = 3
[9] 5x20x1+1x20x1= 120
[10] 10 (>200), 9 (101-200), 8 (81-100), 7 (61-80), 6 (51-60) , 5 (41-50), 4 (31-40), 3 (21-30), 2 (11-20), 1 (0-10)

How did FP7 SSH increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

Most of the projects publish significant part of their scientific production in Open Access: 43% of the articles from FP7 SSH projects are open access articles and 22% are published in Open Access journals. Publications in open repositories range from the 11% of articles in the case of CSA-CA to the 47% of CP-SICA projects.

Furthermore, 42,5% out of the 162 projects (SESAM) have uploaded publications in the OpenAIRE[181] repository, and the average of publications per project (out of those who published in OpenAIRE) is of 6,62. The range oscillates between 1 article to 120 (ACCEPT PLURALISM). Both finished and not finished projects are included in this count.

The development of databases, indicators and tools, is a key part of the outcomes produced under FP7 SSH programme. This allows the creation of new organized knowledge as well as the measurement of different issues in the fields such as welfare, migration, demography and/or labour markets.

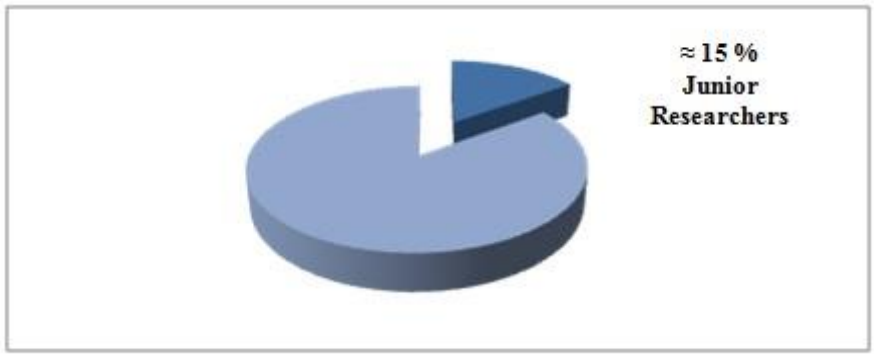
For instance, in the field of Knowledge-based economy and social innovation, as a result of COINVEST Project (in collaboration with INNODRIVE Project), a harmonised database of macro-economic investment in intangibles (education, research, copyrights, etc.) has been created and made accessible on-line to the general public by the European Commission.

Another example is found through the SAMPLE project has developed database software with new indicators, statistical models and procedures that aim at providing a deeper understanding of inequality and poverty. In the same field, the VICO project has created a database sponsored by the European Union on venture capitals in Europe with more than 8,300 companies from seven European countries. Another example can be the project ASSPRO CEE 2007 which has generated 2 databases on standards in the assessment of patient payment policies around the world.

How much did FP SSH contribute to job creation?

According to the workforce statistics gathered in the reports of a sample of 119 FP7 SSH projects, 927 out of 6023 researchers were PhD students. That is to say those, around 15% of the total researchers in FP7 SSH Cooperation projects were junior researchers. Projecting to the total FP7 SSH projects (n=252), it would be an estimation of 1963 PhD students hired throughout the FP7.

[181] The FP7 project OpenAIRE aimed to support the EC and ERC Open Access policies' implementation.



Junior researchers involved in FP7 SSH Projects (%)

Source: DG RTD, data from E-CORDA

The IMPACT EV project shows that most part of the junior researchers hired were aged between 25 and 35 years and are mostly PhD students (other levels are represented as well, up to undergraduate students). Second, many researchers recognised that these junior researchers were hired after the project completion and in around a half of them were promoted to better academic positions. Some of these jobs were related to new projects resulting from the previous ones.

To what extent the results of FP7 SSH contribute to the achievements of the new Commission's priorities?

The FP7 SSH projects fostered the production of new knowledge on socio-economic challenges that our societies are facing, and which address the new Commission priorities. In the "Social innovation research in the European Union: Approaches, findings and future directions " report an overview of results from 17 comparative European projects in the field of social innovation, which produced new knowledge for the use of policy makers, other stakeholders and the broader public is presented.

For instance, the CITISPYCE and CSEYHP projects have generated new theoretical knowledge regarding to combating inequalities and social exclusion among young populations. The INNOSERV and SERVPPIN projects have contributed to generate new knowledge outputs related to innovative social services.

new knowledge in the field of education has been also complied in the Policy Review "Adult and continuing education in Europe: Using public policy to secure a growth in skills " which compiled the findings of research projects on adult and continuing education that have been funded under FP6 and FP7, such as NEUJOBS, WALQING and YOUNEX. In turn, research has also resulted in evidence-based recommendations for new policies and actions. The report "Scientific evidence for policy-making: Research insights from Socio-economic Sciences and Humanities" gathers a big amount of scientific evidence for policy making.

According to the Stock-tacking report[182], the projects have developed outputs across different 9 thematic major clusters: 1) Knowledge-based economy and social innovation; 2) Macroeconomic policies and growth; 3) Employment and labor market; 4) Social inequalities, education and social inclusion; 5) Demographic change; 6) Sustainable socio-economic development; 7) Europe as a Global Actor; 8) Democracy, participation & citizenship; and 9) Diversities and commonalities in Europe.

Moreover, FP7 SSH projects have succeeded in achieving social impact and show how SSH research funded under EC contribution can make real improvements in different contexts and levels.

Examples of FP7 SSH projects with societal impacts, grouped by the EU targets (EU 2020 Strategy and Juncker's Agenda for Jobs, Growth, Fairness and Democratic Change)

Regarding to **employment**, the IMPACT-EV team has found that several projects have contributed to create jobs or to improve of people at risk. For instance, the project MIGROM generated employment opportunities for the Romanian Roma in collaboration with the Manchester City Council, and the project MYPLACE has improved the employability of young unemployed in England through training programmes . There are also other projects which findings can potentially lead to social impact. This is the case of LOCALISE, which identified examples of best practices that might contribute to the employment target , and ASPA, which results may have changed employers´ behaviours towards the older people.

Regarding to the **R&D and innovation dimension**, an example is MEDPRO, which has launched the Euro-Mediterranean Economists' Association (EMEA) with the aim of monitoring and contributing to the reform processes in the political, economic and social agendas. MEDPRO can have social impact. This is especially important as the social impact in this area might require longer perspectives, and therefore more difficulties to identify it in recently finished projects.

Some of the projects were identified as contributing to the **climate change and energy sustainability** dimension. For instance, POINT focused on indicators designed to measure sustainable development and the integration of environmental concerns into other sectors of policy-making. Based on the project results, the Sustainable Development indicator definition in Finland has increasingly included potential users and actors from various sectors and levels of the society, leading to the development of Sustainable Development Commitments, which give part of the responsibility of indicators production to the participating actors. The project SUSTAINCITY shows how projects can create useful outcomes and/or tools with high potential of having social impact in the near future, since as a result of the project a spin-off company and a Town Planning Software were created.

[182] Ref?

Regarding to the **reduction of poverty and social exclusion**, DESAFIO contributed to empower marginalized local communities and helped them to gain access to water in Latin-American countries. CSEYHP worked with young homeless as co-researchers in the fieldwork carried out in four countries, and it influenced positively in empowering these co-researchers. Furthermore, as stated in the Methodology Annex deliverable of CSEYHP project, one young woman who was co-researcher received a student's grant from the project. It allowed her improve her living conditions, as paying her rent arrears and prevented her becoming evicted and homeless again, and also allowed her to remain in college. The other young co-researchers were rewarded with computers and payments for internet access that would help their educational goals.

TENLAW results show that the implementation of a Social Rental Agency system may have a positive impact on the management problems associated with low income households, and SAMPLE which contributed to the activation of an important local network of associations, public administrations, parishes, counselling centres that are involved in local actions against poverty.

Contribution of FP7 SSH to EU 2020 targets and Commission agenda

ACRONYM	Pillar[1]	Social Impact[2]	Responds to at least one EU2020 target or Lisbon strategy objective	% of improvement achieved[3]	Evidences of transferability[4]	Sources of evidences[5]	Sustainability[6]	Score – impact[7]	Social Impact Score[8]
ALAC's (FP7 BSC-CSO)	Democratic change	1	Other target . EU's Justice and Home Affairs Agenda 2020	not available	Yes	Other sources	Yes	**3**	**7**
		2	Yes. Employment	not available	Yes	Other sources	Yes	**7**	
CSEYHP (FP7 CP-FP)	Fairness	1	Yes. Poverty	not available	Yes	Other sources	No	**5**	**5**
DESAFIO (FP7 CP-FP-SICA)	Fairness	1	Yes. Poverty	not available	Yes	Other sources	No	**5**	**5**
INCLUDED (FP6 IP)	Jobs	1	Yes. Education	98%	Yes	Scientific journals	Yes	**10**	**10**
		2	Yes. Employment	39%	Yes	Scientific journals	Yes	**10**	
POINT (FP7 CP-FP)	Growth	1	Yes. Climate change	not available	Yes	Scientific journals	No	**6**	**6**
RESPECT (FP7 CP-FP)	Democratic change	1	Other target. Increased cultural tolerance	not available	No	Other sources	No	**1**	**1**
TAP (FP7 HERA I)	Jobs	1	Yes. Employment	not available	Yes	Scientific journals	Not available	**6**	**6**

[1] Based on Jean Claude Juncker agenda for Jobs, Growth, Fairness and Democratic change
[2] Each social impact corresponds to a specific societal improvement.
[3] Percentage of improvement achieved in relation to the starting situation. For instance, in the case of employment targets, it is the percentage of people who has showed certain improvement as the result of the actions developed based on the project's findings.
[4] At least implemented in 2 different contexts (Yes/No).
[5] Publication on scientific journals (with a recognised impact), other sources (from governmental or non-governmental official bodies).
[6] Evidences of the impact after the end of the project life span (Yes/No).
[7] The Score of each impact is assigned according to the criteria that it fulfils:

10: The impact meets all the criteria, and has more than 30% of improvement
9: The impact meets all the criteria, and has more than 20% of improvement
8: The impact meets all the criteria, and has more than 10% of improvement
7: The impact meets all the criteria, and has some % of improvement (not available the specific %)
6: The impact responds to EU2020/Lisbon strategy objectives, has achieved some % of improvement and meets at least 2 of the other criteria
5: The impact responds to EU2020/Lisbon strategy objectives, has achieved some % of improvement and meets at least 1 of the other criteria
4: The impact responds to EU2020/Lisbon strategy objectives and has achieved some % of improvement
3: The impact responds to other societal objectives, has achieved some % of improvement and meets at least 2 of the other criteria
2: The impact responds to other societal objectives, has achieved some % of improvement and meets at least 1 of the other criteria
1: The impact responds to other societal objectives and has achieved some % of improvement

[8] The final Social Impact Score of a given project will be the highest score obtained.

Examples of FP7 SSH projects with societal impacts beyond the EU 2020 targets

DIASPEACE worked with organisations mainly from Somalia and Ethiopia for mediation in conflicts and peace building. Beyond facilitating mediation dialogues, the projects contributions can be related to the Millennium Development Goals of Combating HIV/AIDS, Malaria and other diseases. DISPEACE has worked closely with a programme supported by the Finnish Ministry for Foreign Affairs in partnership with Somali healthcare institutions. This work allowed Somali Health Professionals based in Finland to make short stages in Somalia in order to improve the skills and practice of health professionals in the African country.

EURESCL has contributed to promote research institutes in Senegal and Haiti on Slavery issue and have developed educational materials and initiatives (in cooperation with UNESCO) to raise awareness of slavery. The EURESCL's work also has aimed to disseminate and promote the study of trafficking and slavery in the scientific community, both in Europe and in the countries where the investigation took place, by setting up research networks, workshops, festivals, expositions, among other activities.

Among the projects that have contributed to strengthen intercultural dialogue, we can highlight the RESPECT project, which was aimed at testing the hypothesis that grounding tolerance on equal respect for persons may contribute to the development of spatial policies capable of resolving the tensions between tolerance and social cohesion in culturally diverse societies. Based on the project results, a dialogue was established between the Milano municipal administration and the representatives of the three main Muslim communities about the construction of a mosque in the city. Though this topic had been debated for years in the city, a proper dialogue was only established when a public meeting was organized in the framework of the RESPECT project, in which a representative of the City Council, representatives of the Muslim communities, and some researchers participated. In the municipality of Heidelberg, in Germany, different initiatives have been implemented with the aim to promote integration of migrants and cultural and religious minorities, based on the concept of respect used in the research project.

The ALAC's project aimed to improve citizen participation in the fight against corruption, transferring one of the challenging issues included in EU's Justice and Home Affairs Agenda 2020. Being a BSO-CSO project with the collaboration of other organisations, this project was closely developed in collaboration with Transparency International (TI), an international NGO dedicated to combat corruption. Under the project, it was possible to develop a standardized system of collecting information about potential corruption cases in all the offices. Additionally, throughout the project, several new ALACs offices were created, in cases, these were the only places where citizens could go to report corruption cases

FP7 SSH impacts also relate to broader or global issues, such as the Millennium Goals of the UN, and others make reference to relevant European policies and priorities such as cultural tolerance, respect and sensitivity with regard to minority groups, corruption, among many others.

Gender issues have been specifically identified in around the 25% of the topics in different activities and areas. The descriptions of the topics point out to specific questions related to gender that need to be addressed such as informal family related policies, gender dynamics of mobilization in the Arab world, women and youth as political actors, or the situation of Roma women. Importantly, in the calls of 2010 and beyond, the Work Programs have stated that all projects are encouraged to raise awareness on combating gender prejudices and stereotypes (Work Programme 2010, 2012, 2013); furthermore, they point out that gender issues will be addressed as an integral part of the research to ensure the highest level of scientific quality.

According to the analysis of the available periodical reports (119), 49% of FP7 SSH projects have a gender dimension associated with the research content and 31% carried out one or more specific gender equality actions. The more frequent action was to set targets to achieve a gender balance in the workforce, followed by the design and implementation of an equal opportunity policy and actions to improve work-life balance.

Regarding the way in which the gender dimension has been integrated in the projects, we found that it aims to produce scientific knowledge in order to promote a more equal and cohesive European society. For instance the project NEUJOBS has identified the difficulties related to women's employment decisions and the possibilities to overcome them. Those orientations are collected in the policy brief "Women on the European Labour Market." More projects that addressed gender issues are listed in the report "Gender research in the 6th Framework Programme and the first period of the 7th Framework Programme Socio-Economic Sciences and Humanities Programme ".

Which was the added value of FP7 SSH when compared with national SSH research and innovation programmes?

The EU added value of the FP7 SSH programme relates to five dimensions:

First, SSH projects allow tackling social problems that go beyond the member state level. The SSH Programme has allowed to map data and social innovations, to compare perspectives, to identify gaps in knowledge, to define road maps in the field of energy, to improve social cohesion, to understand modern societal trends and their impact on socio-economic development in Europe, to reinforce relations at European and international level, or to generate cross-thematic approaches in crucial themes for the EU such as the fight against trafficking of human beings. These achievements would have been more hardly achieved from national based research initiatives.

Second, FP7 SSH programme has contributed to shape National research plans, research agencies and research political priorities. For instance, the National Research

Plan in Spain has shifted totally in SSH and since 2013 is coordinated with Horizon 2020 research priorities, particularly focusing on the H2020 Societal Challenges[183]. The cooperation of experts -from different European regions, disciplines and analytical frameworks- in a common research agenda contributes to a greater extent to both European and Member States targets.

Third, FP7 SSH programme also enabled to reach a relevant EU scale dissemination of the results. The analysis of project reports reveals that in most of the cases dissemination is done both in each of the participant countries and in a European scale through conferences, workshops, web tools among others. The Coordination and Support Actions have played a complementary role for disseminating internationally the outcomes of several projects.

Fourth, international collaboration has been essential not only for the goals and nature of the projects but also for achieving critical mass of a vibrant research community. According to the survey-based report "SSH Experiences with FP7 - a Commentary"[184] the main incentive of the researchers for participating under the FP7 Cooperation Programme was to undertake international cooperation and the awareness that collaborating with international partners might increase the quality of research results. In addition, finding new partners and extending scientific networks was also valued as one of the results of the process of proposal preparation even in the case of not being successful in the application.

Connected to the critical mass, a fifth strategy is identified that is how international collaboration among different, cross-disciplinary teams provides special opportunities for researchers' mobility and junior researchers' integration and improvement of capacities. Respondents of the IMPACT-EV survey have highlighted networking within and outside the EU as a relevant European added value of their project resulting from their participation in the Cooperation Programme.

183 See the blog *Horizonte 2020 (H2020): el programa de investigación e innovación europeo a partir de 2014*

184 NET4SOCIETY, *SSH Experiences with FP7 – a Commentary*.

10.9. Space

Objectives

The objective of the FP7 space was to support a European Space Policy focusing on applications such as GMES (Global Monitoring for Environment and Security, later renamed Copernicus), with benefits for citizens, but also other space foundation areas for the competitiveness of the European space industry. This contributed to address the overall objectives of the European Space Policy, complementing efforts of Member States and of other key players, including the European Space Agency.

Two main classes of activities were undertaken:

- Space-based applications at the service of the European Society, with GMES (Global Monitoring for Environment and Security) being central to this activity;

- Providing R&D support to the foundations of Space science, exploration, space transportation and space technology through synergies with initiatives of ESA or other European, national or regional entities.

The support for the first activity, the development of GMES, were articulates in four main *action areas*:

- Support to the (pre-)operational validation of GMES services and products

- Integration of satellite communication and satellite navigation solutions with space-based observing systems,

- Support to the coordinated provision of observation data, both from space-based infrastructure and from in-situ observing systems.

- Development of Earth observation satellites, which relate to the management of the environment and security, and which complement in-situ systems.

For the second activity, the strengthening of foundations of Space science and technology, the support were articulated in three more *action areas*:

- Support to research activities related to space science and exploration,

- New concepts in space transportation, and space technologies including critical components,

- Research into reducing the vulnerability of space based systems and services.

Space systems and space-based technologies and applications are of general strategic importance to the EU. Investment in space is not only relevant for the development of specific services, such as Copernicus and Galileo, but also to positively impact EU citizens and their businesses. The development of space systems and technologies is expected to contribute to the implementation of a wide range of evolving policy objectives, including:
Europe 2020, through better opportunities for space-related – but also "space enabled" – industries;

Sustainable Development, (e.g. through information gathering in support of the Kyoto Protocol monitoring and the actions resulting from the Johannesburg Summit on sustainable development, taking into account also the "Lisbon Declaration on GMES and Africa";
European non-dependency – allowing the EU to develop critical infrastructure (e.g. Copernicus satellite technology) and industry (e.g. PRS receivers for Galileo) know-how to ensure European non-dependency on other Space actors (USA, Russia, etc.);
Common Foreign and Security Policy (e.g. in support of borders control, conflict prevention and crisis management, continuity of public services, etc.).

Evolution of objectives to respond to the crisis

The economic crisis did not alter the objectives. The primary objective and 80-85% of the budget was devoted to the development of GMES/Copernicus, both services and space and ground infrastructure (satellites and ground stations). This helped to pave the way for the successful launch of the operational Copernicus programme now under way as well as to prepare the European space industry and Earth observation community to reap the benefits of this programme. The other main objective supported the competitiveness of the European space sector by targeting complementary activities.

How did FP7 Space contribute to the competitiveness of European Space industry?

FP7 Space Research has provided substantial funding to EU space companies (circa €300 million) for the development of new technologies and services, and in so doing is helping to underpin the innovation capacity and international competitiveness of Europe's space businesses, which continue to perform strongly in competition against their international counterparts in commercial and institutional markets both in Europe and the rest of the world[185]. In addition, about €700 million was devoted to building GMES/Copernicus satellites, thus benefitting the European satellite manufacturing sector.
The publicly available statistics for the space economy do not present data – supply or demand – that align with the space-enabled applications and downstream services covered by the FP7 Space Research Actions, and as such provide no basis for testing the extent to which the EU is making or holding ground internationally in the areas being supported.
In order to judge the programme's contribution to industrial competitiveness, we have carried out a beneficiary survey, where around 25% of our industrial respondents stated that the programme has had a medium to high impact on their international competitiveness. On balance, we judge this to be a good result.

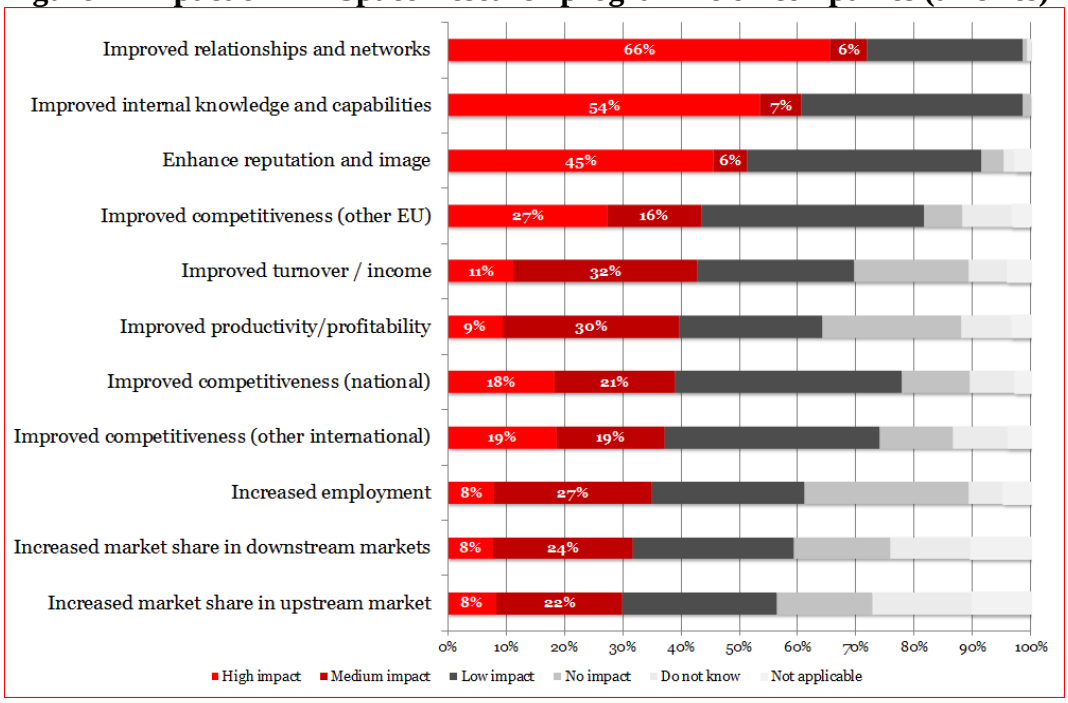
Figure **1** presents feedback from our industrial respondents, and shows the programme is judged to be delivering meaningful benefits to participants across a wide range of technical and commercial areas. In the survey, impacts are judged most positively on

[185] Aerospace and Defence Industries of Europe - Key Facts and Figures for 2012

relationships and networks, internal knowledge and capabilities as well as reputation and image.

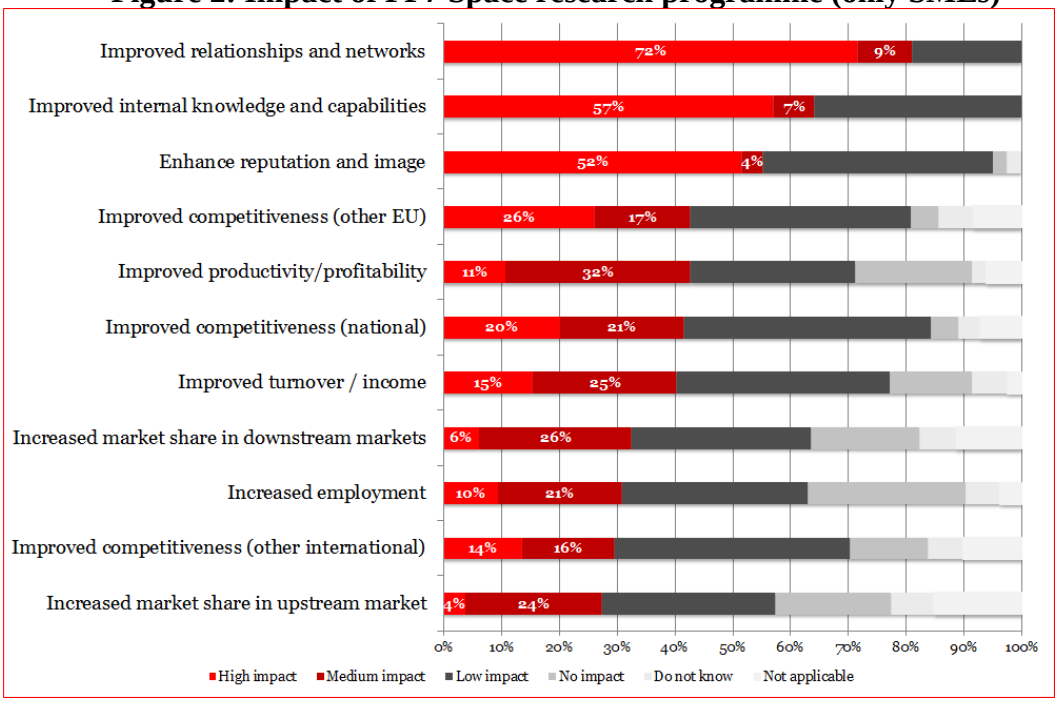
Figure 2 presents the same analysis, but just for participating SMEs (around 85% of the total number of business responses received). It shows a broadly similar distribution as regards the ranking of benefits derived, but a higher overall degree of satisfaction.

Figure 1 Impact of FP7 Space Research programme on companies (all sizes)



Source: Beneficiary survey (2014). Based on up to 157 responses.

Figure 2: Impact of FP7 Space research programme (only SMEs)



Source: Beneficiary survey (2014). Based on up to 157 responses.

This is possibly a reflection of size differences, wherein a €0.5m grant is likely to make a bigger difference to a small company with a €2om turnover than it is to a large prime with a €2 billion turnover. There is also possibly a feature relating to the sector's deep supply chains and the dominance of large primes within those commercial relationships, where a programme like FP7, with its large transnational projects can do a great deal for the visibility of smaller firms and their resulting inclusion within subsequent commercial contracts. The net impact on industrial competitiveness is not clear cut, however, as there is likely to be an element of displacement here, where new relationships forged between primes and their latest suppliers are likely to be at the expense of other lower-tier contractors, possibly also located within the EU.

Turning to stakeholder interviews and considering the provision of improved services to citizens through space-enabled applications and the commercial exploitation of the opportunities presented by space exploration and science, as mentioned above, GMES has already proven its significant impact in helping EU and non EU citizens in dealing with emergency situations. As a case in point, the European Flood Awareness System (EFAS), part of the GMES Emergency Management Service (now Copernicus), has been delivering early warnings of possible major flooding events to member states' national hydrological and meteorological services since 2012. Those alerts have helped anticipate and prepare for floods in several member states, from Scotland to Hungary and Romania.

Moreover, GMES has introduced many new opportunities for market players as several applications were developed through FP7 in different areas. As an example, it was suggested that the ASIMUTH project showed how Earth Observation data could be used by salmon farmers, since satellite maps can be used to help salmon farmers

deal with algae blooms by creating an alert system that will help detect the problem and deal with it.

How did FP7 Space contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

The programme has engaged with participants in 53 countries, including all EU28 member states and a good cross-section of 'Third countries with S&T Agreements' and 'Candidate & Associated' countries[186].

shows the distribution of FP7 Space funding by geography, for the top 10 countries, according to the total EU contribution granted to each of them, in order to show which are the main participants countries.
The data are based on the addresses of all participating organisations and not just lead partners. The table shows that the top 10 countries accounted for 81% of the total EU Contributions, and these include most of Europe's larger 'space nations', missing only Sweden. The top 10 countries also represent 71% of the total participations (1,827 out of 2,534). Furthermore, those top 10 countries (by budget) have also acted as project coordinators for 89% of the projects (228 out of 257 projects).

[186] The figures by country include international organisations based in these countries (e.g. UK figures include the participation of ECMWF and Spanish figures those of the EUSC).

Geographical distribution of FP7 space project portfolio (Top 10)

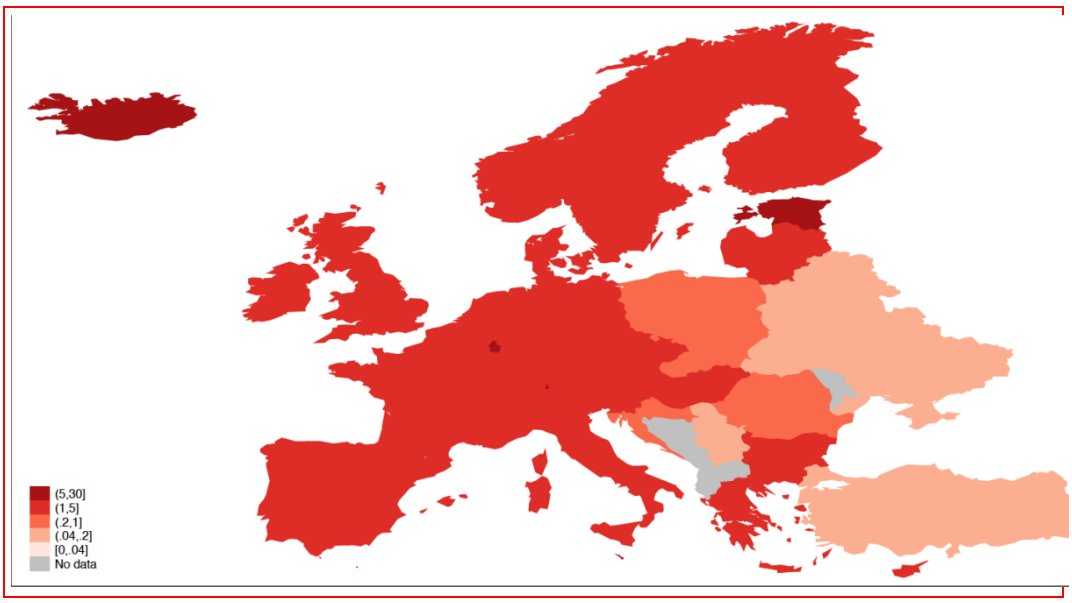
Countries	Total project cost (in '000 EUR)	EC Total Contribution (in '000 EUR)	Number of participations	Percentage of participations country of project coordinator
France (FR)	164,528	111,059	316	13%
Germany (DE)	130,382	93,206	319	11%
United Kingdom (UK)	139,460	93,125	291	12%
Italy (IT)	90,888	63,008	274	11%
Spain (ES)	67,826	47,435	183	15%
Netherlands (NL)	45,530	33,425	126	11%
Belgium (BE)	43,583	32,587	119	14%
Norway (NO)	30,830	21,381	59	12%
Finland (FI)	25,186	18,789	72	13%
Austria (AT)	21,625	16,639	68	15%
Sub-total (Top 10)	759,838	530,654	1,827	89%
Others	165,505	119,386	737	11%
Total	925,343	650,040	2,564	100%

Source: Based on CORDA data, February 2014

The FP7 Space projects have a good international coverage in terms of the location of their participants. The great majority of participants have addresses in the EU; however, participation is spread across the globe with participants from countries such as Russia, China, the USA, Canada, and Brazil, which suggests the 'FP7 Space Research' programme is supporting the formation and strengthening of international networks. International participation (extra-EU) is slightly lower in Space in comparison with FP7 overall. Only 43.6% of space projects included at least one partner from outside the EU, compared to 68.1% of other priority areas (excluding Space Research).

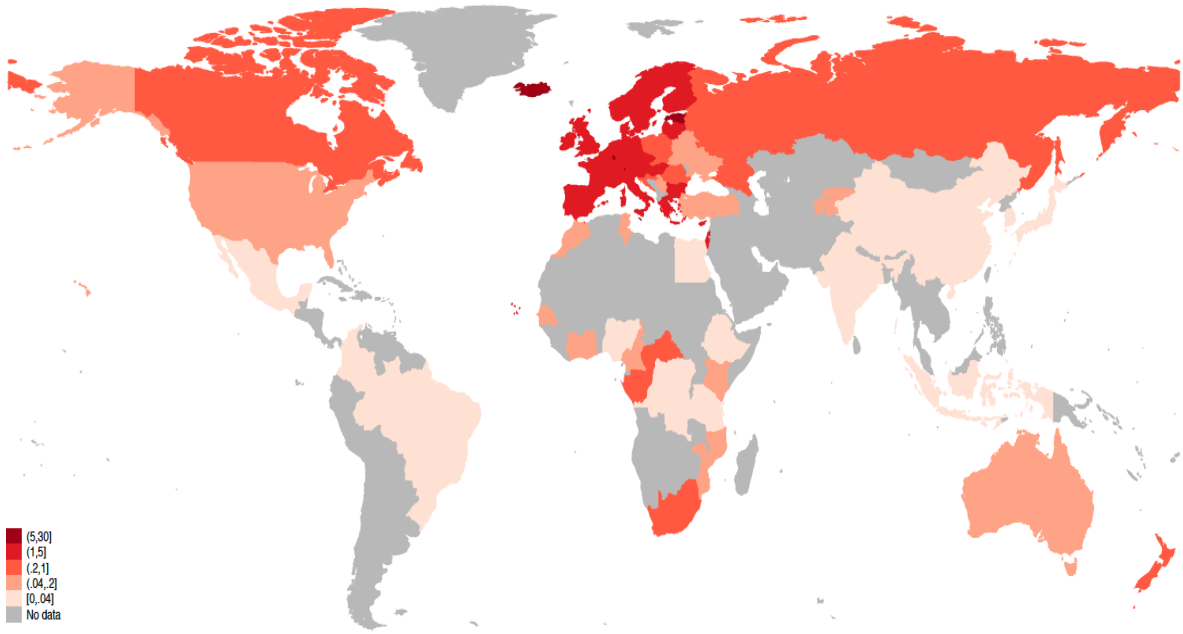
The figures below show the geographical distribution of participants across FP7 Space projects and other priority areas. In both maps, the distribution takes into account the size of the population in each country. The grids in the maps (shown in different colours) are calculated based on 5 percentile groupings, with the dark red indicating a higher number of participants (per 1 million inhabitants). When accounting for population size, the countries with the highest participation are Portugal, Norway, Finland, Ireland, Iceland, Austria and Belgium.

Location of participants (Space): Total number of participants per 1 million inhabitants



Source: Based on CORDA data, February 2014. Data on population has been obtained from the World Development Indicators (2012).

Location of participants (FP7 Space projects): Total number of participants per 1 million inhabitants



Source: Based on CORDA data, February 2014. Data on population has been obtained from the World Development Indicators (2012).

Considering the support to the EU influence in international space policy and related geopolitics, all interviewed stakeholders highlighted the strong positive impact of GMES. For example, the contribution of GMES to support relief operations in several other emergencies including, for example, earthquakes around the world and the Icelandic volcanic cloud.

GMES is becoming the European contribution to GEOSS (Global Earth Observation System of Systems), an international public infrastructure using land, sea, air and space-based Earth observation systems to provide comprehensive environmental data, information and analyses.
This allowed GMES and its services to become an international reference point. As an example, during the nuclear power plant emergency in Fukushima, support was provided by MYOCEAN to help understand the dynamic of sea currents to assess where the radiation would have impacted. As an additional example, the United Nations actually recognised the ability of SAFER project to rapidly provide support to assistance in the event of earthquake in Haiti, as emerged from both high-level interview and the dedicated case study.

The seeds of EU participation in international space policy and geopolitics have been planted through more than 20 projects funded on topics for international cooperation with Russia, Africa, Ukraine, China, etc. on topics such as GMES services, re-entry, space debris, lightweight materials, etc. These projects are judged to be important by interviewed stakeholders (in particular EU officials) because they showed actual **commitments from the** EU side in terms of budget allocation, thus creating the necessary preconditions for cooperation on further space activities.

FP7 Space has also supported various science projects exploiting the data from various international space missions, operated by ESA and in several cases by ESA and other major space agencies like NASA (e.g. STORM and work on solar wind, using data from NASA / ESA Ulysses spacecraft).

How did FP7 Space contribute to improve the coordination of European, national and regional research policies?

Space systems and space–based technologies are increasingly important for the European businesses and citizens. R&D support is not only crucial for the development of specific services, such as GMES, but also for strategic reasons. The continuous development of the space technologies is expected to contribute to reaching a wide range of policy objectives including:
- European non-dependence – allowing the EU to develop critical infrastructure and know-how to ensure European non-dependency on other Space actors (e.g. USA, Russia);

- Sustainable Development – e.g. information-gathering in support of the Kyoto Protocol monitoring and actions resulting from the Johannesburg Summit on sustainable development;

- Common Foreign and Security Policy – e.g. supporting border control, conflict prevention and crisis management;

- Lisbon Strategy – e.g. through better opportunities for space-related industries and the development of the space component of geo-information services, improved access to space based data for services.

The White Paper on Space[187] defined an action plan for a European Space Policy to address several EU needs in the areas of, for example, transport, environment, agriculture, and telecommunications. This publication was followed by years of consultation with key stakeholders, which resulted in the adoption of the European Space Policy, which was published by the Commission in April 2007[188]. The strategic mission of European Space Policy was formulated on the peaceful exploitation of Outer Space by all states and aimed to:

- Develop and exploit space applications serving Europe's public policy objectives and the needs of European enterprises and citizens, including in the field of environment, development and global climate change;

- Meet Europe's security and defence needs as regards space;

- Ensure a strong and competitive space industry which fosters innovation, growth and the development and delivery of sustainable, high quality, cost-effective services;

- Contribute to the knowledge-based society by investing strongly in space-based science, and playing a significant role in the international exploration endeavour;

- Secure unrestricted access to new and critical technologies, systems and capabilities in order to ensure independent European space applications.

The Communication also provided for the establishment of appropriate funding arrangements for the operational phase of GMES.

GMES is Europe's flagship space programme for continuous and expandable Earth observation services. It was determined that FP7 would build on the experiences gained during FP6 to ensure that GMES is successful, in particular building on the foundation of GMES Fast Track Services. The development of core GMES services in areas such as land, ocean, and atmosphere monitoring was meant to lead to improvements in Europe's capabilities to monitor climate change, pollution, land and wide maritime areas (CSES, 2011).

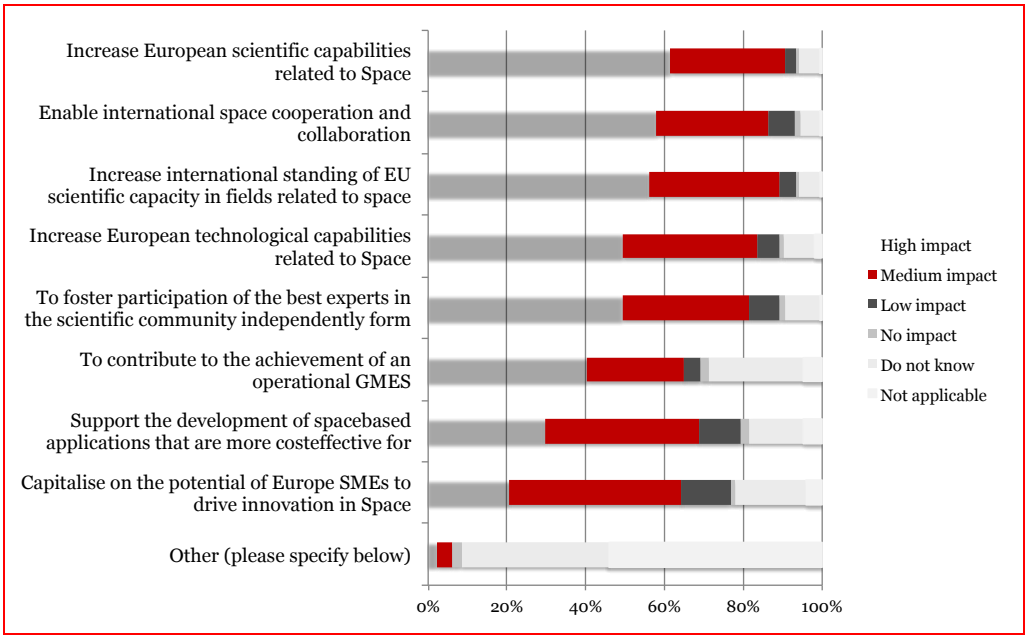
How did FP7 Space strengthen the scientific excellence of basic research in Europe?

[187] EC (2003): Space: a new European frontier for an expanding Union; An action plan for implementing the European Space, COM (2003) 673 final available at: http://eur-lex.europa.eu/LexUriServ/site/en/com/2003/com2003_0673en01.pdf

[188] EC (2007): European Space Policy, COM (2007) 212 final available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0212:FIN:EN:PDF

The participant survey revealed a strongly positive view of the programme's contributions to EU science and technology, with circa 90% of 545 respondents stating that FP7 space had had a *medium to high impact* on the EU's technological capabilities and international scientific standing.

Impact of the FP7 Space Research programme on Community objectives



Source: Beneficiary survey (2014). Based on 545 responses.

Interviews with space researchers were somewhat more equivocal on this point. The in-depth conversations revealed a concern that FP7 Space Research Actions had done rather less than might have been expected with a €700m budget to advance the international standing of space science in Europe, which is largely a function of the balance of funding and the fact that space exploration and RTD foundations secured only around 20% of the total available EC contribution. Indeed, there was a degree of frustration that the admittedly important GMES project should have been funded to the extent it was through FP7, arguably crowding out more conventional research. It was acknowledged, however, that there had been meaningful progress in several areas, such as space weather, which was the object of several calls mainly targeting the scientific community. As a last remark, academic stakeholders were pleased that Horizon 2020 has a separate budget line for GMES, leaving a larger share available for space research / space science activities.

With the exception of research performed under GMES-related topics, stakeholders suggested that the amount of money was perhaps too limited for achieving this objective of enhancing EU scientific and technological capacity and leadership.

There have been individual success stories, however, where initially low budget projects and activities have generated a snowball effect on EU scientific and technological research leadership. As an example, debris removal was first addressed

by the European Commission through FP7 Space. Results obtained have led ESA to launch additional studies and Member States to invest in the topic, providing a financial leverage.

How did FP7 Space promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

Although not primarily devoted to science, FP7 Space promoted the exploitation of European space data, an area where European funding is scarce. This allowed European teams the utilize and add value to Space science data already present in ESA archives and national project repositories.

How did FP7 Space provide the knowledge-base needed to support key Community policies?

The EU Earth observation capacity "Copernicus", developed and piloted under FP7 space (under the name GMES - Global Monitoring for Environment and Security), is now operational. It already today has 2 operational Earth observing satellites in orbit with associated ground infrastructure and in-situ sensors that provide a vast and growing knowledge-base in support of EU policies in key areas, such as environment, security, maritime monitoring, land use, atmosphere monitoring, climate change, migration and emergency response.

How did FP7 Space increase availability, coordination and access in relation to top-level European scientific and technological infrastructure?

As described under point 6, the Copernicus programme constitutes a major European scientific and technological infrastructure. Access to Copernicus data is provided "Full, Free and Open".

In addition, FP7 Space supported scientific data exploitation in relation to European space missions (national or ESA-led), where previously under-utilized data was made available to a wider scientific audience.

How much did FP Space contribute to job creation?

Overall the contribution to EU Space industry competitiveness was significant (cf. Question 1). Industry competitiveness is a prerequisite for retaining jobs and creating new ones.

To what extent the results of FP7 Space contribute to the achievements of the new Commission's priorities?

As already noted under Question 6, Copernicus is contributing greatly to many key Community policies. In addition, resources were devoted to addressing critical technologies for EU non-dependence in line with EU policies in security and EU competitiveness.

To what extent was FP7 Space coherent with other EU actions (CIP, ESF) and EU policy?

The evolving political context was that the Treaty of Lisbon entered into force on 1 December 2009, attributing to the EU a stronger role in space matters. The Treaty introduced for the first time a specific space competence for the European Union, indicating space policy as an EU policy in its own right.

In April 2011, the European Commission issued the Communication "Towards a space strategy for the European Union that benefits its citizens"[189]. The Communication clearly positions space within Europe 2020, stating that "*the space sector directly contributes to achieving the objectives of the Europe 2020 Strategy, namely smart, sustainable and inclusive growth. Space policy thus forms an integral part of the "Industrial Policy" flagship initiative.*" The Communication set out the key priorities for the EU space policy, including ensuring the success of the EU's two flagship space programmes, Galileo and Copernicus. The fifth Space Council meeting identified further priorities, as climate change, security, competitiveness and space exploration have been reaffirmed as priority areas. Moreover, the Communication called for the development of an industrial space policy in close cooperation with EU Member States and the European Space Agency.

On 28 February 2013, the Commission issued a Communication on the "EU Space Industrial Policy: Releasing the Potential for Growth in the Space Sector"[190]. The Communication proposed actions to increase industry's skills levels, support R&D, to ensure the EU's independence in space, to make finance and investment more readily available, and to improve the EU's legislative framework. The Communication also set the objectives for Horizon 2020.

FP7 space was in full coherence with the EU space policy and in particular with the EU action on GMES. In the case of Galileo, the main FP7 support came from the cooperation theme "Transport".

What was the added value of FP7 Space when compared with national Space research and innovation programmes?

The Seventh Framework Programme for Research and Innovation – including the Space area – represented a key tool to respond to Europe's needs in terms of jobs and competitiveness, and to maintain leadership in the global knowledge economy.

Overall, the ex-post evaluation has confirmed strong EU added value – not only at project, but also at programme level – for the vast majority of stakeholders who participated in the evaluation. Among project beneficiaries, out of 538 survey responses, 58.2% suggested that the projects they were involved in could not be supported by a national scheme or ESA rather than by FP funding, whereas 34.8% reported that only some of the projects could be supported. Only 7.1% of the

189 Brussels, 4.4.2011, COM(2011)152 final

190 Brussels, 28.2.2013 COM(2013) 108 final

respondents thought that all of the projects they were involved in could have been funded by alternative sources.

The outcomes of case studies carried out are in line with those of the beneficiary survey. Interviewees involved in SAFER or GEOLAND2 suggested that because of the European dimension of core services and the need for consistent and comparable data, it would have been unrealistic to set up pre-operational service at national level. In the case of AGAPAC and AEROFAST, the projects would not have been supported either at national level or by ESA due to no funding available for the specific activities of the projects. In the case of FRESHMON and μFCU the funding provided by FP7 proved vital to co-finance projects too large for national budgets. Finally, interviewees from all projects praised the opportunity offered by FP7 to bridge top scientists and experts from different EU Member States.

The remainder of this section outlines evidence for each of the components of EU added value identified:

Scale and complexity: the wide majority of interviewed high-level stakeholders consulted over the course of the study suggested that the nature of space research, its complexity, scale and required economic and human resources are one of the key drivers of European Added Value for FP 7 action in this field. These stakeholders confirmed that space research challenges are often so complex that they can only be addressed at European level. In addition, they suggested that national budgets or the scope of national activities are often too limited to support research activities funded by FP7 space.

Coordination of EU and MS potential is another key driver of European added value for this type of research action. It was remarked by different categories of high-level stakeholders that before FP7 Space came into force, the space research community was fragmented and there were few opportunities for the community to work together outside national budgets. Among those project beneficiaries who indicated in the survey that their project would not have received funded without FP7, 78% claimed that national sources in particular would not have supported vital international partners for their project. Thus, bringing together the right actors irrespective of where they are based across the EU is one of the key added values of FP7. FP7 is widely recognised by interviewed stakeholders to have brought the scientific community together, enabling researchers from different organisations to collaborate on the same project.
Moreover, it was suggested by most interviewed stakeholders that FP7 Space outperforms ESA funding schemes, since FP7 enables participation from all MS, whereas with ESA participants are dependent on national contribution provided to ESA programmes. This was particularly relevant for partners from EU Member states that are not part of ESA, as well as for those that joined relatively recently (such as Poland and Romania).

Quality of the knowledge base: the requirement to cooperate, foreseen under FP7 activities, was reported by several stakeholders as having a tremendous impact on the quality of research and knowledge in Europe which could not have been achieved

otherwise. In particular the benefit of bringing together academia and industry were highlighted.

Economic efficiency: all 6 case studies on FP7 projects reveal that in the absence of EC FP7 funding, the project partners would at best have gone ahead with the project, but most with a reduced scope, a smaller number of partners, as well as without vital international partners.
Societal / grand challenges and values: More than three quarters (77%) of project beneficiaries who claimed that funding for their project could not have been obtained from other sources, thought so because the issues addressed in their project were specifically European. Similarly, two thirds (66%) of respondents indicated that their project could only have been funded by FP7 because there is no national funding for this type of activity or in the same research area.

This suggests that there is strong European value added not just in terms of resources, coordination and process but also in terms of the actual topics in which research is conducted. While this does not indicate the magnitude of project impacts, it does suggest that any impacts from FP7 funded space research will occur in areas and at a scale that would otherwise have remained under-researched.

Based mainly on performed high-level interviews and the results of the beneficiary survey, the evaluation has found that FP7 space research performs very well across the different dimensions of EU added value, both at the level of programmes (e.g. focus on pan-European, under-researched topics, coordination between Member States) and on the level of projects (economic efficiency, scale and resources availability, quality of research, etc.). Even compared with other programmes available for some European Member States, such as those run by ESA, FP7 Space research funding has brought significant added value.

Space in H2020: continuity or evolution?

Space research in H2020, is evolving towards a more balanced programme than was the case in FP7. As noted, FP7 Space was devoted largely to pre-operational R&D preparing the Copernicus operational programme devoting some 80-85% of its budget in this area. Only 15-20% of the programme was devoted to "Strengthening Space Foundations" addressing technology development and space science.

H2020 Space research supports EU flagship programmes Galileo and Copernicus with research and developments efforts in two areas: development of future applications and services and development of new technologies for the next generation of the systems. Space Surveillance and Tracking – SST is a new priority for Europe with R&D support from H2020. H2020 Space also devotes significant resources to space technology development with the aim of strengthening the EU Space sector both in commercial space applications and systems (such as Satellite communication, space propulsion and cost effective launch opportunities for in-orbit demonstration and validation) and to space science and space exploration.

10.10. Security

FP7 was the first Framework Programme with a fully-fledged Security Research Theme.

FP7 Security Research goes back to a number of European strategy and policy initiatives that were launched during the early 2000s, in response also to the events of 9/11.

These include the first European Security Strategy of 2003[191], the Group of Personalities (GoP) that helped identifying principles and guidelines of a forthcoming European Security Research Programme[192], and a Preparatory Action in the field of Security Research (PASR) that was launched by the Commission in 2003 and prepared the foundations for a fully-fledged security research programme under FP7. The European Security Research Advisory Board (ESRAB), established in 2005, then defined the strategic lines for European security research and advised on the principles and mechanism for its implementation[193].

Already into FP7, the European Security Research and Innovation Forum (ESRIF) further elaborated the basis for security research with a long-term perspective. ESRIF also proposed to enhance the role and ability of the European security industry to invest in essential research and development activities[194].

FP7 Security Research was mission-driven, structured along four main security missions plus three cross-cutting missions (see below) and focused on filling capability gaps.

By its nature, the FP7 Security Research Programme contributed to the implementation of EU external policies, the Common Foreign and Security Policy (e.g. in support of borders control, conflict prevention and crisis management), to the

191 http://www.consilium.europa.eu/uedocs/cmsupload/78367.pdf

192 http://ec.europa.eu/dgs/home-affairs/e-library/documents/policies/security/pdf/gop_en.pdf

193 http://ec.europa.eu/dgs/home-affairs/e-library/documents/policies/security/pdf/esrab_report_en.pdf

194 http://ec.europa.eu/dgs/home-affairs/e-library/documents/policies/security/pdf/esrif_final_report_en.pdf

creation of an EU-wide area of justice, freedom and security , and to policy areas such as transport, health, civil protection, energy, development, and environment.

Objectives
Original objectives

The overall objective of the FP7 Security Research Theme was "*To develop the technologies and knowledge for building capabilities needed to ensure the security of citizens from threats such as terrorism, natural disasters and crime, while respecting fundamental human rights including privacy; to ensure optimal and concerted use of available and evolving technologies to the benefit of civil European security, to stimulate the cooperation of providers and users for civil security solutions, improving the competitiveness of the European security industry and delivering mission-oriented research results to reduce security gaps*"[195].

The FP7 Security Research Work Programmes provided detailed activity/topic level objectives along the structure of the main and the cross-cutting mission areas, including also 'International Cooperation' and responding to emerging needs and unforeseen policy needs.

Evolution of objectives to respond to the crisis

The FP7 Security Research objectives evolved over time. The 2011 Work Programme[196] made reference to the Europe 2020 strategy and the Innovation Union Flagship Initiative and the contribution of the Security Theme, to "promoting growth and employment in general, stimulating innovation (including in SMEs), enhancing the competitiveness of European industry". The contribution to the innovation objective was then further elaborated in the 2012[197] and 2013[198] Work Programmes.

In parallel, a dedicated initiative to support the competitiveness of the European security industry was launched in 2012. The "Action Plan for an innovative and competitive Security Industry" [199,200] has the overarching aim of enhancing growth and increasing employment in the EU's security industry, and includes activities related to pre-commercial procurement and better integration of the societal dimension under FP7 and Horizon 2020.

How did FP7 Security contribute to the competitiveness of European Security industry?

The FP7 Security Research Programme supported the competitiveness of the European Security Industry by contributing to overcoming market fragmentation, by increasing European S&T collaboration and by fostering innovations and supporting the demonstration and development of new products with market potential, last but

195 FP7 Cooperation Specific Programme Council Decision 2006/971/EC
196 http://ec.europa.eu/research/participants/data/ref/fp7/89287/k-wp-201101_en.pdf
197 http://ec.europa.eu/research/participants/data/ref/fp7/89497/k-wp-201201_en.pdf
198 http://ec.europa.eu/research/participants/data/ref/fp7/192060/k-wp-201302_en.pdf
199 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0417&from=EN
200 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=SWD:2012:0233:FIN:EN:PDF

not least also in the context of security industrial policy and the related action plan (see above).

It should be kept in mind that the situation of FP7 Security Research was a unique and very specific one, given that FP7 Security Research was the first fully-fledged security Research Theme under a Framework Programme. FP7 Security Research had to tackle a number of challenges, amongst them a highly fragmented European security market, a fragmented research community, the gap between research and the market, as well as the societal dimension of security technologies.

As a consequence, the contribution of FP7 Security Research to the competitiveness of the European Security Industry includes a strong structuring effect for European security research that cannot always be directly measured through, for instance, the number of patents or publications (see also question 4).

The study on "Final Evaluation of Security Research under the Seventh Framework Programme for Research, Technological Development and Demonstration"[201] reflects the specific situation of FP7 Security Research and its achievements:

"*The findings from the desk research, interviews and focus group workshop all underlined the fact that Europe is not one market but many and that the degree of fragmentation makes it harder to do business and undermines international competitiveness as well. The fragmentation is partly institutional (political and legal differences between Member States and security actors), but there are also substantive interoperability challenges (organisational, semantic, technical). As such, FP7 has been helpful in bringing together communities – industry and end users – in projects that are helping to develop common concepts, terminology, open interfaces, middleware, etc. that will in turn facilitate improved multilateral and cross-border cooperation.*"[202]

The study also analysed SESAM data of 61 completed and fully processed projects, i.e. for a partial set of about 20% of all FP7 Security Research Projects, and found a total of 19 IPR (Intellectual Property Rights), including 10 patent applications, equivalent to 1.3 IPR, including 0.6 patent applications, for every 10 million € of EC contribution[203]. These figures are rather low, compared with other parts of the Cooperation Specific Programme. However, the specific nature of security research has to be taken into account (see also above), including the fragmented market and the perceived difficulties as regards commercialisation. Project results, knowledge or concepts are sometimes feeding into another FP7 project. In addition, about one third of all FP7 Security Research projects are involving classified information, and hence are subject to security rules for protecting EU classified information.

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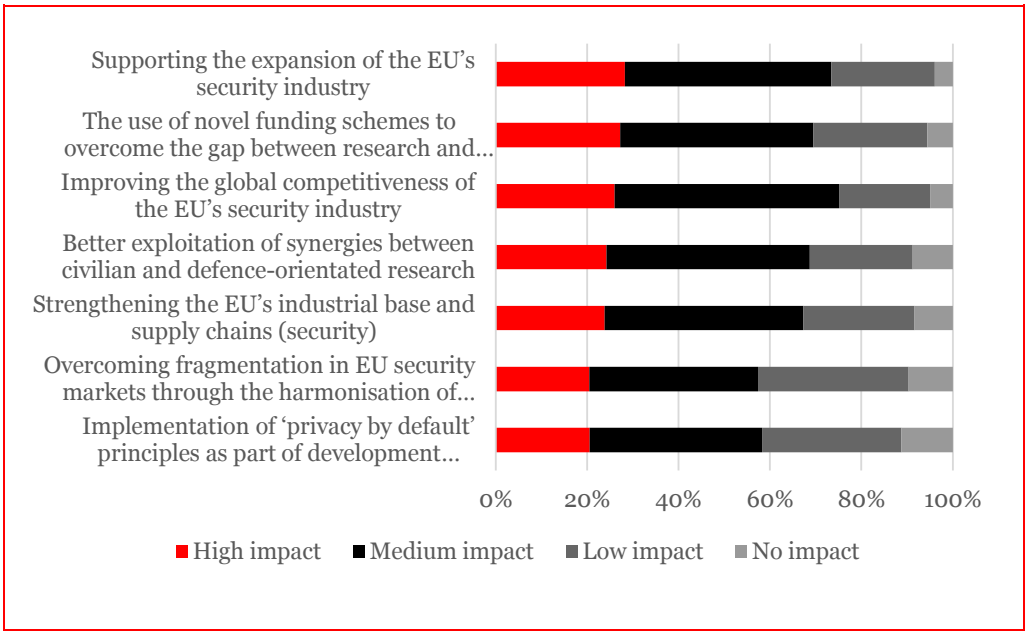
201 Final Evaluation of Security Research under the Seventh Framework Programme for Research, Technological Development and Demonstration (Technopolis, 2015)

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

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

The strong link to the security industry sector is reflected by the fact that Private for Profit Organisations (excluding education, PRC) represent the largest group of actors in FP7 Security Research with 43% of participations. SMEs as part of this group, account for 21% of all participations.

A participant survey carried out in the context of the evaluation study provides more details: Survey participants were asked to assess various aspects of the impact of FP7 Security Research on European security industrial policy including the security industry market. As illustrated by the following figure, a majority of more than 70% of the participants judge that FP7 Security Research had a high or medium impact on improving the global competitiveness of the EU's security industry and on supporting the expansion of the EUs security industry.



Source: Technopolis participant survey, November 2014

(Source: Technopolis, 2015)[204]

The evaluation study confirms the challenging situation of the security industry market and the persisting areas of concern, for instance related to the lack of commercialisation, a low take-up of results, complex IPR rules, and different national standards, but also states "*However, it is worth noting that knowledge, cooperation and networking benefits are widespread, and are seen as equally important assets for competitiveness – though their impact may only materialise in the longer term*".[205]

How did FP7 Security contribute to increase European and international wide S&T collaboration and networking for sharing R&D risks and costs?

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

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

The situation of FP7 Security Research was again unique, given that the European security research programme had been launched by the EU in light of not only a fragmented market, but also a highly fragmented research community.

In total, participants from 48 countries were in involved in FP7 Security Research Projects. The following table shows the EC contribution, number of projects, and number of participations by country:

Country	Code	EC contribution	Participations (and rank*)	Projects
Germany	DE	€159,862,017	380 (3)	199
United Kingdom	UK	€152,305,365	430 (1)	210
France	FR	€151,541,607	379 (4)	172
Italy	IT	€121,772,196	385 (2)	173
Spain	ES	€110,920,970	319 (5)	157
Netherlands	NL	€79,123,262	240 (6)	131
Sweden	SE	€62,294,867	144 (9)	103
Belgium	BE	€52,099,167	168 (7)	112
Austria	AT	€44,060,629	123 (10)	78
Greece	EL	€43,776,916	150 (8)	76
Poland	PL	€33,178,421	102 (11)	75
Finland	FI	€31,869,588	97 (12)	66
Norway	NO	€31,615,361	84 (14)	65
Israel	IL	€31,523,521	85 (13)	56
Switzerland	CH	€28,543,070	80 (16)	59
Ireland	IE	€26,075,799	79 (17)	58
Portugal	PT	€21,651,038	84 (14)	55
Denmark	DK	€14,257,242	41 (18)	33
Slovakia	SK	€7,125,091	25 (24)	19
EU (JRC)	EU	€6,759,664	26 (23)	26
Czech Republic	CZ	€5,789,696	34 (20)	32
Turkey	TR	€5,209,062	28 (21)	25
Luxembourg	LU	€5,033,438	19 (28)	15
Slovenia	SI	€4,457,149	25 (24)	23
Romania	RO	€4,351,272	38 (19)	35
Cyprus	CY	€4,162,720	15 (29)	14
Estonia	EE	€3,686,642	21 (26)	17
United States	US	€3,587,938	11 (33)	8
Hungary	HU	€3,536,682	27 (22)	24
Croatia	HR	€3,497,820	13 (31)	8
Bulgaria	BG	€2,321,091	21 (26)	21
Latvia	LV	€1,542,817	14 (30)	12
Lithuania	LT	€1,204,977	12 (32)	11
Malta	MT	€1,114,228	9 (34)	9
Serbia	RS	€1,039,840	5 (35)	5
Japan	JP	€646,242	4 (36)	4
Iceland	IS	€553,035	3 (38)	2
Australia	AU	€375,996	2 (39)	2

Country	Code	EC contribution	Participations (and rank*)	Projects
Ukraine	UA	€263,280	2 (39)	1
Russia	RU	€175,950	1 (45)	1
Bosnia-Herzegovina	BA	€153,548	1 (45)	1
FYROM	MK	€118,125	2 (39)	2
India	IN	€115,490	2 (39)	2
Egypt	EG	€56,800	1 (45)	1
South Africa	ZA	€54,947	2 (39)	2
Canada	CA	€35,614	4 (36)	4
Palestine	PS	€25,231	1 (45)	1
Montenegro	ME	€22,622	1 (45)	1
Taiwan	TW	€ -	2 (39)	1
All		**€1,263,488,044**	**3,741**	**307**

Source: Technopolis analysis of CORDA data

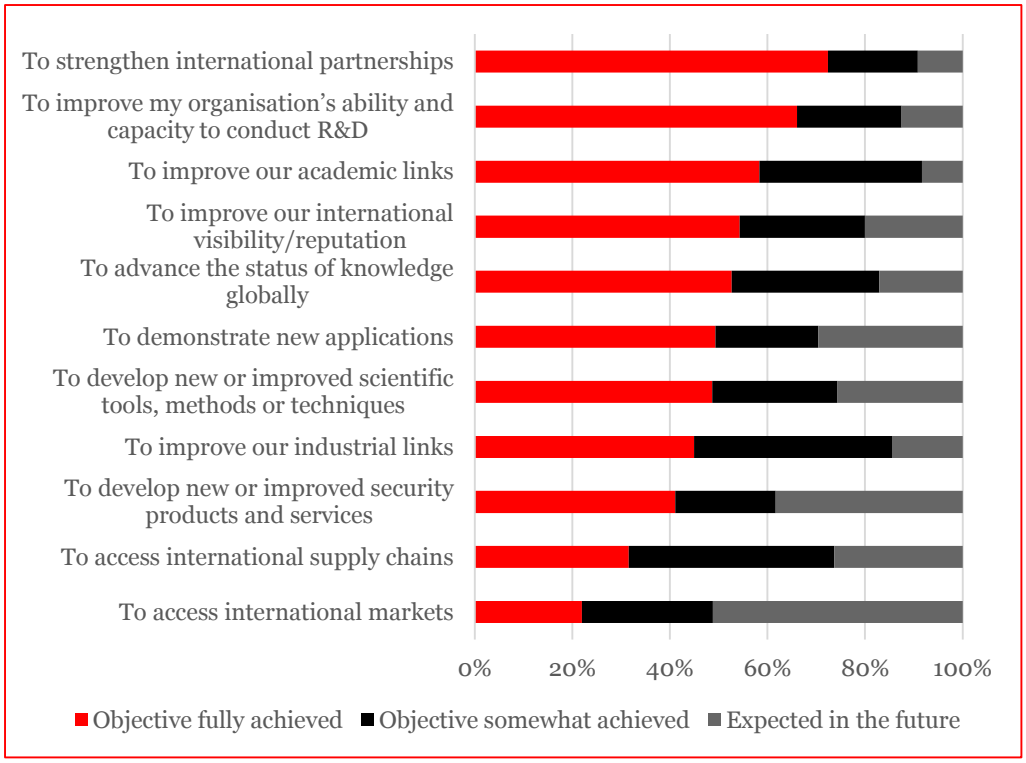
* The number in brackets indicates the rank of the country if the data is sorted according to the number of participations.

(Source: Technopolis, 2015)[206]

According to the participant survey, strengthened international partnerships, improved abilities and capacity to conduct R&D, improved academic links, and improved international visibility/reputation are leading the list of achieved objectives at project level, as seen by all participants[207].

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

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



Source: Technopolis survey of FP7 Security Research participants, November 2014
(Source: Technopolis, 2015)[208]

When asked about the impact of the FP7 Security Research Programme, 88% of the respondents judged the impact of the programme on research cooperation as substantial (i.e. being of high or medium impact)[209].

The involvement of end users represents another important feature of FP7 Security Research and contributes to aspects of networking for R&D risks and costs.

The evaluation study explored the involvement of end-users and the end-user landscape in the EU and concluded that "*one of the major benefits of the FP7 Security Research Actions has been the impact that the programme has already had on the end-user scene. Not only have large numbers of end-users become involved as project participants, coordinators or advisors, but within certain sectors, they have also started to organise themselves into coherent and active communities*"[210].

One example is the Community of Users on Disaster Risk and Crisis Management, which was launched by the Commission in late 2014. Effective communication and interactions among policy-makers, research, industry (including SMEs) and operational actors (e.g. first responders) are essential for policy development and

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

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

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

implementation. This includes a proper exchange of information and communication about policy updates and project results. Such exchanges and transfer of knowledge are also crucial to identify and address users' needs and to better design funding programmes. To address related challenges, e.g. the policy complexity and the gap between research and the market, the Commission is funding large-scale demonstration projects. FP7 projects EDEN[211] and DRIVER[212], in the field of Disaster Risk and Crisis Management (including CBRN-E, natural and man-made disasters), are examples for projects with the potential to support building a critical mass by federating efforts at EU level: EDEN and DRIVER, along with other projects which have an "interfacing" component. The need to build a Community of Users emerged in this context. The Community of Users on Disaster Risk and Crisis Management provides a platform aiming at bringing together key scientific, policy and industry actors, including end-users, and other stakeholders.

As regards end-user involvement, the evaluation study concludes: "*The programme has learned how to engage end-users more effectively through a broad range of promotional and project-related activities, as well as through the enabling infrastructure and networks, to facilitate dialogue and articulation of research needs. The Commission should continue to support these fledgling networks in order to support the development of communities of practice and strengthen interaction with end-users*."[213]

In the context of **International Cooperation**, an Implementing Arrangement between the European Commission and the Government of the United States of America was signed in 2010 for cooperative activities in the field of homeland/civil security research[214].

How did FP7 Security contribute to improve the coordination of European, national and regional research policies?

Here again, the unique situation of FP7 Security Research needs to be taken into account: The coordination of European policies in security research would not exist without FP7 Security Research.

Funding for Security Research has been included for the first time under FP7, going back to quite recent events and policy initiatives, including 9/11. Prior to the launch of FP7 Security Research, coordination of European and national security research policies was almost non-existent. FP7 Security Research responded to increasing and rapidly changing security needs in Europe and contributed to coordinating European and national research policies.

As is confirmed by the evaluation study:

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211 https://www.eden-security-fp7.eu/

212 http://driver-project.eu/

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

214 Commission Decision 2010/293/EU, http://eur-lex.europa.eu/resource.html?uri=cellar:3719a009-7381-4015-a27c-757f7de07f81.0006.01/DOC_1&format=PDF

"*FP7 Security Research has helped to expand capacity and shape the research landscape, with several pan-EU networks as well as national groups having been established.*
The programme has also had a positive impact on Member State investment in security research, with several new national programmes having been created or expanded (e.g. Tekes Safety and Security programme, in Finland) and evolved (e.g. the collaboration and mutual opening up of the French and German national civil security research programmes)."[215]
The evaluation study explored the influence of FP7 Security Research on national research programmes, in particular the national security research programmes of Austria, France, and Germany, and indicates a clear European Added Value. The study concludes that these national security research programmes are:

"… well aligned with the FP7 Security Research Actions. In particular:

The programmes focus on the national needs of security research, formulated in line with their national priorities in the security area. While they have addressed a variety of security threats through the support of end-users, they also address the competitiveness of the security industry and, in two cases, the creation of new jobs. This orientation echoes important aspects of the FP7 SRA(216) objectives.

Anecdotal evidence points to the fact that national programmes have in some cases addressed short-term needs, compared to the longer-term perspective of the FP7 Security Research Actions. In other words the programmes at national level have complemented the actions at EU level.

Similarly, there is anecdotal evidence that the experience, competence and results from projects funded by national programmes have been built upon in projects funded by the FP7 Security research programme. The latter providing also the opportunity to access larger markets.

More generally the analysis suggests that the national security research programmes have contributed to the strengthening of networking and cooperation in the Member States and in the European Union."[217]

How did FP7 Security strengthen the scientific excellence of basic research in Europe?

FP7 Security Research was largely focused on reducing the capability gap between research and the market, and hence on applied research. As is stated in the Cooperation Specific Programme, "*This capability gap driven approach will be complemented by a "bottom-up" approach which scopes and examines technologies in order to assess how they could be utilised to enhance European security. An important aspect is to draw on the excellence of the supply side (e.g. industry,*

215 Final Evaluation of Security Research under the Seventh Framework Programme for Research, Technological Development and Demonstration (Technopolis, 2015)
216 SRA – Security Research Actions
217 Final Evaluation of Security Research under the Seventh Framework Programme for Research, Technological Development and Demonstration (Technopolis, 2015)

universities, research centres) to bring forward innovative security solutions. Research will be multidisciplinary and mission-oriented, it will range from technology and methodology development, to technology and systems integration, demonstration and validation. A multi-purpose nature of technologies is encouraged to maximise the scope for their application, and to foster cross-fertilisation and take-up of available and evolving technologies for the civil security sector."[218]

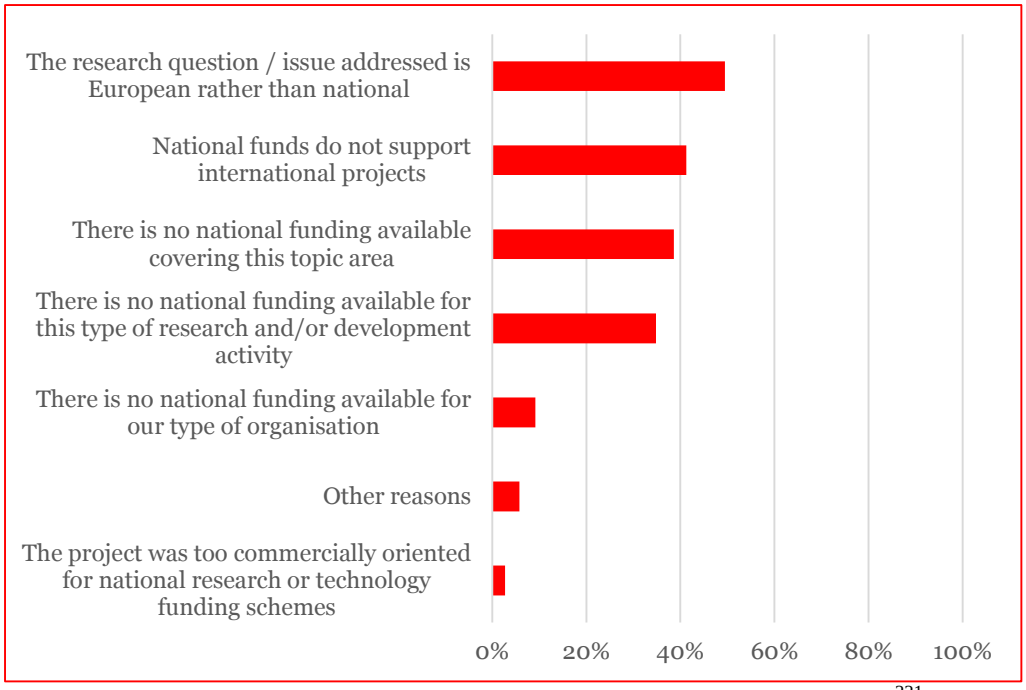
The evaluation study analysed SESAM data of 61 completed and fully processed projects, i.e. for a partial set of about 20% of all FP7 Security Research Projects and found a total of 214 reported publications, equivalent to 15 publications, including 2.3 publications in high-impact peer-reviewed journals, for every 10 million € of EC contribution[219]. As for patents (please, see above), these figures are rather low, again reflecting the specific nature of security research, where the share of participants from universities (HES) and research organisation (REC) academia is lower than in other areas and hence, most likely, the inclination towards publication. Project results, knowledge or concepts are sometimes feeding into another FP7 project. In addition, about one third of all FP7 Security Research projects are involving classified information, and hence are subject to security rules for protecting EU classified information.

A **high level of additionality** for FP7 Security Research is suggested by the participant survey: When asked what would have happened without FP7 support, more than 80% indicate that the project would not have been carried out[220]. The following figure presents the reasons provided by those participants indicating that the project could not have been supported by another funding scheme. This underlines the absolute need for a European Security Research Programme.

218 FP7 Cooperation Specific Programme Council Decision 2006/971/EC

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

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



Source: Technopolis participant survey, November 2014, (Source: Technopolis, 2015)[221]

How did FP7 Security promote the development of European research careers and contribute to make Europe more attractive to the best researchers?

Training activities are recognised as a tool for promoting the development of research careers. FP7 Security Research included a number of projects specifically dealing with training; examples are projects CAST[222], CRISIS[223], and PANDORA[224]. Many other FP7 Security Research projects included training components in their work programme.

As regards the attractiveness of Europe to the best researchers, the evaluation study concludes that "*The programme has successfully attracted many of Europe's leading national research laboratories and major security and defence companies.*"[225]

The analysis of FP7 Security Research Participant data shows that Europe's leading security research organisations are participating in FP7 Security Research projects. The top three organisations (as per total EC funding) are Fraunhofer, FOI (Swedish Defence Research Agency), and TNO (Netherlands Organisation for Applied

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

222 Comparative Assessment of Security-Centered Training Curricula for First Responders on Disaster Management in EU (http://cast.sbg.ac.at/)

223 CRitical Incident management training System using an Interactive Simulation environment (http://idc.mdx.ac.uk/projects/crisis/)

224 Advanced training environment for crisis scenarios (http://pandoraproject.eu/)

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

Scientific Research), directly followed by THALES, a major multinational company[226].

How did FP7 Security provide the knowledge-base needed to support key Community policies?

In April 2015, the Commission adopted a "European Agenda on Security"[227] for the period 2015-2020, to support Member States' cooperation in tackling security threats and step up common efforts in the fight against terrorism, organised crime and cybercrime. The Agenda sets out the concrete tools and measures which will be used in this joint work to ensure security and tackle these three most pressing threats more effectively.

The Agenda acknowledges the importance of research and innovation to keep up-to-date with evolving security needs, to identify new security threats and their impacts on society, and to find innovative solutions to mitigate security risks. The Agenda highlights the central role of Horizon 2020 in ensuring that the EU's research effort is well targeted and meeting the needs of law enforcement by involving end-users at all stages of the process, from conception to market. The Agenda underlines the role of a competitive European security industry towards contributing to meeting security needs.

The following success stories represent examples of knowledge created under FP7 in support of key European policies and/or security threats.

BONAS/EMPHASIS (BOmb factory detection by Networks of Advanced Sensors/Explosive Material Production (Hidden) Agile Search and Intelligence System)

Two projects combining results to produce a new approach that automatically detects the presence of homemade bomb materials and alerts authorities (http://www.bonas-fp7.eu, www.emphasis-fp7.eu):

http://www.bbc.com/news/science-environment-29354579

MIRACLE (Mobile Laboratory Capacity for the Rapid Assessment of CBRN Threats Located within and outside the EU)

http://cordis.europa.eu/project/rcn/111244_en.html

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

[227] http://ec.europa.eu/dgs/home-affairs/e-library/documents/basic-documents/docs/eu_agenda_on_security_en.pdf

http://www.cbrnlab.eu/miracle/index.php?option=com_content&view=article&id=1&Itemid=102

The objective of MIRACLE is to harmonize the definition of a mobile CBRN laboratory, to define its needs, and subsequently to provide solutions for deployment of this device in- and outside the EU.

MIRACLE has developed a "Biological scenario" which closely mimics the current Ebola crisis situation and its rapid spread in West Africa, and how it can be addressed. This scenario is currently being implemented in real life operational conditions: An in-field laboratory in the immediate vicinity of an Ebola treatment centre located in the outskirt of Nzere Kore, Guinea, close to the borders of Liberia, Ivory Coast and Sierra Leone. In addition to helping identify Ebola patients quickly, this laboratory will also support new clinical research into one of the most promising drugs for the treatment of Ebola patients. Lessons learned from this deployment will also help refine the analysis of gaps, technological or logistical improvements and missing technologies for mobile laboratories.

SGL for USAR (Second Generation Locator for Urban Search and Rescue Operations)

http://www.sgl-eu.org/

SGL for USaR is mission oriented towards solving critical problems following large scale structural collapses in urban locations. This project combined chemical and physical sensors integration with the development of an open ICT platform for addressing mobility and time-critical requirements of USaR Operations. The project developed two tangible product prototypes, FIRST, a standalone back-pack device carried out by the rescuers enabling chemical, audio and video capabilities, and REDS, a Remote Early Detection System that continuously monitors the large-scale situation at disaster scenes.

FASTID (FAST and efficient international disaster victim Identification)

http://www.interpol.int/fr/INTERPOL-expertise/Databases/FASTID/FAST-and-efficient-international-disaster-victim-IDentification

FASTID developed an international database for missing persons and unidentified bodies. It set out to streamline efforts to identify victims during such events, as well as helping with other day-to-day policy tasks. The team created a standardised system to identify disaster victims. This involves an information management and decision support system that uses rich Internet application software to automatically match missing persons and those discovered injured or dead at disaster sites. A key part of FASTID was to promote greater cooperation between different national authorities. It involved experts from around the world to develop the system, accounting for different national and cultural considerations in its specifications. Another important element was developing training to use the system.

ASSERT (Assessing Security Research: Tools and Methodologies to measure societal impact): http://assert-project.eu/

ASSERT has addressed the problem that in traditional thinking, societal impacts are reduced to side effects of instrumental (technological and legal) security measures. The project set out to demonstrate that societal dimensions of security research taken into account from the very beginning of the "design process" can increase the variety pool of feasible solutions.

Starting from a synthesis of state of the art discussions on societal security, ASSERT has identified best practice cases exploring and assessing societal impacts of science and technology in the security domain and beyond. This was done in a multidisciplinary fashion from different perspectives, including end-users, stakeholders, researchers, policy-makers and NGOs. Bringing together these different perspectives in a series of workshops created the basis for the development of a tool and a strategy for the sustainable implementation of societal impacts in future EU research activities in the field of security.

PERSEUS (Protection of European seas and borders through the intelligent use of surveillance): http://www.perseus-fp7.eu/

PERSEUS represents the first demonstration project implemented by the FP7 Security Research Theme. PERSEUS contributes to Europe's efforts to monitor illegal migration and combat related crime and goods smuggling by proposing a large scale demonstration of a EU Maritime surveillance System of Systems, on the basis of existing national systems and platforms, enhancing them with innovative capabilities and moving beyond EUROSUR's 2013 expectations. It is an example of how EU Research and Development activities are set into the present political context.

PERSEUS has assembled major users and providers, ensuring privileged access to existing surveillance systems and assets for an optimised coverage of the area of interest. These users will define, assess and validate the alignment of PERSEUS's recommendations to their needs. PERSEUS also includes an evolution mechanism to enlarge the user base and integrate emerging technologies during its lifetime.

The PERSEUS scope was three-fold; (1) Design of a system of systems architecture that integrated existing and upcoming surveillance systems as well as innovations created within PERSEUS and those originating from other projects. The goal of the system of systems was to address the complex security missions, focusing on irregular migration and trafficking; (2) Validation and demonstration of the system of systems through six exercises representing specific surveillance missions, instantiated in the Western and Eastern regions of the Mediterranean sea; (3) Strong involvement of end users to warrant a realistic step by step approach to reach an efficient operational cooperation among the Member States while preserving the national prerogatives.

PERSEUS delivered a comprehensive set of validated and demonstrated recommendations and proposes standards.

How much did FP Security contribute to job creation?

According to the workforce statistics provided in the final reports of the 61 competed and fully processed projects[228], the total workforce for these 61 projects amounts to 3506 people, working in different roles in the projects. 253 additional researchers have been recruited specifically for these projects. For both, the total workforce as well as the newly created jobs, the gender distribution is 69% male/31% female.

The 61 completed and fully processed projects represent a partial set of about 20% of all FP7 Security Research Projects. Extrapolating from this partial set to all FP7 Security Research projects, results in about 1270 new jobs for researchers that should have been created directly by and within FP7 Security Research projects.

The workforce statistics for the 61 completed projects include 259 PhD students, out of which 62% are male, 38% female. Extrapolating to all FP7 Security Research projects, one could expect about 1300 PhD students working in FP7 Security Research projects.

To what extent the results of FP7 Security contribute to the achievements of the new Commission's priorities?

As indicated above, FP7 Security Research contributed to increasing European S&T collaboration and networking, to fostering innovations and supporting the demonstration and development of new products with market potential. In line with the "Action Plan for an innovative and competitive Security Industry"[229], the FP7 Security Research Programme supported the competitiveness of the European Security Industry and contributed to security industrial policy via a strong structuring effect of the European security research community that is a prerequisite for overcoming market fragmentation.

FP7 Security Research contributed to a broad range of key EU policies, for instance the CBRN Action Plan[230] (DG HOME) and the EU Action Plan on Enhancing the Security of Explosives[231]. Further policies include border security (EUROSUR, DG HOME), customs (DG TAXUD), integrated maritime surveillance (DG MARE).

The EU has encouraged the development of innovative security solutions, for example through standards. FP7 Security Research contributed to the following standardisation activities:

- Development of standards mandate M/487[232], covering the development of a work programme for the definition of European standards in the area of security;

- Development of standards mandate M/530[233]: The Commission recently mandated European standardisation organisations to produce a European standard to allow

228 Extraction date 02/09/2014

229 http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0417&from=EN

230 COM(2009) 273 final and COM(2014) 247 final

231 Doc. 8109/08 and Regulation 98/2013

232 ftp://ftp.cen.eu/CEN/Sectors/List/SecurityandDefence/SecurityoftheCitizen/M_487.pdf

manufacturers and service providers to develop, implement and execute a 'privacy by design' approach in their processes. Compliance with such a standard will ensure that EU security products and services respect individuals' rights and thereby enhance consumer confidence.

To what extent was FP7 Security coherent with other EU actions (CIP, ESF) and EU policy?

The coherence of FP7 Security Research with the security industrial policy action plan and a range of Commission policies have been outlined above.

The coordination of research activities between the European Commission and the European Defence Agency (EDA) under the European Framework Cooperation (EFC) represents another example for the coherence of FP7 Security Research with other EU policies. The European Framework Cooperation was established in 2011, when the European Commission and the EDA agreed to harmonise their research activities. CBRNE was identified as a pilot area, to explore synergies between the FP7 Security Research programme and the EDA Joint Investment Programme for CBRNE (JIP CBRNE).

Which was the added value of FP7 Security when compared with national Security research and innovation programmes?

There is considerable added value given that the budget for the FP7 Security Research Theme exceeded the level of civil security research funding in any single Member State.

The Commission contribution made available through FP7 Security Research represents more than 50% of the EU wide public financing for security research.

This specific situation explains the degree of structuring and the impacts of the FP7 Security Research Action.

For more details, please, see under Question 3.

This positive view is confirmed by the evaluation study that concludes:

"*There is a **universally strong and positive view** about the programme's EAV. This question produced very substantial amounts of feedback from the stakeholders, with a high degree of consistency across the many interlocutors and even among different types of actors. The views of the interviewees broadly reflected the opinions of*

[233] ftp://ftp.cencenelec.eu/CENELEC/EuropeanMandates/M530_EN.pdf

participants, with the availability of research funds and the transnational nature of project teams being the most widely cited sources of EAV."[234]

Security in H2020: continuity or evolution?

Both:

One the one hand, Horizon 2020 builds on the achievements of FP7 Security Research. The "building block" structure of the FP7 Security Theme, leading from study-like CSA to large scale demonstration projects, is maintained. Many of the FP7 projects have set the ground for follow-up projects aimed at the development of prototypes, the establishment of EU wide standards.

On the other hand, the H2020 Secure Societies Challenge has a wider mandate than the FP7 Security Theme. The external dimension and cyber-crime/security are new areas of competence in H2020 which were not part of FP7. H2020 Secure Societies also aims at bringing research even closer to market. A focus in this context is the Pre-Commercial-Procurement Scheme PCP[235], which has been integrated extensively under H2020 Security Societies. PCP differs from and complements the other building blocks, by involving directly, and supporting financially, end-user entities (typically national or European agencies or authorities).

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

235 Where "'*pre-commercial procurement' means the procurement of research and development services involving risk-benefit sharing under market conditions, and competitive development in phases, where there is a clear separation of the research and development services procured from the deployment of commercial volumes of end-products*", Horizon 2020 Participation Rules, REGULATION (EU) No 1290/2013.